REPORT ON

EXISTING AIR QUALITY AND METEOROLOGICAL STUDIES FOR THE PROPOSED NICO PROJECT

Submitted to:

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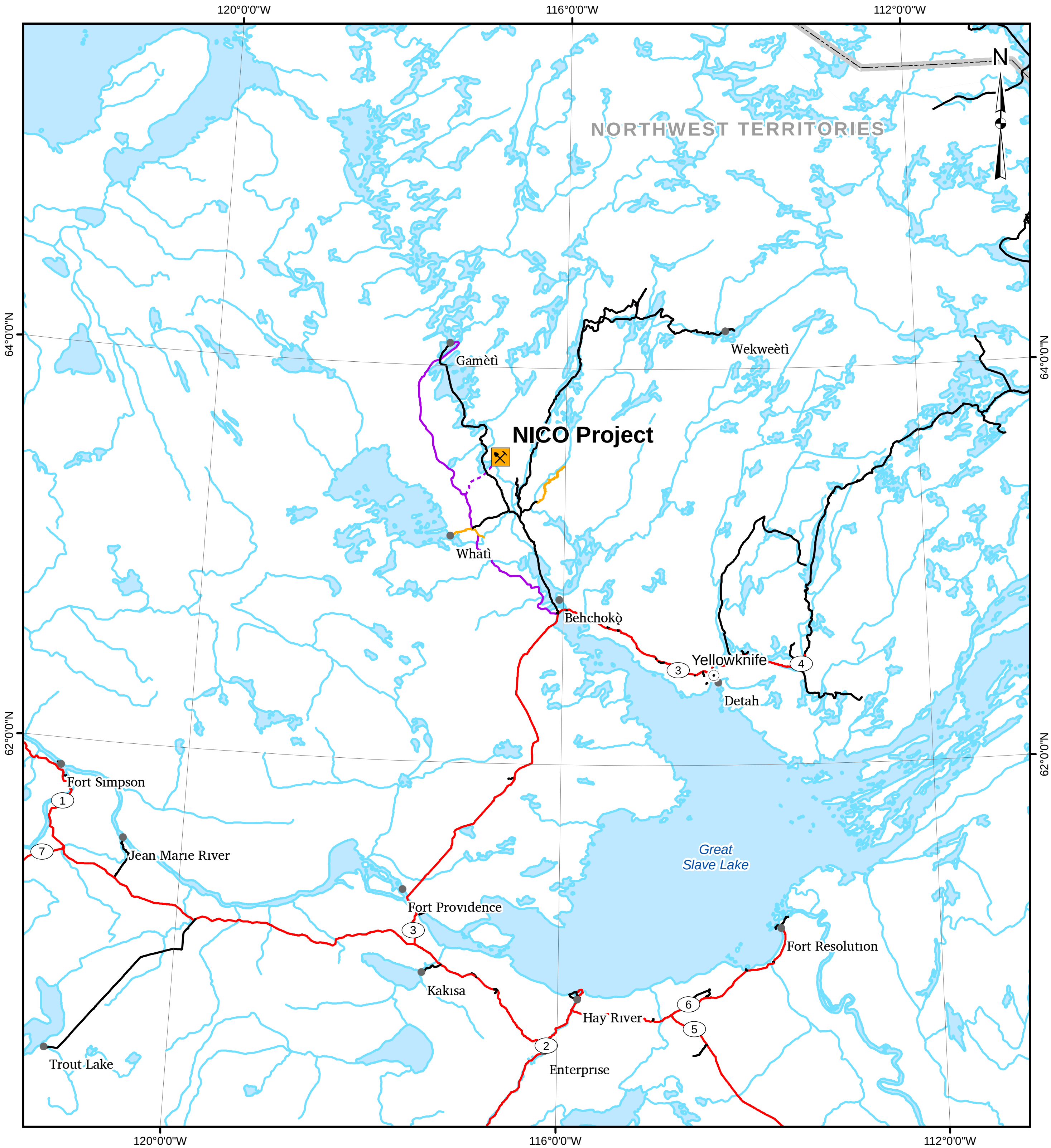
1 INTRODUCTION

Fortune Minerals Limited (Fortune) is proposing to develop the NICO cobalt-gold-bismuth-copper Project (NICO Project) approximately 160 kilometres (km) northwest of Yellowknife in the Northwest Territories (NWT). The location of the NICO Project is shown in Figure 1-1. Operations at the NICO Project are expected to generate atmospheric emissions from fossil fuel combustion and fugitive dust sources. Combustion products will include carbon dioxide (CO_2), oxides of nitrogen (NO_X), particulate matter (PM), volatile organic compounds (VOCs), sulphur dioxide (SO_2), and water vapour (H_2O). Mining activity will also generate fugitive PM of various size ranges.

The air quality and meteorological baseline is one component of a comprehensive environmental and socio-economic baseline program designed to describe the natural and socio-economic environment in the vicinity of the NICO Project. This report summarizes baseline meteorological data collected in the NICO Project area from October 2004 to April 2008. The baseline air quality data was collected during the summer months of 2007 and 2008. This report also summarizes meteorological data published by Environment Canada (2008) and air quality within the region published by the Government of the Northwest Territories Department of Environment and Natural Resources (2008; McKay 2010, pers. comm.).

The purpose of obtaining baseline data is to provide an overview of the existing conditions in the NICO Project area and to provide context for air quality predictions in the Environmental Assessment included in the Developer's Assessment Report. In doing so, the potential effects of the NICO Project on air quality can be estimated by comparing baseline air quality to predicted air quality concentrations during the NICO Project. Therefore, the objectives of the baseline study are as follows:

- to present representative baseline concentrations of atmospheric emissions for comparison with modelled concentrations that incorporate the changes from the NICO Project and other regional sources; and
- to provide representative meteorological data for use in the assessment.



LEGEND

- NICO PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- EXISTING ALL-WEATHER ROAD
- EXISTING WINTER ROAD
- PROPOSED ALL-LAND WINTER ROAD ROUTE
- PROPOSED NICO PROJECT ACCESS ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- WATERBODY

REFERENCE

Base data obtained from Atlas of Canada, DMTI and ESRI.
Projection: Canada Lambert Conformal Conic

100 0 100

SCALE 1:3,000,000 KILOMETRES

PROJECT

FORTUNE MINERALS LIMITED
NICO DEVELOPERS ASSESSMENT REPORT

TITLE

LOCATION OF THE NICO PROJECT

Golder Associates
Edmonton, Alberta

FILE No. B-Air-001-GIS				
PROJECT No. 08-1373-0017			SCALE AS SHOWN	REV. 0
DESIGN	CM	10 Dec. 2008	FIGURE: 1-1	
GIS	CW	10 Dec. 2008		
CHECK	LY	17 Nov. 2010		
REVIEW	GA	17 Nov. 2010		

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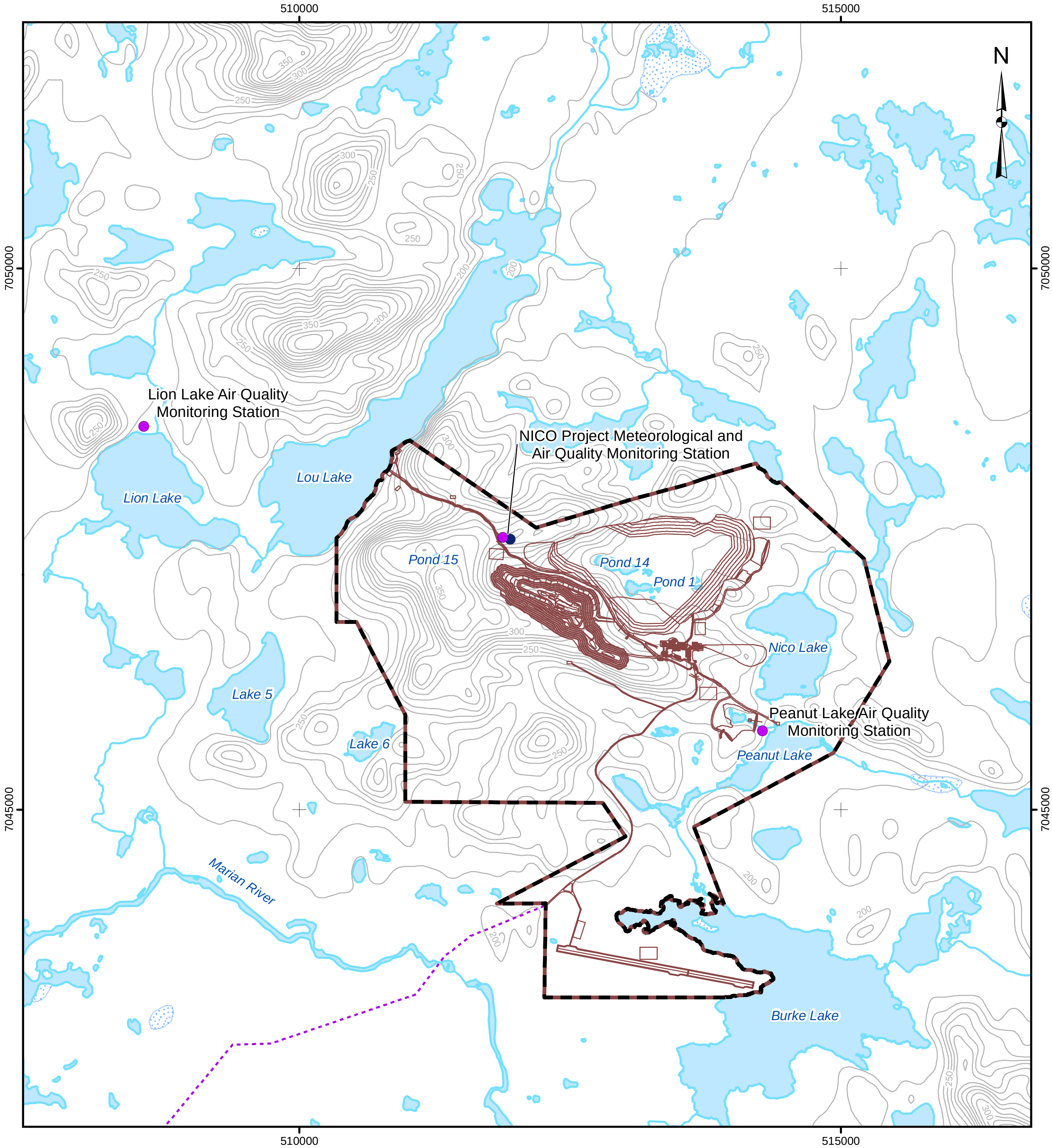
2 STUDY AREA

The baseline study area was selected based on the scope of the proposed NICO Project development. The NICO Project will be primarily an open-pit mine with an associated processing facility. Underground mining will take place for the first few years of the NICO Project. Emissions will be generated from on-site diesel generators, heavy mining equipment, ore processing equipment, and an incinerator. The study area was selected to include areas that are within the anticipated zone of influence of the proposed facility and areas that are expected to be beyond the zone of major influence. Because there are no other facilities within many kilometres of the site, the focus was on monitoring at the site and at 2 stations near the site: Peanut Lake and Lion Lake (Figure 2-1). The air quality effects from the NICO Project are expected to be less at the off-site monitoring stations near Peanut Lake and Lion Lake than at the on-site monitoring stations.



LEGEND

- PROPOSED LEASE BOUNDARY
- PROPOSED NICO MINE SITE
- CONTOUR (10 METRE INTERVAL)
- PROPOSED ALL-LAND WINTER ROAD ROUTE
- PROPOSED NICO PROJECT ACCESS ROAD
- WATERCOURSE
- WATERBODY
- WETLAND
- AIR QUALITY MONITORING STATION
- METEOROLOGICAL STATION

1 0 1

SCALE 1:50,000 KILOMETRES

REFERENCE

Base data obtained from GeoGratis.
Projection: UTM Zone 11 Datum: NAD 83

PROJECT
FORTUNE MINERALS LIMITED
NICO DEVELOPERS ASSESSMENT REPORT

TITLE
AIR QUALITY AND METEOROLOGICAL STATIONS

Golder Associates
Edmonton, Alberta

FILE No. B-Air-002-GIS

PROJECT No. 08-1373-0017			SCALE AS SHOWN	REV. 0
DESIGN	NP	18 May 2010	FIGURE: 2-1	
GIS	CW	18 May 2010		
CHECK	LY	17 Nov. 2010		
REVIEW	GA	17 Nov. 2010		

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3 APPROACH

This section of the report considers the methods used to measure local meteorology and air quality. It includes a discussion of the data quality checks and the various sources of regional climate and air quality data. It also summarizes the regulatory criteria governing air quality in the NWT.

3.1 METEOROLOGICAL MONITORING AT THE NICO PROJECT

3.1.1 Data Collection

Meteorological data have been collected at the NICO Project site since October 2004. The NICO Project meteorological station is located at the height of land northeast of the proposed mine at 511 931 East and 7 047 508 North (NAD 83) (Figure 2-1). Data were logged year-round on an hourly basis. Maximum values, average values, and total values were collected for rainfall, relative humidity, temperature, radiation, and wind. Table 3-1 provides a list of the meteorological monitoring equipment installed at the NICO Project site.

The data have been checked to determine data validity. Conditions that led to the rejection of some data included a frozen wind sensor (due to heavy frost), intermittent rain measurements recorded during temperatures well below freezing, and an expired station battery.

3.1.2 Data Quality

The meteorological data were subjected to data quality assurance checks prior to being presented. Intermittent technical issues (e.g., data-logger programming errors) and extreme weather conditions (e.g., excess frost) resulted in some missing data, but there are substantial valid data available for analysis.

Table 3-1 NICO Project Meteorological Measurement Instruments

Parameter	Instrumentation
Temperature	
Average air temperature -55 degrees Celsius [°C] to +50°C	Campbell Scientific YSI 44002A thermistor mounted at 2.5 metres (m) up the tower
Wind	
Wind speed in kilometres per hour [km/h]	R.M. Young 05103 Propeller Anemometer (10 m)
Wind direction degrees [°]	R.M. Young 05103 Propeller Anemometer (10 m)
Standard deviation of wind direction degrees [°][a]	R.M. Young 05103 Propeller Anemometer (10 m)
Solar Radiation	
Incoming solar radiation in watts per square metre [W/m²]	Kipp and Zonen SP Lite (2.5 m)
Precipitation	
Rainfall in millimetres [mm]	Texas Electronics TE525 WS Tipping Bucket Rain Gauge (2 m)
Relative Humidity	
Relative humidity in percent [%]	Vaisala capacitive relative humidity sensor (2.5 m)
Data Storage and Retrieval	
Datalogger	Campbell Scientific CR10X (Cold Spec)
Power supply	Solar panel and battery back-up
Instrument mounting	10 m tower

[a] The Standard Deviation of wind direction [°] is calculated in the datalogger using the Yamartino Algorithm.

3.2 AIR QUALITY MONITORING AT THE NICO PROJECT

3.2.1 Data Collection

A baseline monitoring program was initiated in October of 2004 at the NICO Project site. Nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) concentrations were measured at 3 locations in the NICO Project area: the NICO Project meteorological station, at Peanut Lake, approximately 3 km to the southeast, and at Lion Lake, approximately 3.5 km to the northwest (Figure 2-1). The main purpose of collecting data at the Peanut Lake and Lion Lake sites was to provide background concentrations outside of the proposed site development.

