Table 3-3: Water Quality Sampling Program in Streams, 1995 to 2009 (continued)

Sampling Location	Drainage System	1995	1997	1998	1999	2000	2007	2008
Peter Lake to Diana Lake (PL-DL)	Peter Lake Drainage		Spring and Fall	Spring and Summer				
Atulik Lake Drainage								
Outlet of Atulik Lake (DI-6)	Atulik Lake Drainage	Summer						Spring
Downstream of basins below Atulik Lake on Atulik River (DI-7)	Atulik Lake Drainage	Summer						Spring
Downstream of NEW-3; outlet into DI5 which flows into Meliadine Lake (NEW-2)	Atulik Lake Drainage							Spring
Outlet of Chickenhead Lake (i.e., Lake DI1) (NEW-3)	Atulik Lake Drainage							Spring

3.3 Sediment Quality

Sediment quality data were collected during 5 baseline studies that were performed between 1994 and 2009 (Table 3-4). Sediment samples were collected from 8 stations in August 1994 (Dillon 1994). These stations were located in lakes on the Peninsula draining into Meliadine Lake (specifically, from Basins A, B, C, and D); in Chickenhead Lake (part of the Atulik Lake drainage basin), and in DI2 Lake, which is part of a watershed that drains into the southeast basin of Meliadine Lake. Samples were also collected from two different stations in the Meliadine Lake and Atulik Lake drainage basins by Dillon in July 1995 (Dillon 1995).

Sediment samples from 11 lake stations and one marine station (i.e., Hudson Bay) were collected by RL&L in July 1998. The freshwater stations were located in lakes on the Peninsula (specifically, from Basins A and B) and in Meliadine Lake (multiple locations), Control Lake, Peter Lake, and Little Meliadine Lake.

In June 2008, Golder collected sediment samples in 4 lakes on the Peninsula (specifically, from Basins A and B), in Meliadine Lake (multiple stations), in Chickenhead Lake (part of the Atulik Lake drainage basin), and in Control Lake (a lake draining into the south basin of Meliadine Lake) (Golder 2008). In July 2009, sediment was collected from one station in Basin A.

Table 3-4: Sediment Quality Sampling Program in Lakes, 1994 to 2009

Sampling Location	Basin	1994	1995	1998	2008	2009
Meliadine Lake						
DI4	Meliadine Lake		√		√	
ML-E	Meliadine Lake			√	√	
ML-A	Meliadine Lake	√		√	√	
East basin of ML in "toe of the boot" (BOOT-1)	Meliadine Lake				√	
East basin of ML at the outlet of the "toe of the boot" (BOOT-2)	Meliadine Lake				√	
ML-W	Meliadine Lake			√	√	
ML-S	Meliadine Lake			√	√	
ML-SE	Meliadine Lake				√	
ML-B	Meliadine Lake			√	√	
Peninsula Lakes						
A1 (aka PL-06 in Dillon 1994)	Peninsula Basin A	√				
A5 (aka PL-5 in Dillon 1994)	Peninsula Basin A	√				
A6 (aka PL-3 in Dillon 1994)	Peninsula Basin A	√		√		√
A8 (aka PL-1 in Dillon 1994)	Peninsula Basin A	√		√	√	
B5	Peninsula Basin B			√	√	
B6	Peninsula Basin B				√	
B7	Peninsula Basin B				√	
B36 (aka PL-2 in Dillon 1994)	Peninsula Basin B	√				
C5 (aka PL-4 in Dillon 1994)	Peninsula Basin C	√				

Table 3-4: Sediment Quality Sampling Program in Lakes, 1994 to 2009 (continued)

Sampling Location	Basin	1994	1995	1998	2008	2009
D7 (aka MB-1 in Dillon 1994)	Peninsula Basin D	√				
Little Meliadine Lake						
LML	Little Meliadine Lake			√		
DI2 Lake						
DI2	Other	√				
Control Lake						
Control Lake	Control Lake			√	√	
Peter Lake						
PL	Peter Lake			√		
Atulik Lake Drainage						
DI1 (Chickenhead Lake)	Atulik Lake Basin	√			√	
DI5	Atulik Lake Basin		√			
Hudson Bay						
Ocean	Ocean			√		

3.4 Aquatic Habitat and Biota

Between 1997 and 2009, substantial sampling effort was put forth to survey fish, lower trophic levels, and fish habitat in the Meliadine Study Area (Table 3-5). Field biologists used a number of sampling techniques to evaluate lower trophic level communities and to survey fish communities and fish habitat in Meliadine Lake, the Meliadine River, and numerous lakes, ponds, and interconnecting streams on the Peninsula basins. Investigations were focused on determining the distribution of species throughout the watersheds, Arctic Char movements using radio telemetry, the timing and size of the Arctic Char run in the Meliadine River. Surveys also were conducted to identify habitat features with regard to their suitability for fish movement, spawning, rearing, and overwintering.

Table 3-5: Aquatic Biota Sampling Activities, 1997 to 2009

Study Component / Activity	1997	1998	1999	2000	2001	2004	2008	2009
Physical Environment								
Habitat assessments	✓	✓				✓	✓	✓
Bathymetry	✓	✓					✓	✓
In-situ water quality	✓	✓	✓				✓	✓
Water temperature monitoring	✓	✓	✓	✓				
Lower Trophic Levels								
Periphyton	✓	✓						
Phytoplankton	✓	✓						

Table 3-5: Aquatic Biota Sampling Activities, 1997 to 2009 (continued)

Study Component / Activity	1997	1998	1999	2000	2001	2004	2008	2009
Zooplankton	✓	✓						
Benthic macroinvertebrates	✓	✓	✓	✓				
Fish Populations								
Backpack electrofishing	✓	✓					✓	✓
Gill netting	✓	✓	✓	✓			✓	✓
Fyke netting	✓	✓		✓			✓	✓
Fish fence	✓	✓	✓					
Angling	✓	✓		✓				
Egg sampling	✓	✓					✓	
Fish tissue sampling	✓	✓						
Implantation of radio transmitters	✓	✓		✓				
Radio tracking flights	✓	✓	✓	✓	✓			
Crossing assessments							✓	✓

4.0 HYDROLOGY

4.1 Hydroclimate (Long-term Regional Meteorology)

4.1.1 Available Data

The most proximate long-term climate station to the Project site that is operated by Meteorological Services of Canada (MSC) is Rankin Inlet A (Station 2303401) (Environment Canada 2009). This is located approximately 30 km south of the Project site and provides records from January 1981 to 2009. The station is considered to be close enough to represent the meteorological conditions at the Project site.

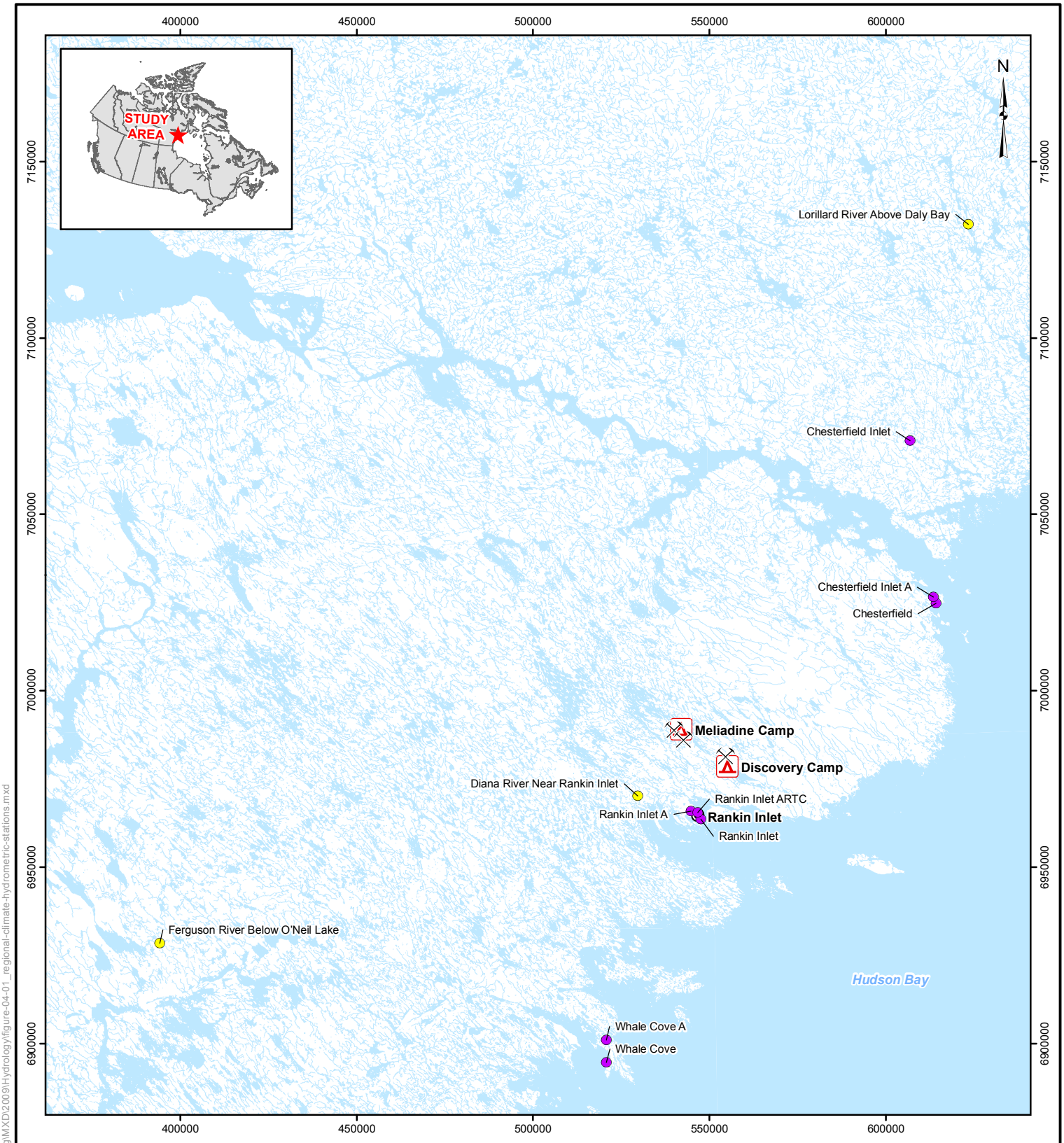
Regional data are available from MSC stations (Environment Canada 2009) at Chesterfield Inlet, located approximately 80 km north of the Project site, and Whale Cove, approximately 90 km south. Basic information on these MSC stations is summarized in Table 4-1. Station locations are presented in Figure 4-1.