Table 3-2 lists the air quality monitoring parameters and the equipment installed to measure the parameters in the NICO Project area. Measurements of NO_2 and SO_2 were taken from October to December 2006 and March to September 2007 when the monitoring sites were accessible.

Too few PM data exist in the region to provide meaningful background information. Consultation with Environment Canada personnel (Fox 2008 pers. comm.) confirmed that ambient particulate data should be considered negligible at the site and that monitoring particulate matter to determine baseline concentrations at this location was unnecessary. Logistical constraints including the lack of available electricity to operate a particulate sampler added to the overall challenge of particulate monitoring at the NICO Project. Using a diesel generator for the sole purpose of measuring ambient particulate concentrations was not considered because the generator emissions may influence the measurements. Further, it was suggested that monitoring from community locations "near" the site may substantially over-represent the concentrations at the NICO Project site. Other compounds including VOCs and ozone were not measured because of the remoteness of the site and the lack of industrial development in the region.

The remoteness of the NICO Project does not eliminate the possibility of measurable ambient particulate in the NICO Project area. Local and regional forest fires, pollen, and other aerosols may contribute to natural ambient PM levels.

Table 3-2 Air Quality Parameters and Equipment, 2006 and 2007

Parameter	Instrument	Reason for Collection
SO_2 – long-term measurements taken over periods between 30 and 90 days	Passive Monitor	SO_2 is generated from combustion of sulphur-containing fuels, such as diesel
NO_2 – long-term measurements taken over periods between 30 and 90 days	Passive Monitor	NO_2 is generated from the combustion of fuel
Total and Fixed Dustfall[a]	Dustfall collection jar	Dust is generated from mechanical mining and construction activity as well as from vehicle movement

[a] total and fixed dustfall are not specifically air quality parameters though some data have been collected through the air quality monitoring program for future study.

NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide

The SO_2 and NO_2 data were collected intermittently using passive air quality samplers from October 2006 to September 2007. Passive sensors are designed to provide average concentrations measured over a 30-day period; however, because site access is limited, measurements were taken over longer periods. The data were not intended to provide an exhaustive data record; rather, they were installed to confirm the assumption that background conditions of the selected compounds were low in the absence of development in the area.

3.2.2 Data Quality

The data collected at the site between 2006 and 2007 were subject to data quality assurance checks. More than half (55 %) of the samples deployed were either irretrievable or were spoiled by wildlife. Samplers that were in good condition were sent to Maxxam Analytics in Edmonton, Alberta, for analysis.

3.3 OTHER DATA SOURCES

3.3.1 Meteorology and Climate Data

Climate normals (statistics based on 30 years of data) were available from the Environment Canada Yellowknife airport station through the National Climate Archive website (Environment Canada 2008). The Yellowknife monitoring station is approximately 170 km southeast of the NICO Project site. These data were also used to document existing conditions.

3.3.2 Baseline Air Quality Data

The Government of the Northwest Territories (GNWT) Department of Environment and Natural Resources (ENR) also monitors air quality in the NWT. Table 3-3 lists the approximate distance of each station from the NICO Project site. Particulate matter data from Daring Lake were included in the analysis since both Daring Lake and the NICO Project are far from other sources of particulate matter.

Table 3-3 Distance of the NICO Project to the Government of the Northwest Territories Monitoring Sites

Monitoring Station	Approximate Distance from the NICO Project (km)	Direction
Yellowknife	170	SE
Inuvik	920	NW
Norman Wells	520	NW
Fort Liard	510	SW
Daring Lake	290	NE

km = kilometres; SE = southeast; SW = southwest; NE = northeast; NW = northwest

3.4 AMBIENT AIR QUALITY CRITERIA

The GNWT has established air quality criteria in the NWT (GNWT 2002) for the following compounds:

- SO_2;
- ozone;
- total suspended particulates (TSP); and
- particulate matter with particle diameter nominally smaller than 2.5 micrometres (µm) ($PM_{2.5}$).

Table 3-4 summarizes the NWT criteria along with the national air quality objectives for regulated compounds, which includes NO_2 and CO. The guidelines and objectives refer to averaging periods ranging from one hour to one year. The Canadian government has established levels of objectives (Canadian Council of Ministers of the Environment [CCME] 1999), which are defined as follows:

- **Desirable:** This level establishes the long-term goal for air quality, providing a basis for an anti-degradation policy for the unpolluted parts of the country, and for the continuing development of control technology.
- **Acceptable:** This level provides adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, and personal comfort and well-being.
- **Tolerable:** This level establishes the concentration of an air contaminant that requires abatement without delay to avoid further deterioration of air quality that endangers the prevailing Canadian lifestyle or, ultimately, to an air quality that poses a substantial risk to public health.

Health Canada has established the Canada-Wide Standards (CWS). The CWS provide an alternative regulatory tool for the management of environmental issues of national interest. The CWS are intended to be achievable targets that will reduce health and environmental risks within a specific timeframe. The CWS for $PM_{2.5}$ and ozone (O_3) was included for comparison.

Table 3-4 Northwest Territories and National Ambient Air Quality Guidelines and Objectives

Substance	Averaging Period	NWT Standards		Canadian Objectives			
		($\mu g/m^3$)	(ppb)	Desirable ($\mu g/m^3$)	Acceptable ($\mu g/m^3$)	Tolerable ($\mu g/m^3$)	CWS ($\mu g/m^3$)
Sulphur dioxide	Annual	30	11	30	60	—	—
	24-hour	150	57	150	300	800	—
	1-hour	450	172	450	900	—	—
Nitrogen dioxide	Annual	—	—	60	100	—	—
	24-hour	—	—	—	200	300	—
	1-hour	—	—	—	400	1000	—
Carbon monoxide	8-hour	—	—	6000	15 000	20 000	—
	1-hour	—	—	15 000	35 000	—	—
Ozone	8-hour	127	65	—	—	—	130
Total suspended particulates	Annual[a]	60	—	60	70	—	—
	24-hour	120	—	—	120	400	—
$PM_{2.5}$[(c)]	24-hour	30	—	—	—	—	30

[a] As a geometric mean.

[b] PM_{10} – particulate matter emissions with particle diameter less than 10 micrometres (µm).

[c] $PM_{2.5}$ – particulate matter emissions with particle diameter less than 2.5 µm. The Canadian 24-hour objective is based on the 98th percentile averaged over 3 years. The territorial standard is a numeric standard is not based on the 98th percentile averaged over 3 years.

Source: Government of the Northwest Territories (2002), Canadian Council of Ministers of the Environment (2000), and Health Canada (2006).

NWT= Northwest Territories; $\mu g/m^3$= micrograms per cubic metre; ppb= parts per billion; CWS= Canada Wide Standards.

4 METEOROLOGY

4.1 WIND SPEED AND WIND DIRECTION

4.1.1 Method

Hourly wind speed and wind direction were measured using an RM Young 05103 propeller anemometer. The anemometer is located 10 metres (m) above the ground to avoid some of the effects of surface friction and to be consistent with siting protocols elsewhere. Winds recorded below 1.85 km/h (0.5 metres per second) were considered to be calm. To calculate the percentage of time when calm conditions were observed, hourly wind measurements were sorted in ascending order for the year. Hours with no available records due to instrument failure were removed. The number of measurements below 1.85 km/h were divided by the number of total recorded measurements and multiplied by 100.

The data were fully recovered for the sampling period through to the spring of 2008. Battery failure caused data loss between May and August 2008. Instrument maintenance, including field calibration, was performed in June 2006 and in August 2008. However, the station has been inoperable and in need of repairs since August 2009.

4.1.2 Results

October 2004 to December 2004

From October to December 2004, the winds at the NICO Project were predominantly from the south-southeast followed by winds from the north-northwest through west-northwest (Figure 4-1). Winds greater than 30 kilometres per hour (km/h) occurred from both directions. The maximum observed and sustained hourly wind speed between October and December 2004 was 47 km/h. Calm conditions occurred 13 % of the time.

January to December 2005

From January to December 2005, the winds at the NICO Project were predominantly from the south-southeast (Figure 4-2). Wind from the north was also common, particularly in the third quarter. Sustained wind speeds in excess of 30 km/h were common throughout the year, and calm wind conditions were recorded 4.7 % of the time.

The January to March windrose shows that winds were predominantly from the south-southeast followed by winds from the north-northwest (Figure 4-3). During

April to June, the winds were predominantly from the south-southeast and north. The July to September period also showed winds from the north. Both the July to September and October to December periods continued to show winds predominantly from the south-southeast.