Data records from the Rankin Inlet, Rankin Inlet ARTC, Chesterfield, Chesterfield Inlet, and Whale Cove stations (Stations 2303400, 2303403, 2300700, 2300705, and 2303985) are incomplete and were not used in any analysis.

Table 4-1: Regional MSC Climate Stations within 90 km of the Project

Station Name	MSC Station Number	Period of Record	Longitude	Latitude	Distance from Project
Rankin Inlet[a]	2303400	1954 to 1962	92° 04.0’	62° 48.0’	30 km South
Rankin Inlet A	2303401	1981 to 2009	92° 07.2’	62° 49.2’	30 km South
Rankin Inlet ARTC[a]	2303403	1976	92° 05.0’	62° 49.0’	30 km South
Chesterfield[a]	2300700	1930 to 1981	90° 43.0’	63° 20.0’	80 km North
Chesterfield Inlet[a]	2300705	1921 to 1931	90° 50.0’	63° 45.0’	80 km North
Chesterfield Inlet A[b]	2300707	1985 to 2007	90° 43.8’	63° 21.0’	80 km North
Whale Cove[a]	2303985	1974 to 1984	92° 36.0’	62° 11.0’	90 km South
Whale Cove A[b]	2303986	1985 to 2007	92° 36.0’	62° 14.4’	90 km South

Note: [a] incomplete records; not used in analysis
[b] partial hourly records up to 2009. Daily records up to 2007
km= kilometres



LEGEND

- Camp
- Proposed Mine Site
- Regional Climate Station
- Regional Hydrometric Station
- Watercourse
- Waterbody

30 0 30

SCALE 1:1,500,000 KILOMETRES

REFERENCE

Base data obtained from Comaplex Minerals Corporation. Station locations obtained from Environment Canada.
Projection: UTM Zone 15 Datum: NAD 83

DRAFT

PROJECT

COMAPLEX MINERALS CORP

COMAPLEX MINERALS CORPORATION
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

REGIONAL CLIMATE AND HYDROMETRIC STATION LOCATIONS

Golder Associates
Edmonton, Alberta

PROJECT NO. 09-1373-0010			PHASE No. 5000	
DESIGN	JL	28 Oct. 2009	SCALE AS SHOWN	REV. 0
GIS	CDB	28 Oct. 2009		
CHECK	NPS	17 Nov. 2009		
REVIEW	GA	25 Nov. 2009		

FIGURE 4-1

N:\Bur-Graphics\Projects\2007\1373\07-1373-0055\Mapping\MXD\2009\Hydrology\figure-04-01_regional-climate-hydrometric-stations.mxd

4.1.2 Air Temperature

Continuous air temperature data are available at the Rankin Inlet A climate station for the period 1981 to 2009, with missing data in 1993. The station is thought to be close enough to describe the long-term temperature conditions of the Project site. Temperatures for this period are presented on a monthly basis in Table 4-2 and Figure 4-2. Monthly and annual temperature data are provided in Appendix A1. Because of missing data in 1993, that year was omitted from the analysis.

Air temperature at the Project site may fall below 0°C on any day of the year. The monthly mean air temperature is typically above 0°C for the months of June to September, and is below 0°C between October and May. July has been the warmest month and January has been the coldest month. The mean annual temperature for the period of record was -10.4°C.

Over the period 1985 to 2007, the mean annual temperature was -10.6°C at Chesterfield Inlet A and -10.0°C at Whale Cove A. Long-term air temperature characteristics for these climate stations are available in Appendix A1.

Table 4-2: Air Temperature Statistics for Rankin Inlet A, 1981 to 2009 (Degrees Celsius)

Month	Warmest and Coldest Day in the Month				Monthly Mean
	Extremes		Means		
	Maximum	Minimum	Maximum	Minimum	
January	0.0	-46.1	-19.8	-37.2	-30.9
February	-4.4	-49.8	-24.0	-35.3	-30.1
March	1.3	-43.4	-18.8	-30.8	-25.1
April	3.4	-35.7	-10.4	-20.2	-15.7
May	14.1	-23.8	-1.2	-10.8	-5.9
June	26.1	-9.4	6.7	0.1	4.1
July	28.9	-1.9	14.9	6.9	10.5
August	30.5	-1.4	11.2	7.7	9.7
September	20.6	-9.0	6.8	1.3	3.8
October*	9.3	-27.4	1.7	-9.9	-4.6
November*	0.9	-36.5	-10.2	-23.6	-17.2
December*	-2.0	-43.6	-19.4	-33.3	-25.9
Annual	**30.5**	**-49.8**	**14.9**	**-37.2**	**-10.4**

Note: * = incomplete at the time of reporting (2009 data not available)

Observations of the Rankin Inlet A climate station and inspections of historical records (Environment Canada 2008a) provide the following information that is not available on the Environment Canada web site. These changes must be considered when making any judgments on climate change based on temperature data from this station:

- the station was moved approximately 200 m northwest, after 1996. The original station was fenced, and the existing station is not fenced;

- the original station appears to have been sited on a gravel pad on grade, while the existing station is located on a constructed gravel pad up to 2 m thick; and
- snow clearing at the gravel pad may have a microsite effect on surface albedo. The original station was fenced, but the current site is not fenced and can be accessed by powered snow clearing equipment.