Figure 4-1 Windrose, October through December 2004

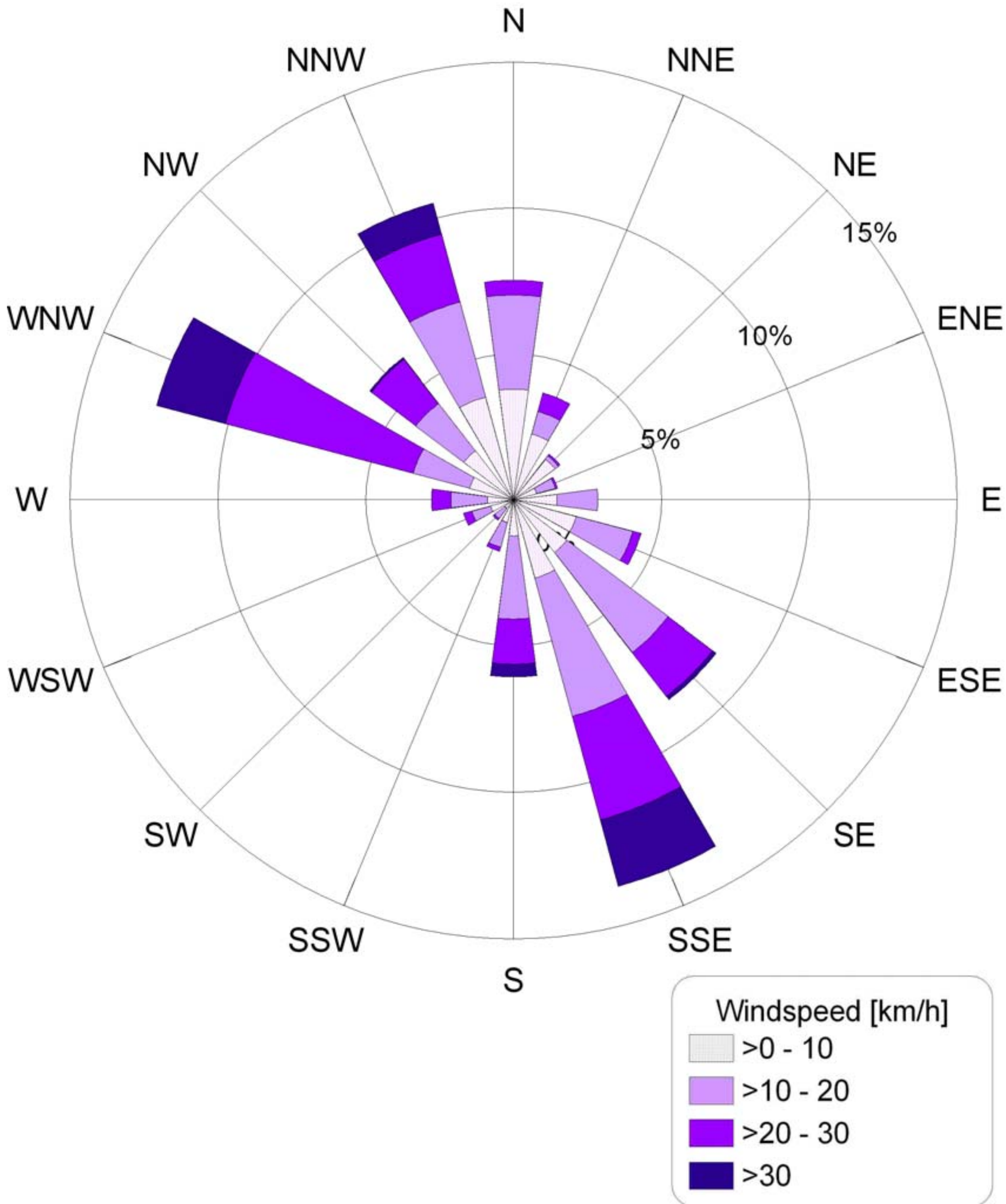


Figure 4-2 Windrose, January through December 2005

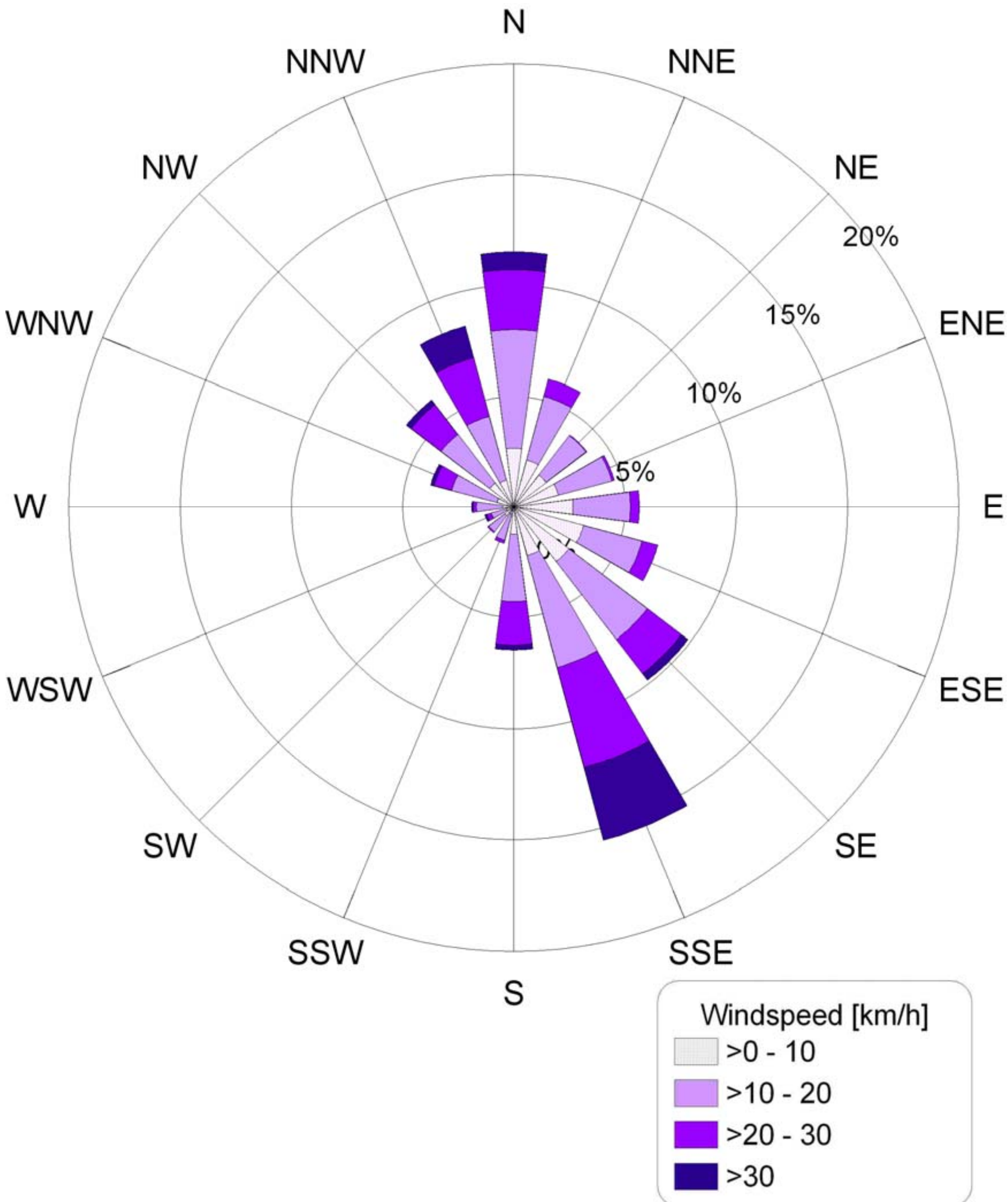
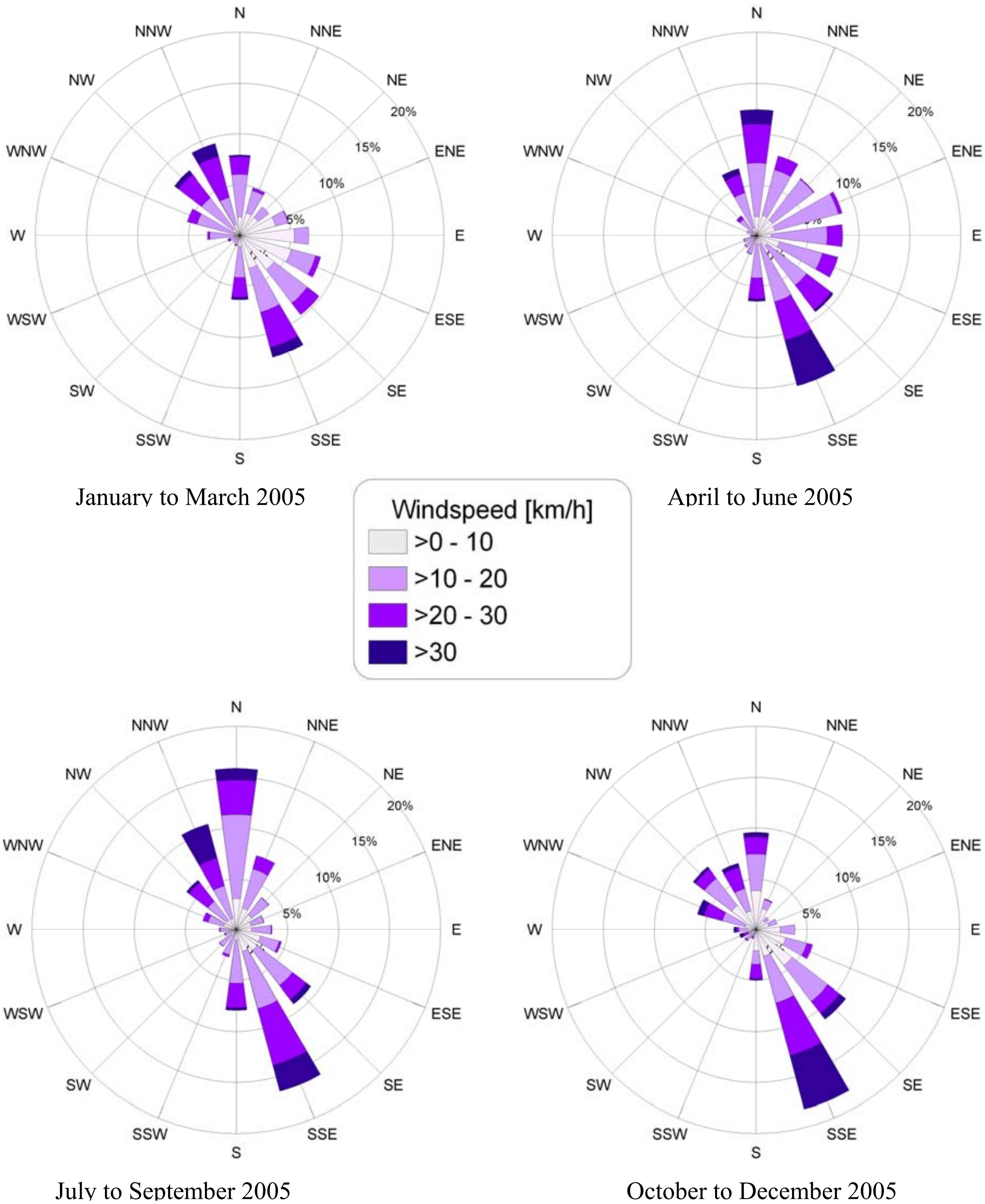


Figure 4-3 Windroses, Quarterly 2005



January to December 2006

From January to December 2006, the winds at the NICO Project were predominantly from the southeast quadrant (Figure 4-4). Winds from the north through northwest were also common, particularly in the first, third, and fourth quarters (Figure 4-5). Sustained wind speeds in excess of 30 km/h were common throughout the year. Calm winds (less than 0.5 metres per second) occurred 4.4 % of the time in 2006.

Figure 4-5 shows quarterly windroses at the NICO Project for the same monitoring duration. The January to March windrose shows that winds were predominantly from the south-southeast followed by winds from the north through northwest. In the second quarter of 2006, winds were predominantly from the south-southeast. The July to September period showed predominant winds from the southeast, and an increase in winds from the north through northwest. The October to December period also received winds predominantly from the southeast.

Figure 4-4 Windrose, January through December 2006

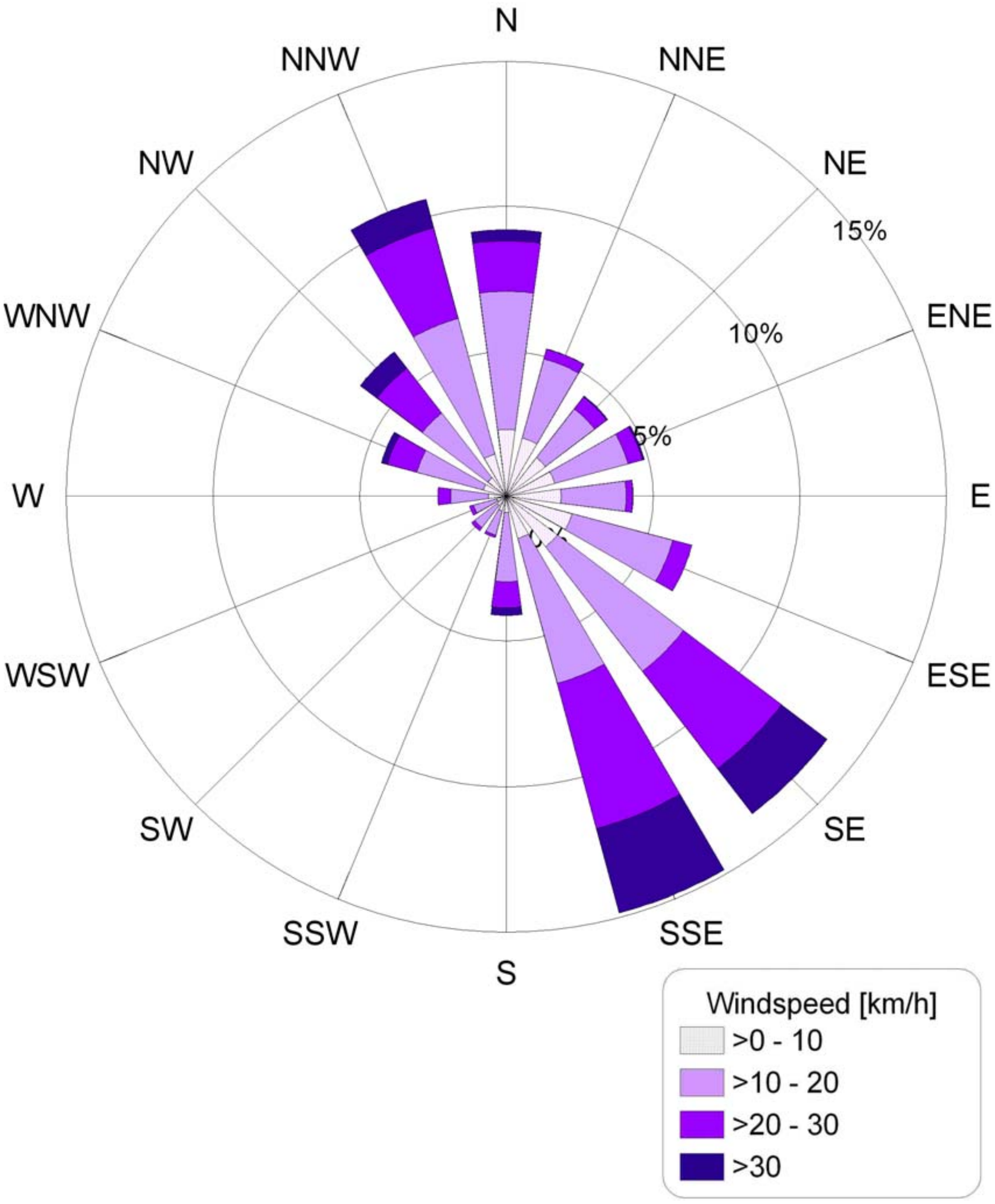
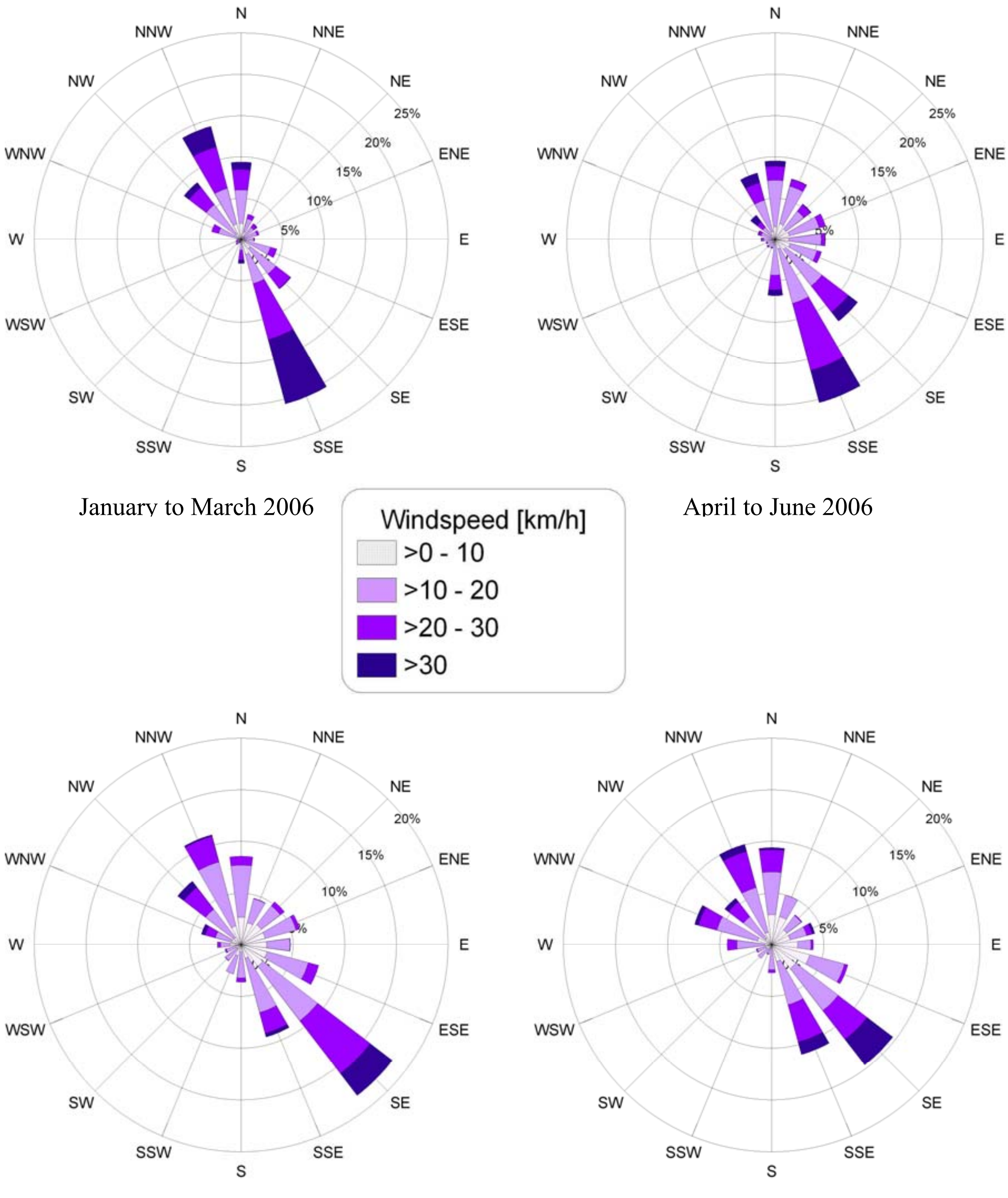


Figure 4-5 Windroses, Quarterly 2006



January to March 2006

April to June 2006

July to September 2006

October to December 2006

January to December 2007

From January to December 2007, winds at the NICO Project were predominantly from the southeast quadrant (Figure 4-6). Sustained wind speeds in excess of 30 km/h were recorded regularly through the winter. Calms were recorded 6.4 % of the time in 2007.

Figure 4-7 shows quarterly windroses at the NICO Project for the same monitoring duration. The January to March windrose shows that winds were predominantly from the north-northwest; however, by the second quarter, the familiar, dominant south-southeast pattern was re-established. The July to September and October to December periods showed a similar pattern, with winds from the north-northwest and from the southeast.

January to 15 April 2008

The January to 15 April 2008 windrose shows that winds were predominantly coming from the southeast and were frequently observed from the north-northwest (Figure 4-8). Calm conditions occurred approximately 4.6 % of the time.