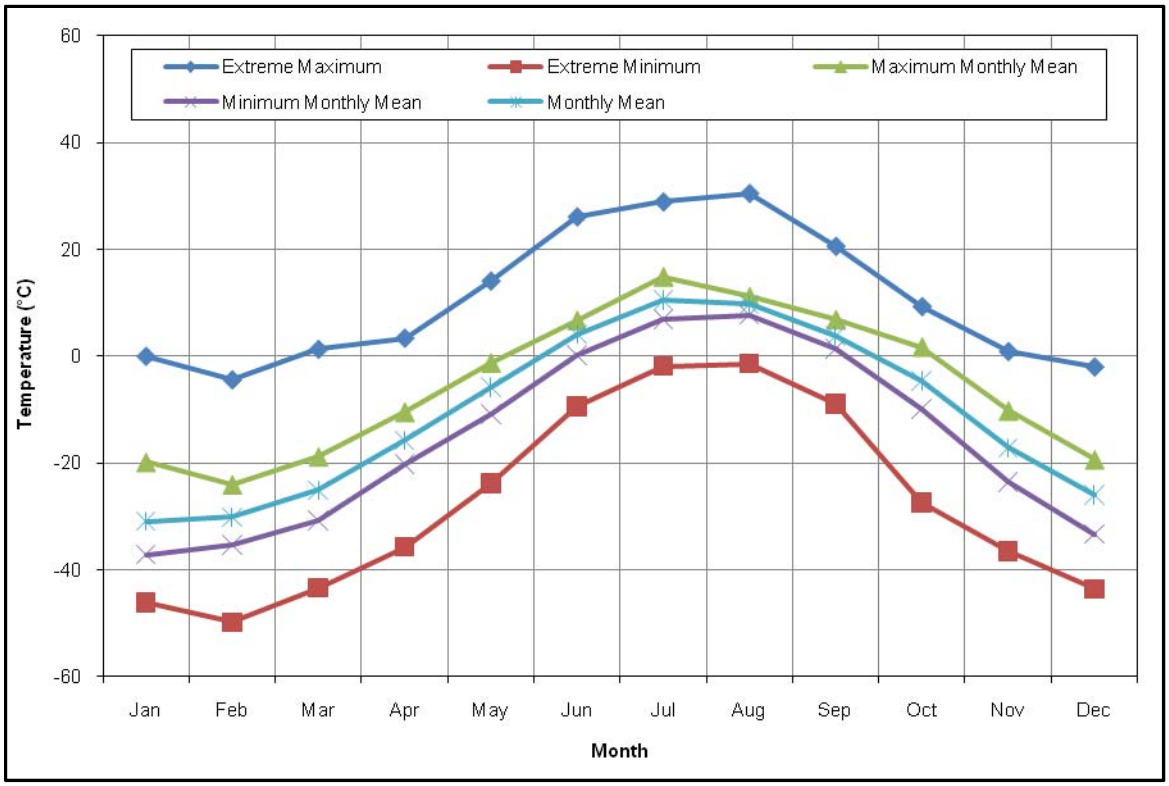


Figure 4-2: Air Temperature Statistics at Rankin Inlet A, 1981 to September 2009

4.1.3 Precipitation

4.1.3.1 Monthly Precipitation

Precipitation data recorded at the Rankin Inlet A climate station from 1981 to 2007 were compared with the concurrent records at the active Chesterfield Inlet A and the Whale Cove A climate stations, as shown on Figure 4-3. It must be noted that data from 1993 was not included in the analysis due to a data gap at the Rankin Inlet A climate station.

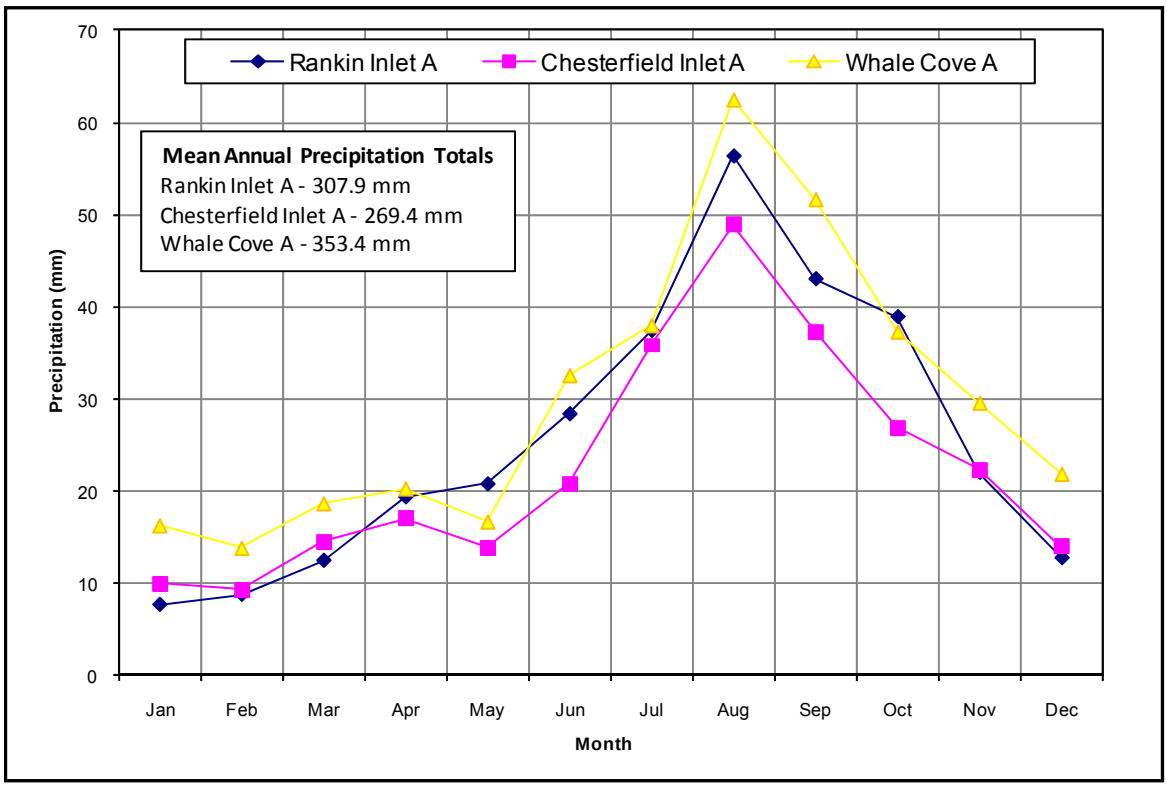


Figure 4-3: Comparison of Regional Precipitation

Figure 4-3 shows that the 3 locations have similar precipitation patterns. The lowest monthly precipitation occurs during the winter months of January and February, and peaks occur in August. While the precipitation amounts are similar, the data show that precipitation is greater in the south and lower in the north. Monthly and annual precipitation data for both regional climate stations are provided in Appendix A1.

The recorded mean monthly rainfall, snowfall, and precipitation at the Rankin Inlet A climate station for the period of record 1981 to September 2009 are presented in Table 4-3. Details of the monthly data series are provided in Appendix A1. Because of missing data in 1993, that year was omitted from the analysis. Based on the precipitation data series, 59% of precipitation in the Project area typically occurs as rain and 41% occurs as snow. Precipitation in the form of rain usually occurs between June and September, and while it can snow in any month, the majority of snow occurs in October and November. Additional precipitation data for the Rankin Inlet A climate station are provided in Appendix A1.

MSC records present rainfall and total precipitation in units of millimetres and snowfall in units of centimetres. At many stations, including Rankin Inlet A, rainfall is measured by a tipping bucket rain gauge and is expressed in millimetres of water depth. Snowfall is measured using two methods, including a snow ruler and a nipher snow gauge. The nipher gauge captures and melts snowfall, which is then measured as a snow water equivalent in units of millimetres depth. The snow ruler is used to measure the depth of snow that accumulates on the ground, and is measured in centimetres. Total precipitation is the sum of the measured rainfall and snowfall as measured by the nipher gauge, expressed as millimetres of water depth. Snow water equivalents can be calculated by subtracting rainfall from the total precipitation for a given period.

Table 4-3: Mean Monthly and Mean Annual Precipitation at Rankin Inlet A, 1981 to September 2009

Month	Rainfall (mm)	Snowfall (cm)	Precipitation (mm)
January	0.0	8.6	8.4
February	0.0	8.7	8.4
March	0.0	12.4	12.2
April	1.2	19.2	20.0
May	6.8	12.8	19.1
June	23.4	4.7	28.0
July	38.7	0.1	38.8
August	56.4	0.2	56.5
September	40.0	3.8	43.8
October*	13.7	24.6	37.9
November*	0.3	22.2	21.6
December*	0.0	12.6	12.0
Annual	**180.6**	**128.8**	**305.5**

Note: *= incomplete at the time of reporting (2009 data not available)
mm= millimetres, cm= centimetres

4.1.3.2 Annual Precipitation

Annual rainfall, snowfall, and precipitation for Rankin Inlet A are presented for each hydrological year of record in Table 4-4 and Figure 4-4. A hydrological year is defined to include most, if not all, precipitation that contributes to the annual runoff. For the Project site, most precipitation occurring after 1 October will fall as snow and accumulate over the winter to contribute to the next year's runoff. The hydrological year is thus defined to extend from 1 October of the previous year to 30 September of the current year. Because of missing data in 1993, the hydrological years 1993 and 1994 were omitted from the analysis.

The driest hydrological year on record occurred in 1997 with a total recorded precipitation of 167.5 mm, or 54% of the mean, whereas the wettest hydrological year occurred in 2005 with a total recorded precipitation of 461.8 mm, or 148% of the mean.

Hydrology field programs at the Project site took place during dry years in 1997, 2000, and 2009, and wet years in 1998 and 1999. Precipitation in the 2009 hydrological year was slightly under the long-term mean.