Figure 4-6 Windrose, January through December 2007

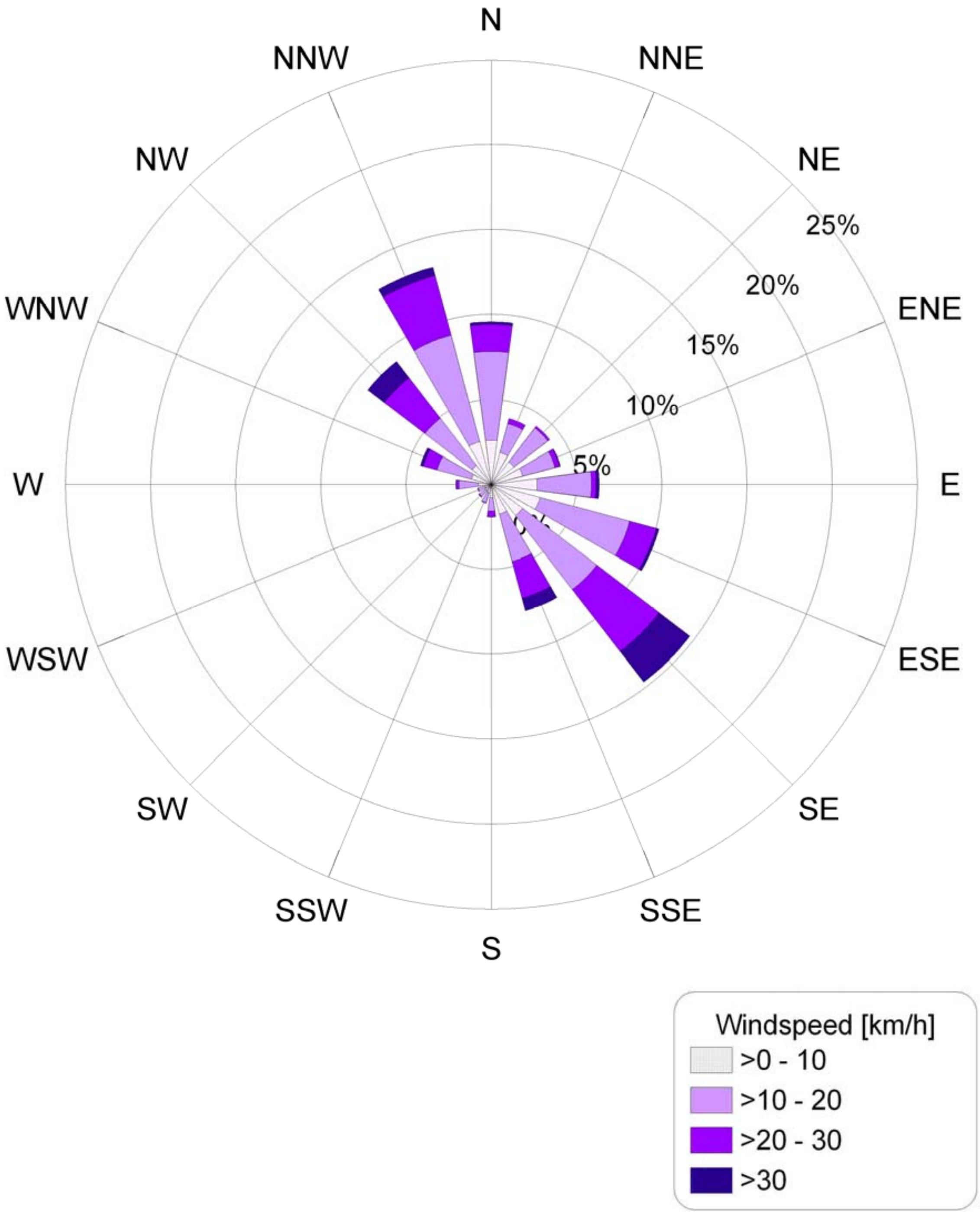
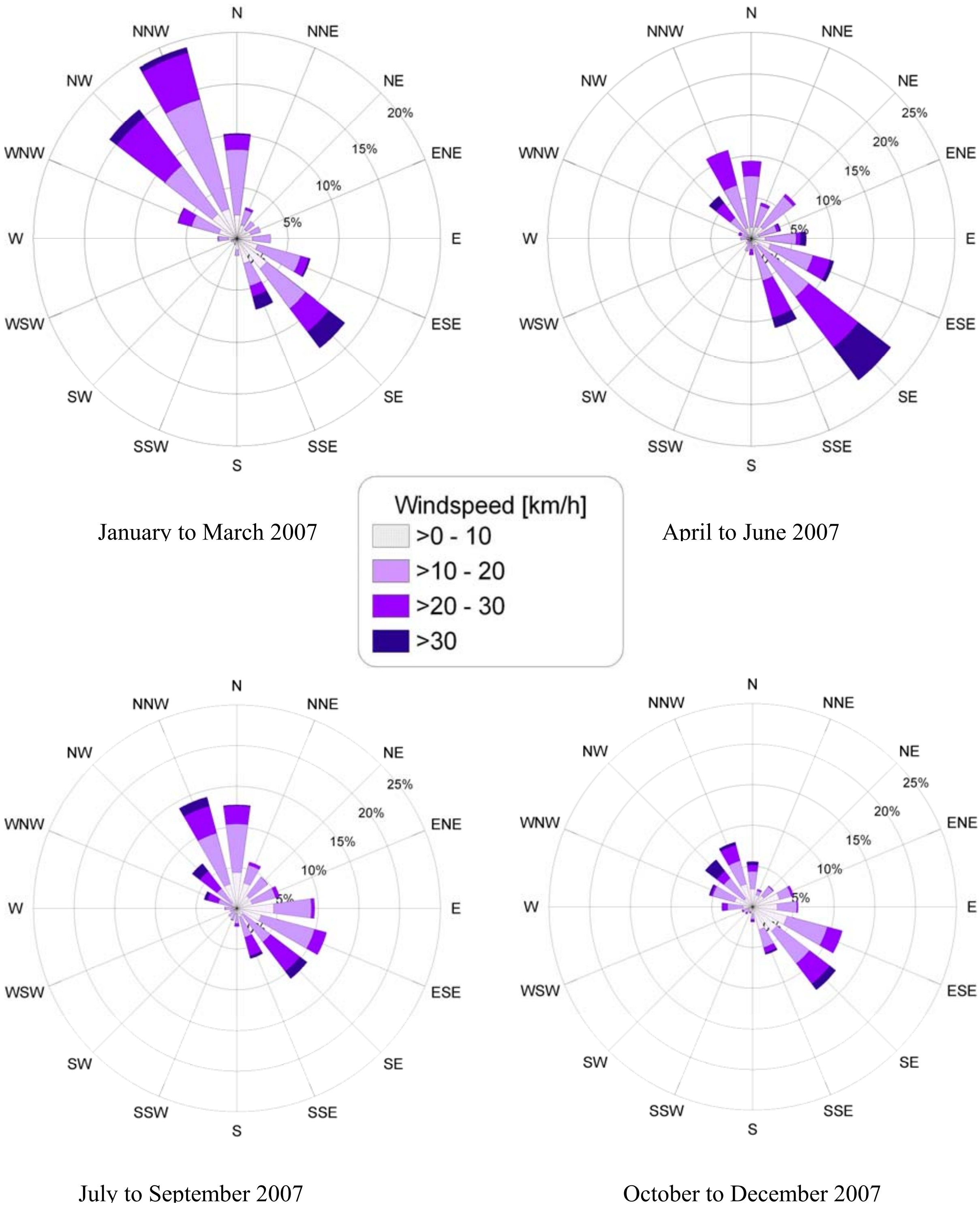


Figure 4-7 Windroses, Quarterly 2007



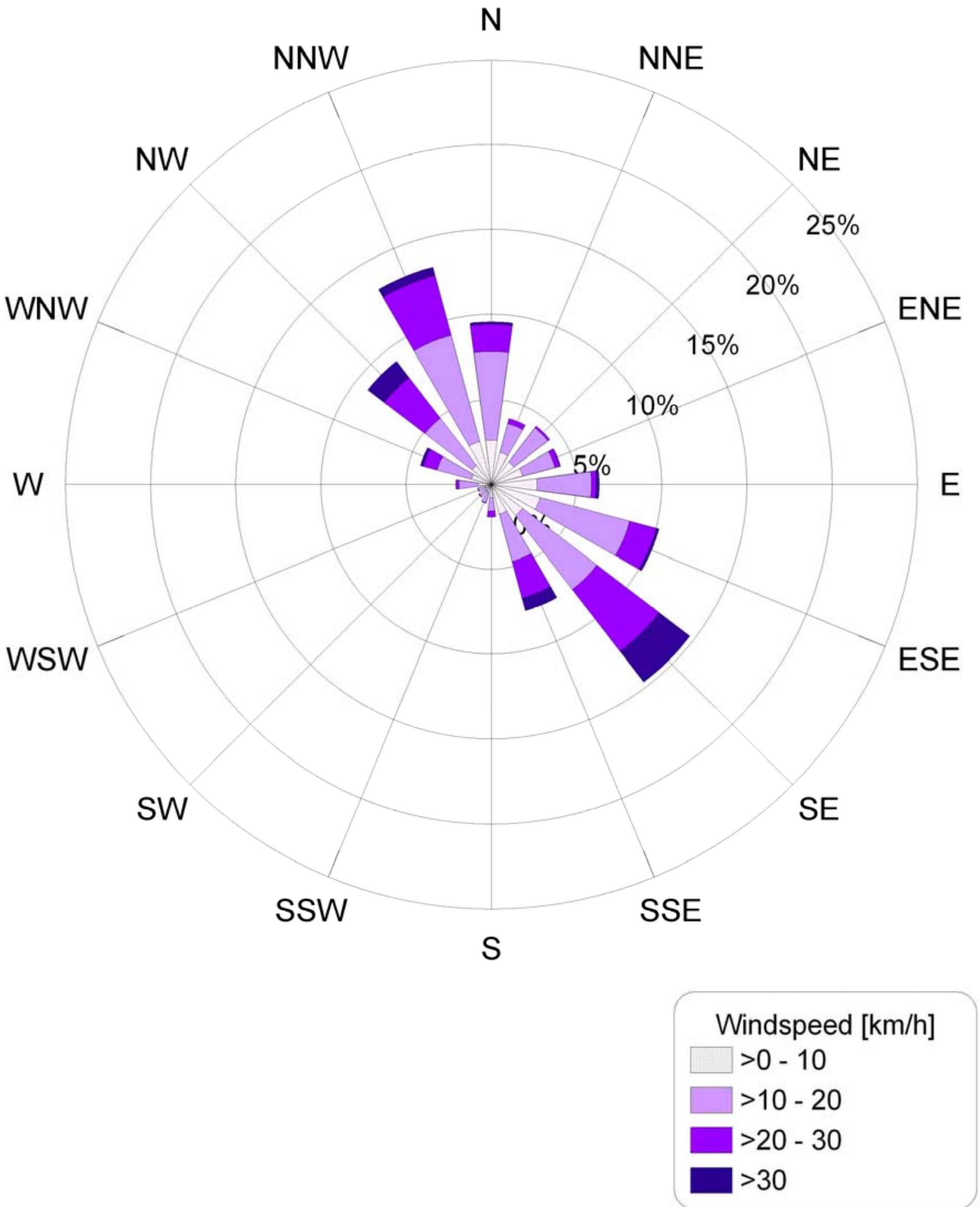
January to March 2007

April to June 2007

July to September 2007

October to December 2007

Figure 4-8 Windrose, January through 15 April 2008



4.1.2.1 Wind Direction Discussion

A composite windrose (Figure 4-9) for the October 2004 to April 2008 period shows frequent winds from the southeast and northwest, with approximately 25 % of the total winds from the southeast. The annual and quarterly windroses also show winds predominantly from the southeast and northwest. The pattern of large-scale weather systems that move through the region influence annual winds and dominance from the southeast is consistent with the expected pattern in the region of the NICO Project.

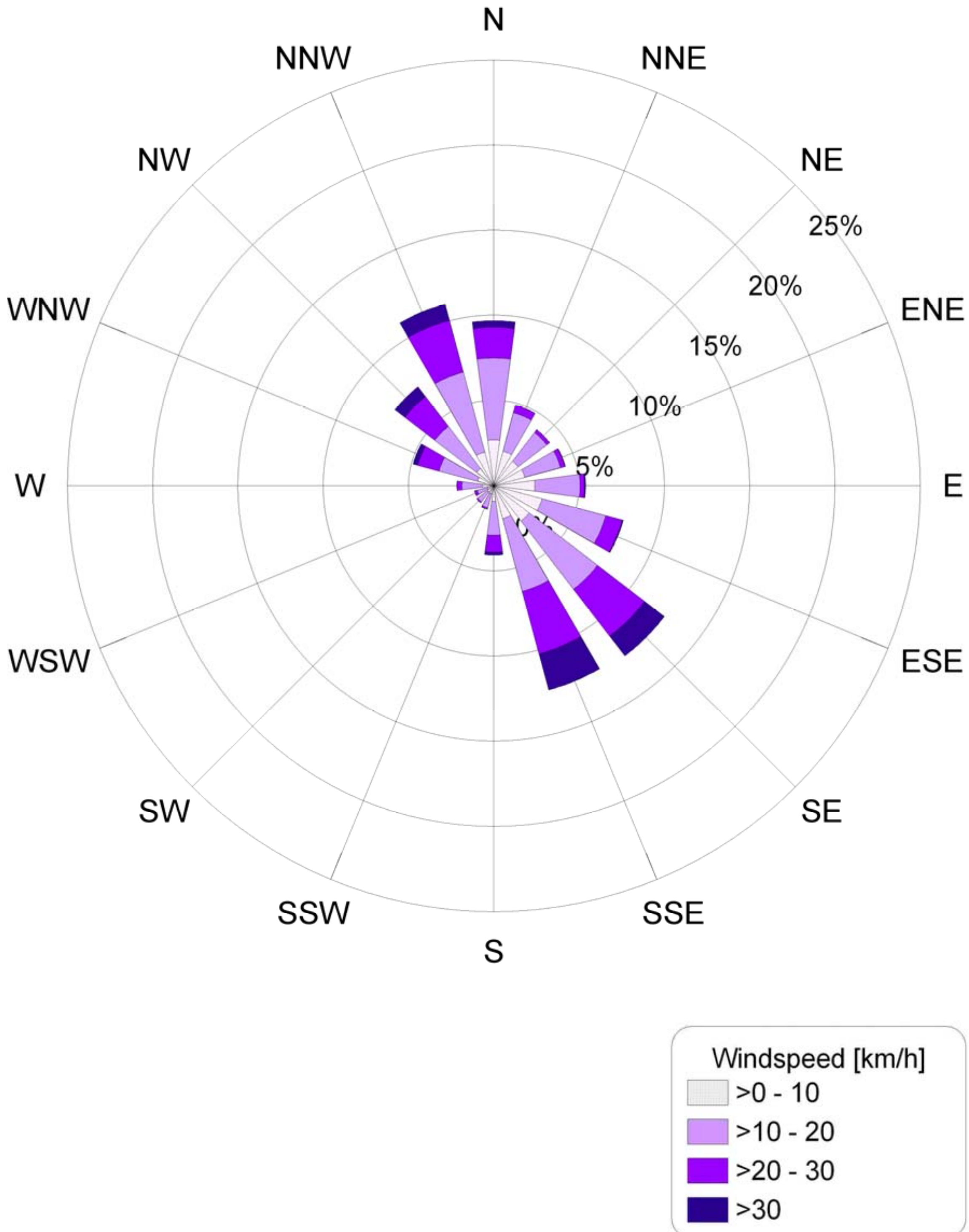
Table 4-1 is a summary of the winds observed at the Environment Canada Yellowknife airport station between the years of 1971 and 2000 (Environment Canada 2008). Similar data between the sites were not expected since the terrain is markedly different between the 2 locations.

Table 4-1 Climate Normal Wind Statistics at Yellowknife Airport, 1971 to 2000

Wind	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average speed (km/h)	12.2	13.0	13.7	14.8	15.5	14.8	13.7	13.7	14.8	15.8	14.0	11.9	14.0
Most frequent direction	NW	NW	NW	NE	SE	SE	SE	SE	SE	E	E	NW	E
Maximum hourly speed (km/h)	72.0	60.8	60.8	64.1	64.1	68.0	64.1	64.1	72.0	64.1	64.1	56.9	72.0
Maximum gust speed (km/h)	105.1	97.9	74.2	92.9	87.1	88.9	85.0	79.9	105.1	92.9	113.0	79.9	105.1

Source: Environment Canada (2008), internet site

Figure 4-9 Windrose, October 2004 to April 2008



4.2 RAINFALL

4.2.1 Methods

Rainfall was measured at the NICO Project meteorological station from October 2004 to April 2008 using an automated Texas Electronics TE525WS tipping bucket rain gauge. Data were recorded by a Campbell Scientific CR10X data-logger. Data were downloaded to a laptop computer intermittently and were periodically subjected to quality assurance checks by Golder Associates Ltd. (Golder) technicians. A field maintenance program involving field calibration was performed in June 2006 and August 2008.

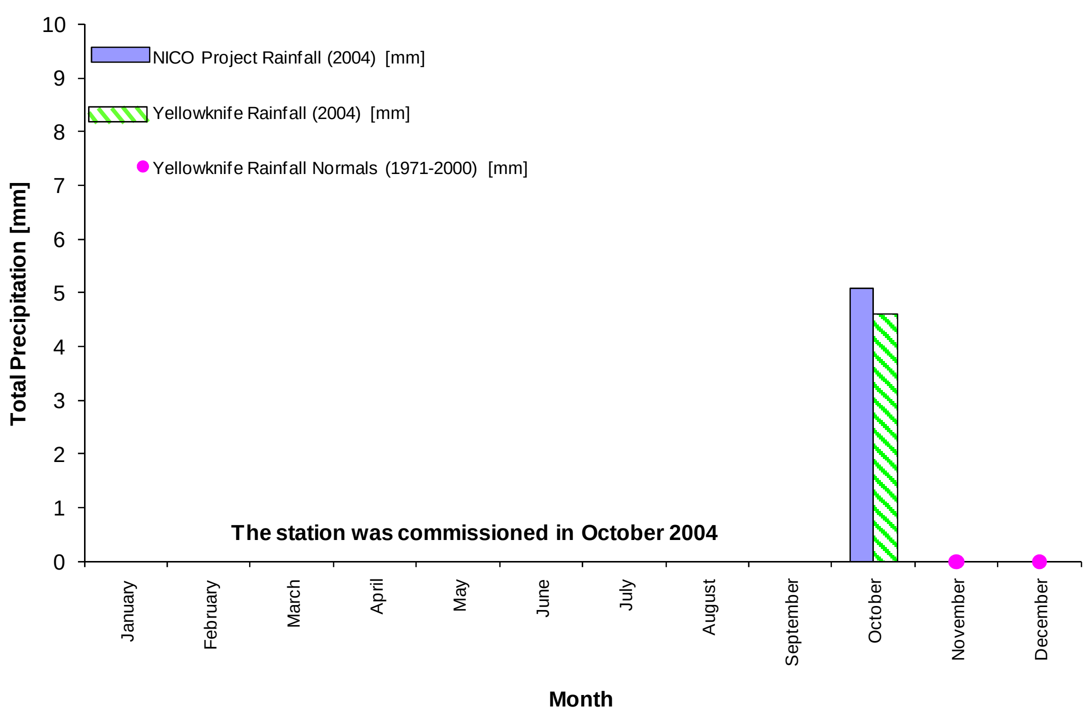
4.2.2 Results

The majority of rainfall occurs between April and October. A summary of the monthly rainfall readings in millimetres (mm) at the NICO Project from 2004 to 2008 is provided below. The data were compared to the monthly rainfall for Yellowknife for the same year and were also compared to the Canadian Climate Normal 30-year average for Yellowknife, based on data from 1971 to 2000.

October to December 2004

The total rainfall recorded at the NICO Project station between mid-October and the end of December 2004 was 5.08 mm, which is higher than the Yellowknife total for October 2004 (4.60 mm) and lower than the Yellowknife long-term (1971 to 2000) rainfall normals of 14.70 mm for the period (Figure 4-10).

Figure 4-10 Rainfall Summary, 2004

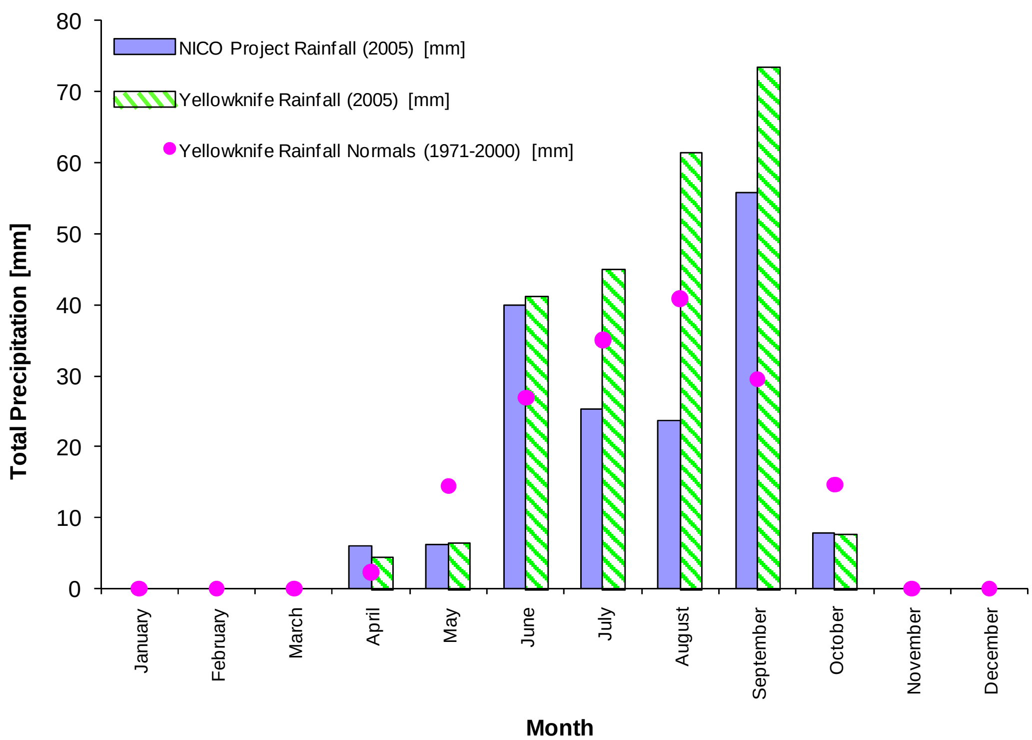


January to December 2005

Total annual recorded rainfall at the NICO Project was 165.10 mm in 2005, which is lower than the Yellowknife total for 2005 of 239.60 mm and marginally higher than the Yellowknife long-term (1971 to 2000) annual rainfall average of 163.93 mm (Figure 4-11).

The monthly rainfall totals from April through June and October at the NICO Project were similar to the totals recorded for Yellowknife in 2005, whereas the months from July through September recorded lower rainfall at the NICO Project than in Yellowknife. When compared to the long-term climate normals for Yellowknife, monthly totals recorded at the NICO Project for April, June, and September were higher than expected, and the rainfall amounts for May, July, August, and October were lower than the climate normals.

Figure 4-11 Rainfall Summary, 2005

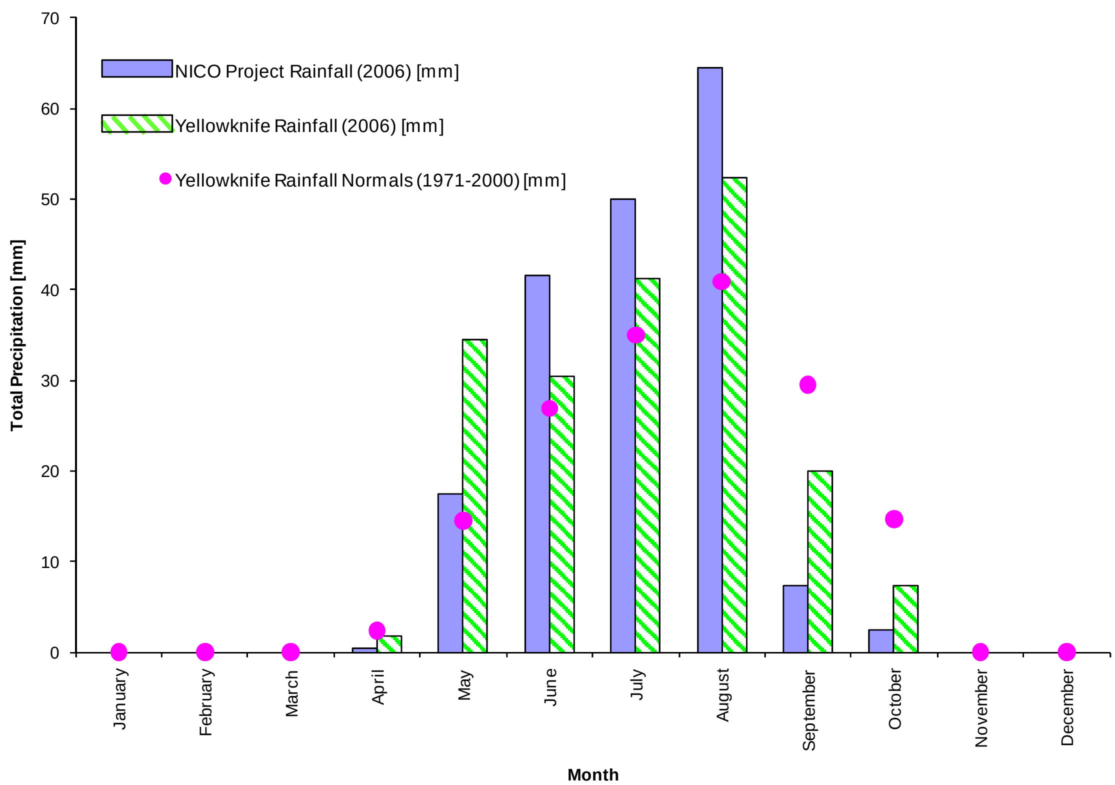


January to December 2006

Total rainfall at the NICO Project was 184.15 mm in 2006, which is lower than the Yellowknife total for 2006 (187.80 mm) and higher than the Yellowknife long-term (1971 to 2000) annual rainfall average of 163.93 mm (Figure 4-12).

The total monthly rainfall amounts at the NICO Project were higher from June through August 2006 than was observed at Yellowknife for the same period and were also higher than the 1971 to 2000 long-term average for Yellowknife. The rainfall amounts for the months of April, May, September, and October 2006 were below the rainfall totals for the corresponding months in Yellowknife. For 9 of the 12 months, the data show that 2006 was as wet or wetter than average Yellowknife Rainfall Normals, and was the wettest of the 3 complete years measured at the NICO Project.

Figure 4-12 Rainfall Summary, 2006

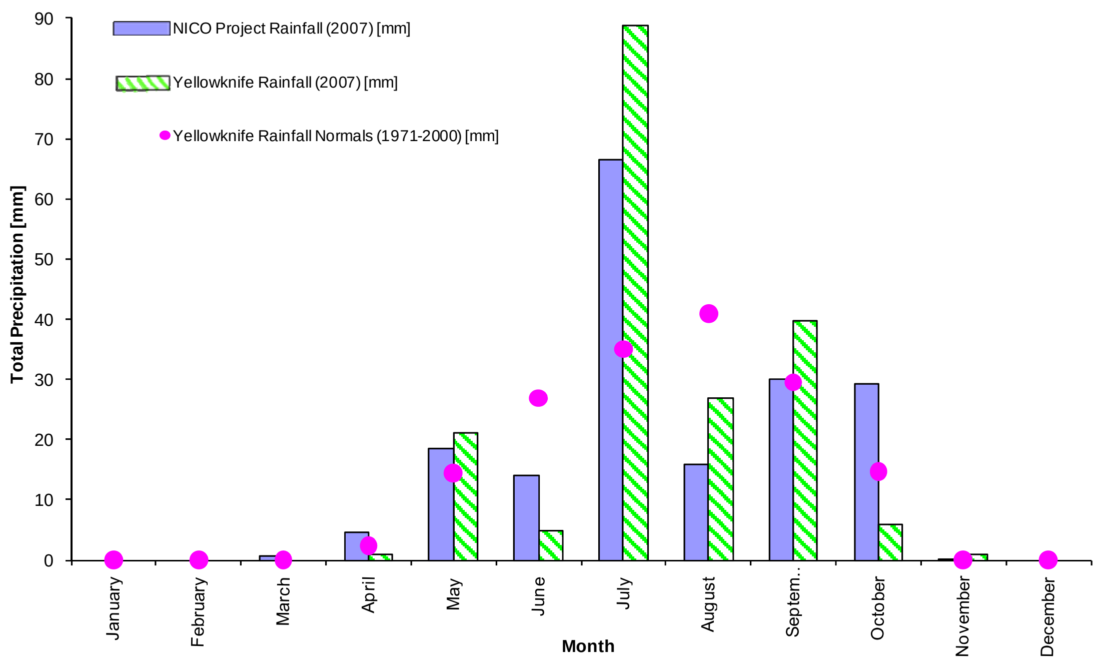


January to December 2007

Total rainfall recorded at the NICO Project between January and December 2007 was 179.8 mm, which is less than the Yellowknife total for the same period (189.2 mm). Approximately 10 % more rain fell at the NICO Project than the average for Yellowknife based on observations between 1971 and 2000 (163.9 mm) (Figure 4-13).

The monthly rainfall totals for April, June, and October 2007 at the NICO Project were higher than those for Yellowknife, whereas the rainfall amounts recorded during the remaining months of 2007 were less. For the months of May and July 2007, both the NICO Project and Yellowknife monthly rainfall totals were above the corresponding 1971 to 2000 monthly long-term climate averages observed at Yellowknife.