4.1.3.3 Undercatch

Precipitation occurs as rainfall or as snowfall. In general, the accuracy of measurements for actual rainfall and snowfall amount is subject to limitations inherent in methods and equipment, most of which result in measured amounts being less than actual amounts. This phenomenon is termed "undercatch." Three main factors influence undercatch:

- wind turbulence at the gauge, which tends to deflect some precipitation (especially snow) away from the gauge opening;
- wetting of gauge surfaces, which later evaporates and is not recorded as precipitation; and

- trace events, which are too small to measure.

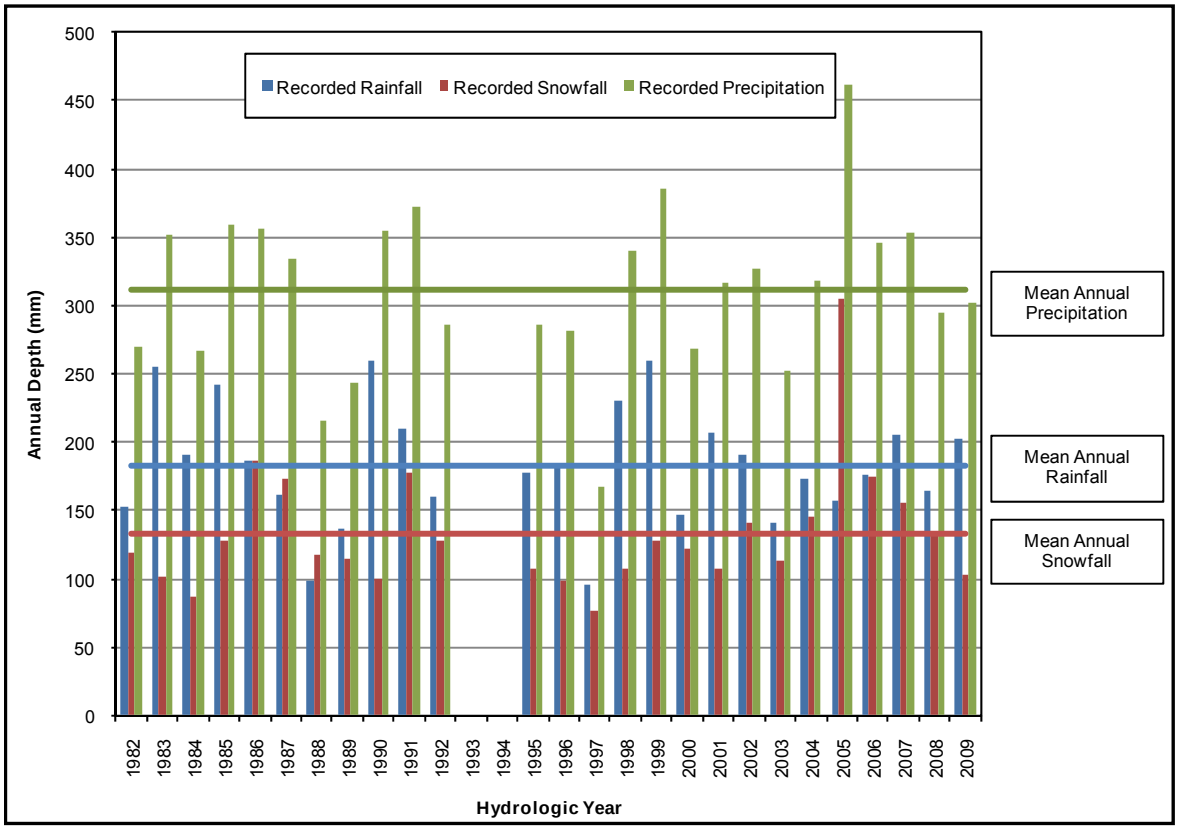


Figure 4-4: Annual Precipitation at Rankin Inlet A by Hydrological Year, 1982 to 2009

The cumulative effect of these factors is larger in northern climates than southern climates due to the high incidence of wind during snowfall events and more frequent occurrences of trace events in the northern climates.

A discussion of the issues involved, and the approach taken by Environment Canada in assessing undercatch and developing corrections, is presented by Mekis and Hogg (1999). The corrected datasets for many climate stations throughout Canada, including MSC stations around the Project area, are available to researchers from Environment Canada (Environment Canada 2008b). The corrected datasets are currently available to the end of 2007.