Figure 4-13 Rainfall Summary, 2007

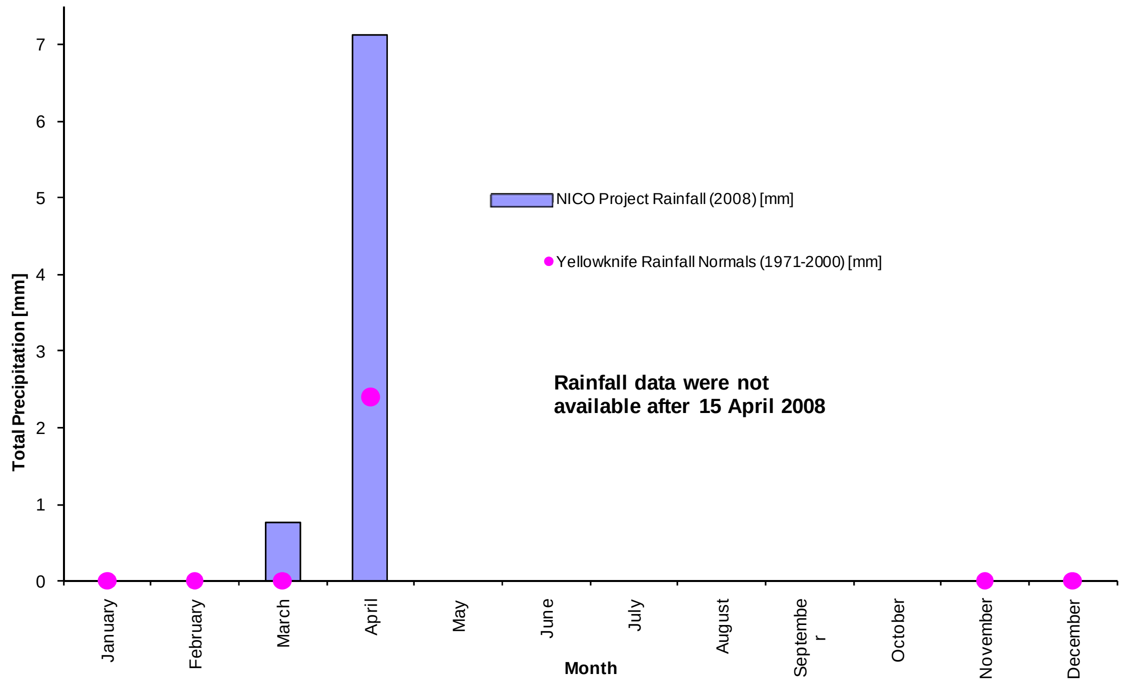


January to 15 April, 2008

Total rainfall recorded at the NICO Project between January and 15 April 2008 was 7.9 mm. The 7.9 mm observed at the NICO Project is slightly higher than would be expected at Yellowknife based on the Yellowknife climate normals

(2.4 mm). Data between 15 April 2008 and the end of August 2008 were lost due to battery failure (Figure 4-14).

Figure 4-14 Rainfall Summary, 2008



4.3 TEMPERATURE

4.3.1 Methods

Temperature was measured at the NICO Project between October 2004 and August 2007. A Campbell Scientific YSI 44002A thermistor recorded air temperature data. The temperature sensor is housed in a radiation shield that is mounted on the tower at approximately 2.5 m above ground level. As part of the station maintenance program, scheduled calibration of this instrument was performed in June 2006 and again in August 2008. Because this instrument must be calibrated off-site, a back-up unit was used with the primary unit during calibrations.

4.3.2 Results

The ranges of monthly mean temperatures at the NICO Project site between 2004 and 2008 were as follows:

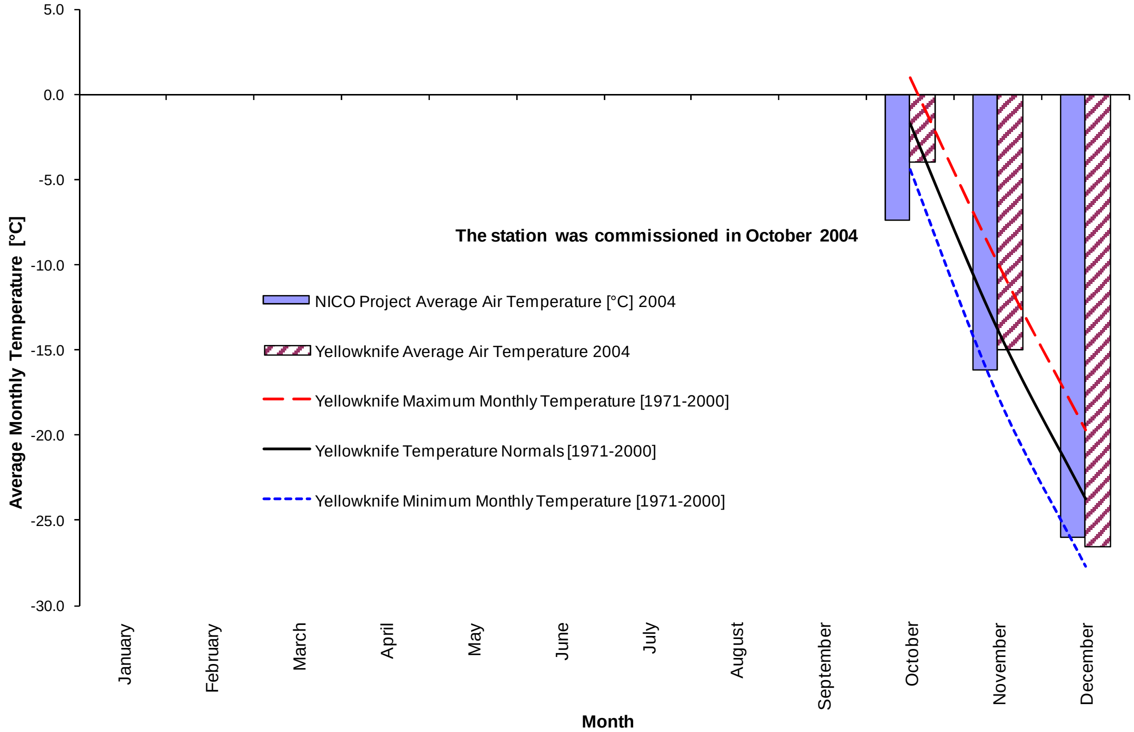
- -26.0°C in December to -7.4°C in October 2004 (October to December 2004 data only);
- -25.8°C in January to +14.5°C in July 2005;
- -23.4°C in January to +15.9°C in June 2006;
- -25.2°C in February to +17.5°C in July 2007; and
- -26.7°C in February to -3.7 in April 2008 (January to April data only).

The temperatures observed at the Yellowknife airport for the corresponding months and the 1971 to 2000 long-term climate normals for Yellowknife are also provided in the following sections for comparison.

October to December 2004

The average temperature of -16.5°C observed at the NICO Project between October and December was 1.3°C cooler than observed at Yellowknife (-15.2°C) for the same period, and 3.4°C cooler than the long-term (1971 to 2000) normal average for October, November, and December at Yellowknife (-13.1°C) (Figure 4-15).

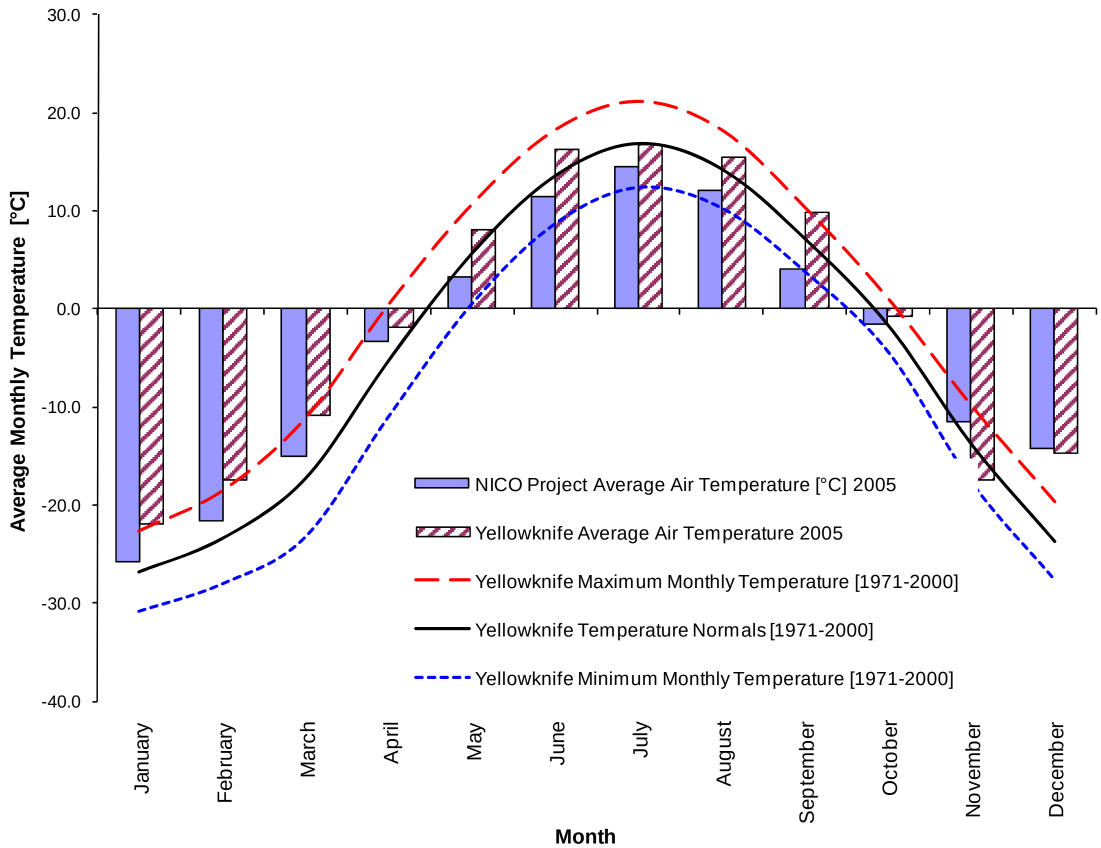
Figure 4-15 Temperature Summary, 2004



January to December 2005

The average temperature of -4.0°C recorded at the NICO Project in 2005 was 0.6°C warmer than the average annual temperature of -4.6°C at Yellowknife for the 30-year period between 1971 and 2000 and was 0.4°C cooler than the 2005 Yellowknife annual average (-3.6°C) for the same year (Figure 4-16). Yellowknife was 1.0°C warmer in 2005 than the long-term (1971 to 2000) Yellowknife climate average (-4.6°C). Average monthly temperatures at the NICO Project were cooler than at Yellowknife from January through to October 2005, but warmer for the months of November and December 2005.

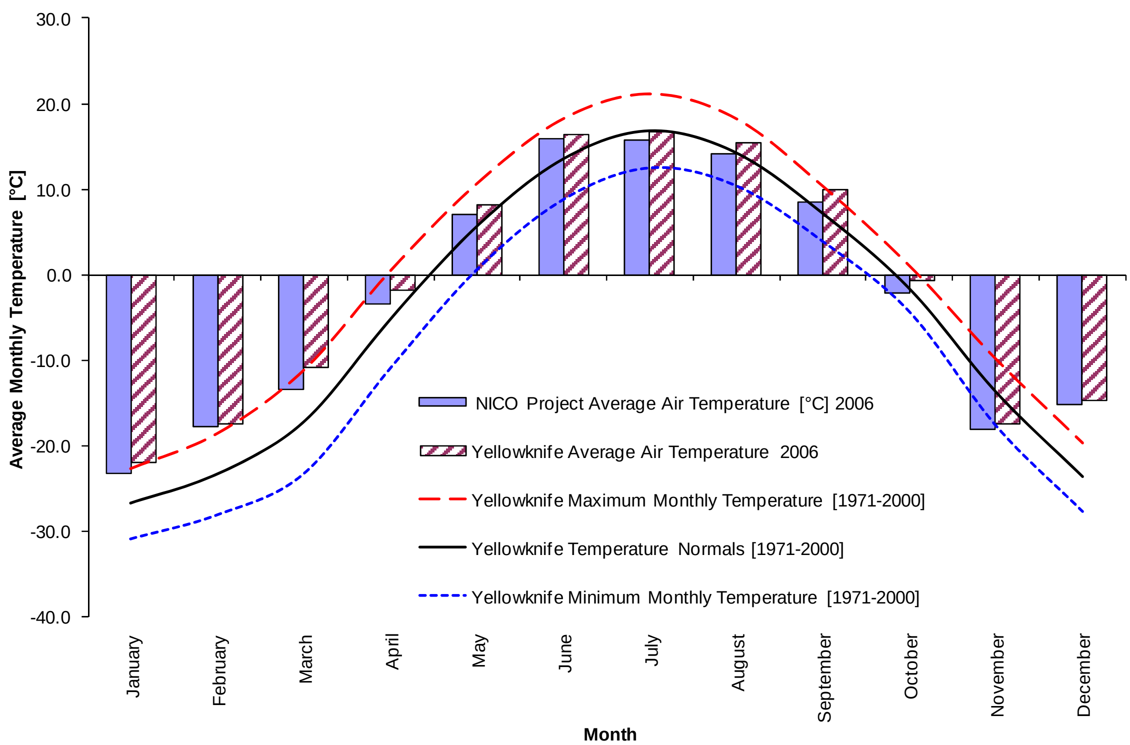
Figure 4-16 Temperature Summary, 2005



January to December 2006

The annual average temperature of -2.7°C in 2006 at the NICO Project was 1.9°C warmer than the annual average temperature of -4.6°C for Yellowknife calculated for the period between 1971 and 2000 (Figure 4-17). The annual average temperature at the NICO Project in 2006 was 1.3°C warmer than in 2005 (-4.0°C). The average temperature recorded at Yellowknife shows a similar pattern. Yellowknife was 3.0°C warmer in 2006 (-1.6°C) than the long-term (1971-2000) climate average (-4.6°C). Monthly average temperatures for the NICO Project were slightly cooler than Yellowknife during 2006.

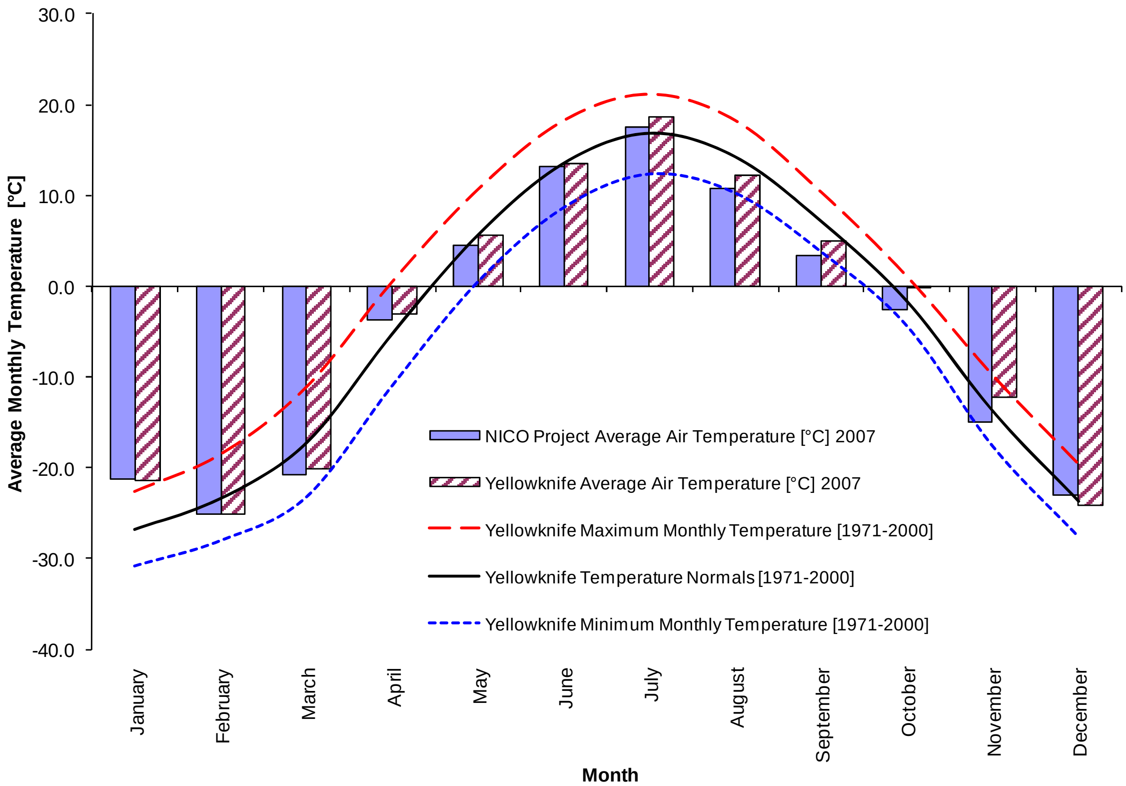
Figure 4-17 Temperature Summary, 2006



January to December 2007

The January through December average temperature of -5.2°C in 2007 at the NICO Project was 0.9°C cooler than the annual average temperature of -4.3°C for Yellowknife in 2007 (Figure 4-18). In contrast, the annual average temperature for Yellowknife was 0.3°C warmer compared to its long-term (1971-2000) average. Though the calculated averages at the NICO Project and at Yellowknife fell on either side of the long-term average for Yellowknife, temperatures followed a similar pattern and were close in value for the period of record. Monthly temperature averages at the NICO Project followed a very similar pattern from 2004 to 2007.

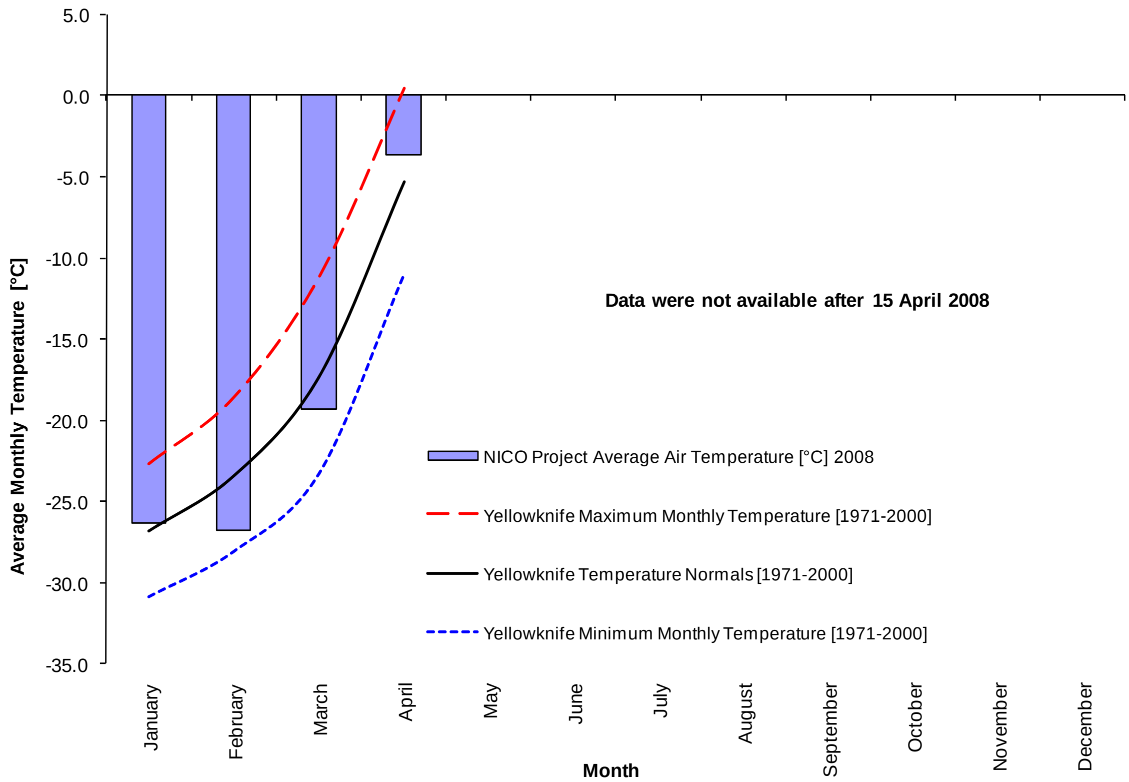
Figure 4-18 Temperature Summary, 2007



January to 15 April 2008

The January through 15 April 2008 average temperature of -19.0°C in 2008 at the NICO Project was 0.9°C cooler than the average temperature of -18.2°C for Yellowknife for the same period (Figure 4-19).

Figure 4-19 Temperature Summary, 2008



4.4 RELATIVE HUMIDITY

Relative humidity is a measure of the amount of water vapour present in the air at a given temperature and pressure, relative to the maximum amount of vapour that could be present at the same temperature and pressure.

4.4.1 Methods

Relative humidity was measured at the NICO Project from October 2004 through to April 2008. A Vaisala capacitive relative humidity sensor recorded hourly relative humidity data. The relative humidity sensor was housed in a radiation shield that was mounted at approximately 2.5 m above the ground at the meteorological station. Relative humidity values were measured for the duration of the sampling period. As part of the station maintenance program, scheduled calibration of this instrument was performed in June 2006 and again in August 2008. Because this instrument must be calibrated off-site, a back-up unit was used with the primary unit during calibrations.

4.4.2 Results

Average monthly relative humidity ranges at the NICO Project between 2004 and 2008 were as follows:

- 79.4% in December to 90.3% in October 2004 (October to December data only) (Figure 4-20);
- 56.4% in June to 92.1% in November 2005 (Figure 4-21);
- 54.0% in June to 89.2% in December 2006 (Figure 4-22);
- 47.4% in June to 93.3% in October 2007 (Figure 4-23); and
- 64.2% in April to 79.2% in January 2008 (January to April data only) (Figure 4-24).

The mean monthly relative humidity data recorded at the NICO Project for the years 2004 to 2008 are shown in Figures 4-20 to 4-24. Long-term (1971 to 2000) data for Yellowknife are also included for comparison. Long-term (1971 to 2000) relative humidity averages at Yellowknife are recorded at 6:00 AM and 3:00 PM.

If the amount of vapour remains constant and the temperature rises, relative humidity will fall. Morning humidity readings were typically higher than afternoon readings due to cooler temperatures. The relative humidity data for the NICO Project showed a pattern and range consistent with that of the Yellowknife data. The relative humidity data were a higher on average at the NICO Project than in Yellowknife, which could be attributed to lower ambient temperatures at the NICO Project.