The corrected data are conventionally termed “adjusted” data, while the data as recorded and published by Environment Canada are conventionally termed the “archived” data. Archived and adjusted datasets for Chesterfield Inlet A are presented in Appendix A1 and used in this report, as appropriate for the intended purpose.

Table 4-4: Annual Precipitation at Rankin Inlet A by Hydrological Year

Hydrological Year	Recorded Data		
	Rain (mm)	Snow (cm)	Precipitation (mm)
1982	152.5	119.2	270.1
1983	255.6	102.0	351.4
1984	191.5	86.9	266.5
1985	241.3	127.7	359.7
1986	185.8	186.1	356.7
1987	161.4	173.3	334.5
1988	99.2	117.0	215.5
1989	136.3	114.4	243.4
1990	260.2	99.6	354.3
1991	209.4	177.9	371.9
1992	160.6	127.9	286.1
1993*	138.0	89.4	227.3
1994*	114.6	67.8	182.4
1995	177.8	108.1	286.3
1996	183.6	98.2	281.4
1997	95.8	76.2	167.5
1998	230.5	108.0	340.3
1999	259.6	127.2	385.4
2000	146.3	122.6	267.9
2001	207.6	107.0	316.0
2002	191.2	141.7	326.5
2003	140.8	113.3	252.7
2004	173.0	145.0	317.4
2005	157.4	304.4	461.8
2006	176.2	174.8	346.4
2007	205.3	156.0	353.1
2008	163.8	132.8	295.2
2009	202.4	102.7	302.4
Minimum	**95.8**	**76.2**	**167.5**
Maximum	**260.2**	**304.4**	**461.8**
Mean	**183.3**	**132.7**	**311.9**
Median	**180.7**	**120.9**	**316.7**

Note: *= incomplete data (not included in the statistics)
mm= millimetres, cm= centimetres

No adjusted data set for the Rankin Inlet A climate station was available. Corrected precipitation factors developed by Environment Canada (Mekis 2004) were used to derive the undercatch factor for Rankin Inlet A

and Whale Cove A and are available in Figure A-1 in Appendix A1. Undercatch factors for the Rankin Inlet A and Chesterfield Inlet A climate stations are shown in Table 4-5.

Table 4-5: Mean Undercatch Factors for Regional Climate Stations

Climate Station	Rainfall	Snowfall	Total Precipitation
Rankin Inlet A*	1.13	1.50	1.32
Chesterfield Inlet A	1.06	1.58	1.30
Whale Cove A*	1.13	1.49	1.31

Note: *= incomplete data

Adjusting observed average annual rainfall by 13%, snowfall by 50%, and precipitations by 32% at Rankin Inlet to account for undercatch results in a mean of 207.1 mm of rainfall, 199.1 mm of snowfall, and 411.7 mm of total precipitation based on the hydrological year. Based on these values, the proportion of adjusted precipitation that falls during the summer months and the spring snowfall is almost equal (51.0% for summer rainfall; 49.0% for spring snowfall).

4.1.3.4 Extreme Precipitation

Annual Precipitation

A frequency analysis was conducted on the annual precipitation data based on the hydrological year to characterize extreme values for various return periods at the Project site, using the Pearson 3 distribution for rainfall and precipitation and Log Pearson 3 distribution for snowfall, according to the best-of-fit (Environment Canada 1994). Results of these analyses are tabulated in Table 4-6. Annual rainfall, snowfall, and precipitation events were estimated using data from the Rankin Inlet A climate station for the period of hydrological years 1982 to 2009. Because of missing data in 1993, the hydrological years 1993 and 1994 were omitted from the analysis.

Adjustment for undercatch was not considered in the analysis.

Table 4-6: Frequency Analysis of Annual Precipitation at Rankin Inlet A

Return Period (years)		Rainfall (mm)	Snowfall (cm)	Precipitation (mm)
Wet	200	297.8	384.7	464.4
	100	286.5	325.9	449.9
	50	274.2	275.8	434.0
	20	255.9	220.5	410.1
	10	239.7	185.5	388.7
	5	220.1	155.0	362.6
Median	2	183.0	119.2	312.3
Dry	5	146.3	100.6	261.5
	10	127.2	95.0	234.6
	20	111.6	91.9	212.4
	50	94.0	89.6	187.2
	100	82.4	88.5	170.3
	200	71.8	87.9	154.8

Note: mm= millimetres, cm= centimetres