Figure 4-20 Relative Humidity Summary, 2004

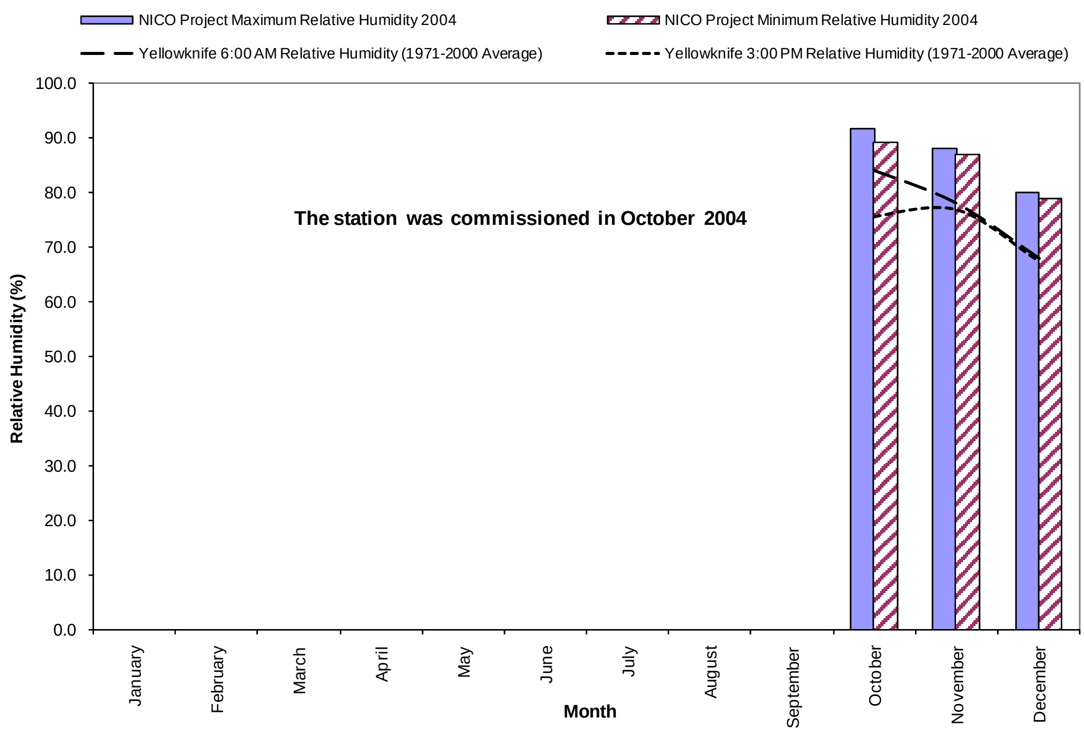


Figure 4-21 Relative Humidity Summary, 2005

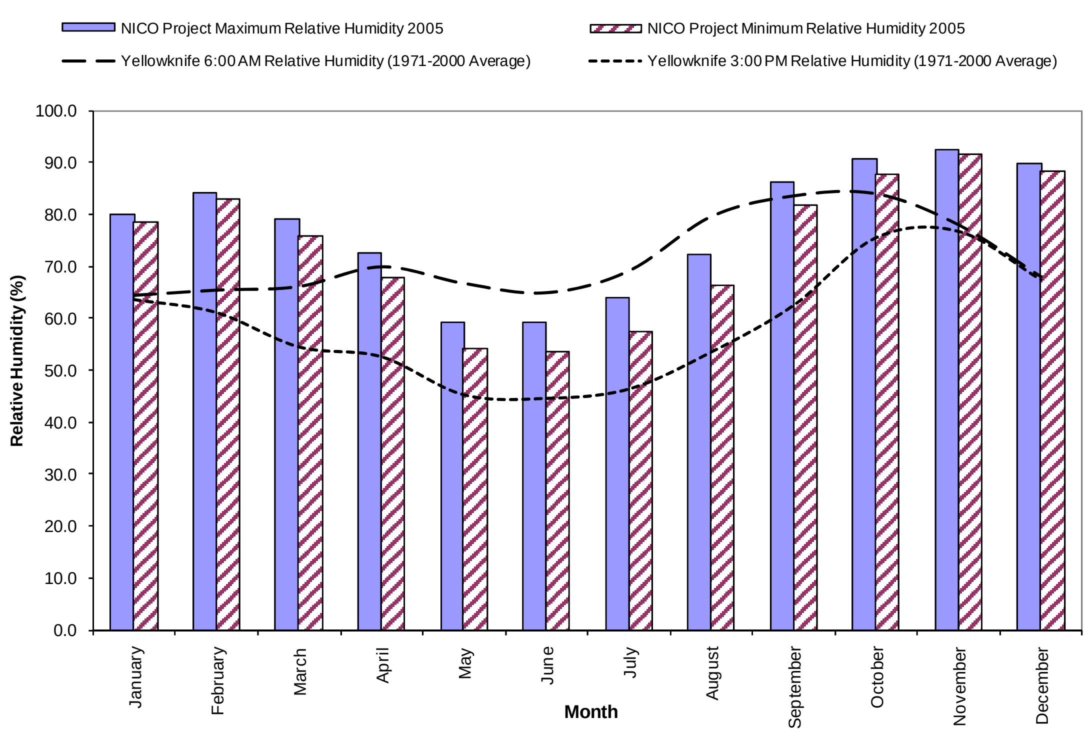


Figure 4-22 Relative Humidity Summary, 2006

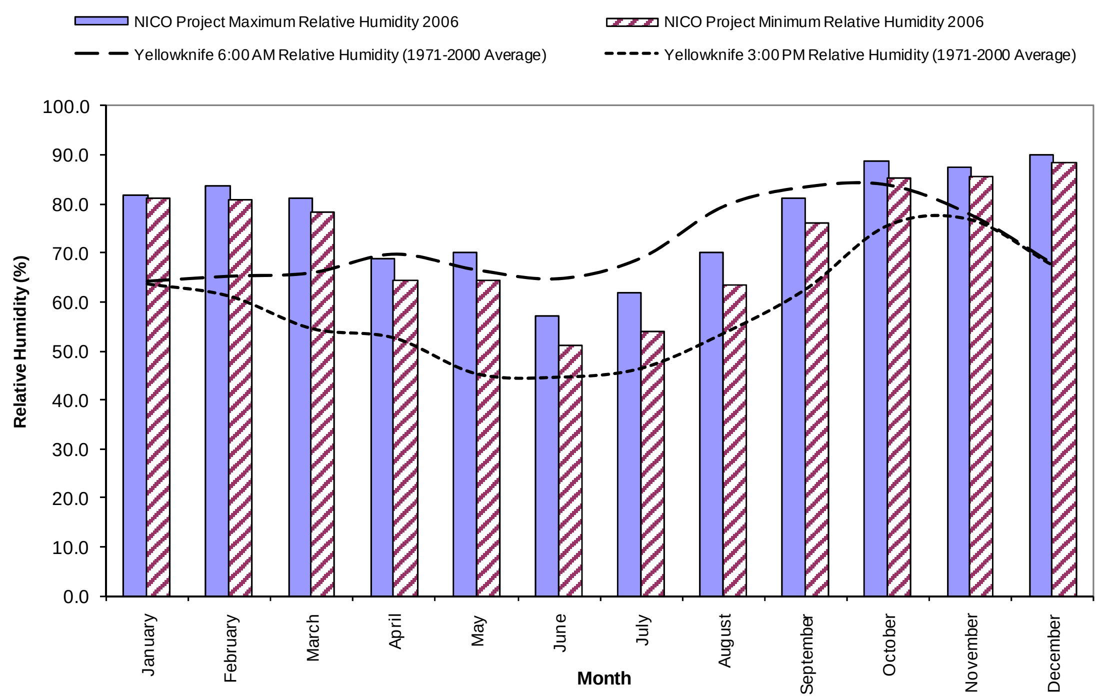


Figure 4-23 Relative Humidity Summary, 2007

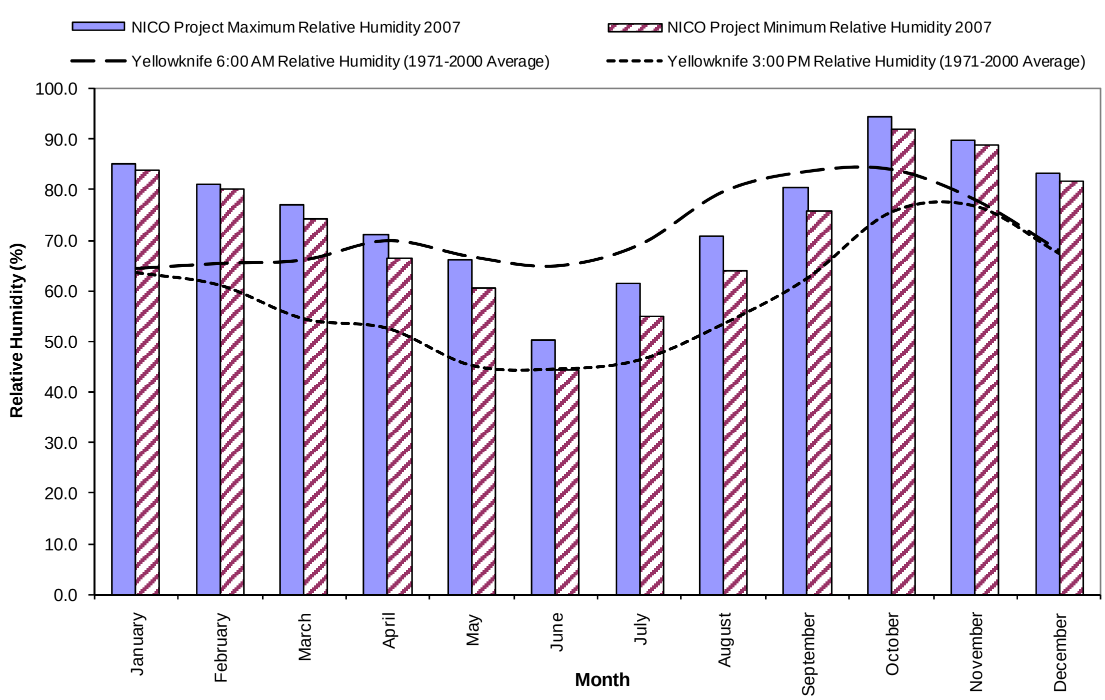
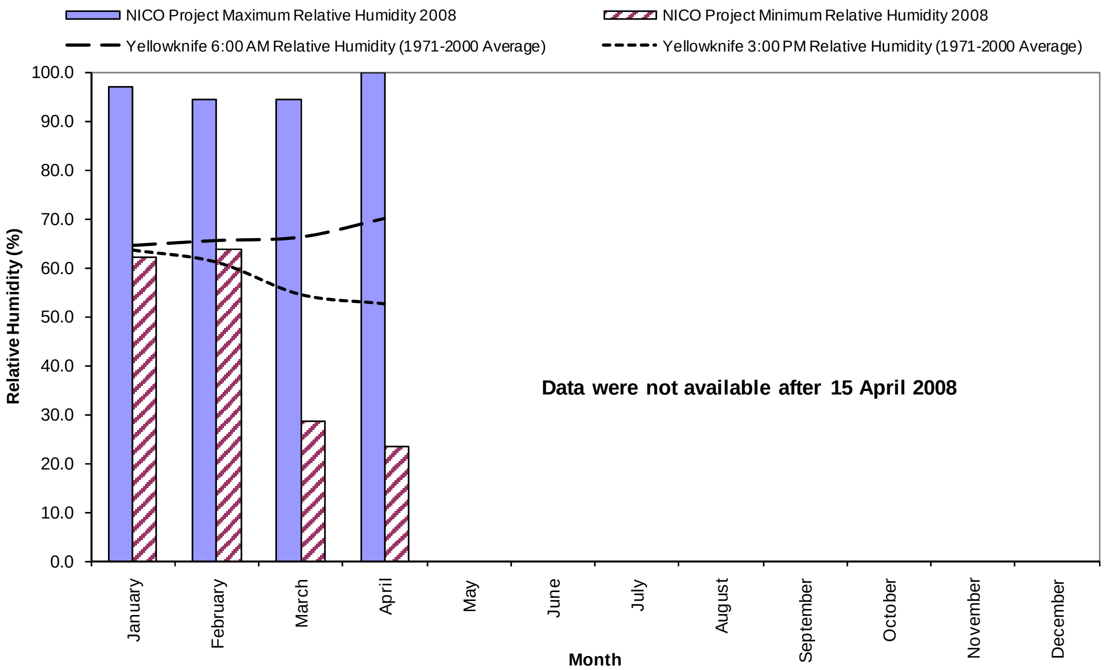


Figure 4-24 Relative Humidity Summary, 2008



4.5 SOLAR RADIATION

Solar radiation levels measured at the surface are a function of hours of sunlight and sun azimuth angle, as well as a function of local weather conditions, including relative humidity, cloud cover, cloud type, and cloud depth.

4.5.1 Methods

Solar radiation was measured at the NICO Project from October 2004 to April 2008. A Kipp and Zonen SP Lite pyranometer collected hourly solar radiation data at the NICO Project throughout the sampling period. The device was mounted approximately 2.5 m above grade on the meteorological station tower. The data were fully recovered for the duration of the sampling period. As part of the station maintenance program, scheduled calibration of this instrument was performed in June 2006 and again in August 2008. Because this instrument must be calibrated off-site, a back-up unit was used with the primary unit during calibrations.

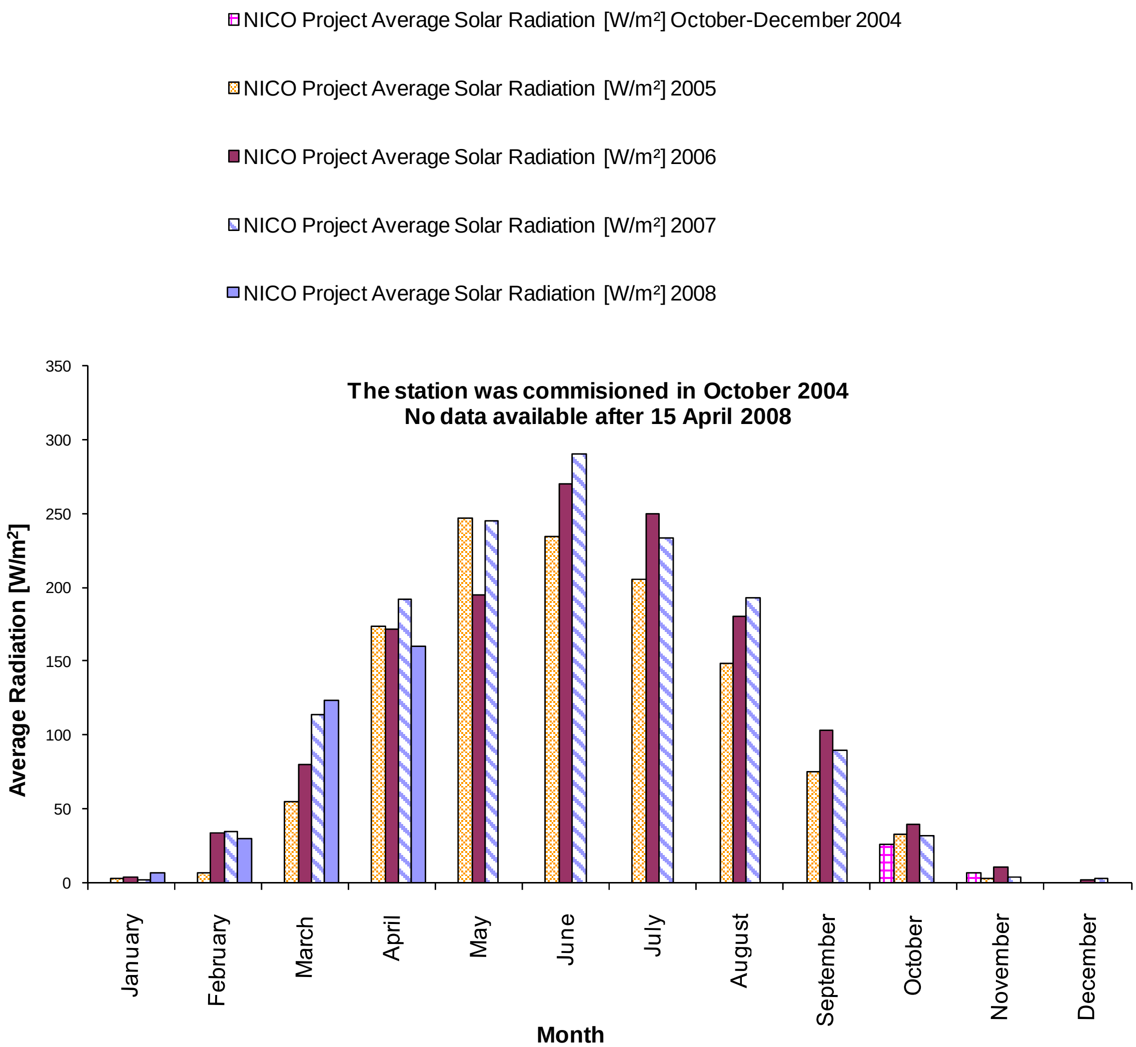
4.5.2 Results

Figure 4-25 presents the combined monthly solar radiation summaries for 2004 to 2008. The annual ranges of solar radiation monthly averages at the NICO Project between 2004 and 2008 were as follows:

- 1.4 watt per square metre (W/m^2) in December to 26.4 W/m^2 in October 2004 (October to December data only);
- 0.5 W/m^2 in December to 247.7 W/m^2 in May 2005;
- 1.6 W/m^2 in December to 270.2 W/m^2 in June 2006;
- 2.0 W/m^2 in January to 290.2 W/m^2 in June 2007; and
- 2.0 W/m^2 in January to 160.1 W/m^2 in April 2008.

Changes in the weather variables may cause the annual peak in solar radiation to fluctuate from year to year. The peak occurred in May during 2005 and in June for both 2006 and 2007. Data were not collected in May and June of 2004 and are not yet available for 2008.

Figure 4-25 Solar Radiation Summary, 2004 to 2008



Note: W/m^2 = watts per square metre

4.6 SUMMARY

A meteorological monitoring station at the NICO Project site recorded ambient meteorological conditions from October 2004 to April 2008. The data collected were consistent with regional data and the data collection efficiency was almost 100 % through 15 April 2008. The data gaps were a result of station calibration, occasional wind sensor freeze-up during winter months, and a failed battery in the summer of 2008. The calibration of equipment was performed in June 2006 and August 2008.

5 AIR QUALITY MONITORING AT THE NICO PROJECT

Background air quality information based on locally collected, pre-development data is preferred to “proxy” (i.e., substitute) estimates from a distant location. In the absence of sufficient local data, values from other locations can be considered, as long as the activity in the air shed, terrain, land-use, and climate are similar. An ambient air quality monitoring program was undertaken at the NICO Project in the summers of 2006 and 2007 to monitor NO_2 and SO_2. A summary for each compound is provided below.

Background air quality measurements were taken during a period of relatively low activity at the NICO Project. An underground bulk ore sampling program was undertaken, but the level of activity at the site was light relative to what would be expected during construction and operation of the NICO Project.

5.1 NITROGEN DIOXIDE AND SULPHUR DIOXIDE MONITORING

5.1.1 Methods

Nitrogen dioxide and SO_2 concentrations were measured at 3 locations in the NICO Project area: the NICO Project meteorological station, at Peanut Lake approximately 3 km to the southeast, and at Lion Lake approximately 3.5 km to the northwest (Figure 2-1). Passive samplers from Maxxam Analytics Ltd. were used to collect the data. The sampling duration ranged from 30 to 90 days, but the data are reported as prorated 30-day averages. The stations were frequently disturbed by wildlife activity, and hence the dataset is not complete. However, it still provides a reasonable estimate of ground-level concentrations of NO_2 and SO_2 in the area.

5.1.2 Results

The maximum NO_2 concentration observed during the monitoring period was 2.6 micrograms per cubic metre (µg/m^3) and the minimum concentration was 0.2 µg/m^3 (Table 5-1). The maximum SO_2 concentration observed during the monitoring period was 0.5 µg/m^3 and the minimum concentration was of 0.3 µg/m^3 (Table 5-2). The data support the assumption that background concentrations of NO_2 and SO_2 are low in the NICO Project area.

Table 5-1 Nitrogen Dioxide Observed Ground-Level Concentrations

Exposure Date	Collection Date	Sampling Duration (days)	Location	Concentration (ppb)	Concentration (µg/m³)
1 October 2006	1 November 2006	31	NICO Project Met Station	0.2	0.4
9 April 2007	1 June 2007	53	NICO Project Met Station	0.4	0.8
1 June 2007	1 July 2007	30	NICO Project Met Station	0.6	1.1
1 July 2007	31 July 2007	30	NICO Project Met Station	0.7	1.3
31 July 2007	1 September 2007	32	NICO Project Met Station	0.1	0.2
1 September 2007	29 September 2007	28	NICO Project Met Station	0.5	0.9
			NICO Project Meteorological Station Site Average	***0.4***	***0.8***
1 October 2006	29 October 2006	28	Lion Lake	1.4	2.6
9 April 2007	1 June 2007	53	Lion Lake	0.2	0.4
1 June 2007	1 July 2007	30	Lion Lake	0.6	1.1
1 July 2007	31 July 2007	30	Lion Lake	0.5	0.9
1 September 2007	29 September 2007	28	Lion Lake	0.6	1.1
			Lion Lake Site Average	***0.7***	***1.2***
1 October 2006	1 November 2006	31	Peanut Lake	0.2	0.4
1 October 2006	1 November 2006	31	Peanut Lake	0.6	1.1
9 April 2007	1 June 2007	53	Peanut Lake	0.4	0.8
1 June 2007	1 July 2007	30	Peanut Lake	0.8	1.5
1 July 2007	31 July 2007	30	Peanut Lake	0.6	1.1
1 July 2007	31 July 2007	30	Peanut Lake	0.3	0.6
31 July 2007	1 September 2007	32	Peanut Lake	0.4	0.8
31 July 2007	1 September 2007	32	Peanut Lake	0.4	0.8
1 September 2007	29 September 2007	28	Peanut Lake	0.7	1.3
1 September 2007	29 September 2007	28	Peanut Lake	0.6	1.1
			Peanut Lake Site Average	***0.5***	***0.9***
Overall Average				**0.5**	**1.0**

Notes: ppb = parts per billion; µg/m³ = micrograms per cubic metre

Table 5-2 Sulphur Dioxide Observed Ground-Level Concentrations

Exposure Date	Collection Date	Days of Exposure	Location	Concentration (ppb)	Concentration (µg/m³)
1 March 2007	1 June 2007	92	NICO Project Met Station	0.2	0.5
1 March 2007	1 June 2007	92	NICO Project Met Station	0.2	0.5
			NICO Project Meteorological Station Site Average	***0.2***	***0.5***
1 March 2007	1 June 2007	92	Lion Lake	0.2	0.5
			Lion Lake Site Average	***0.2***	***0.5***
1 September 2006	1 December 2006	91	Peanut Lake	0.1	0.3
1 March 2007	1 June 2007	92	Peanut Lake	0.2	0.5
1 June 2007	1 September 2007	92	Peanut Lake	0.1	0.3
			Peanut Lake Site Average	***0.1***	***0.5***
Overall Average				**0.2**	**0.5**

Notes: ppb = parts per billion; µg/m³ = micrograms per cubic metre.

Based on the data observed at the site in October and November 2006 and April through September 2007, the baseline NO_2 concentration for comparison for the assessment is 1.0 µg/m³. The stations farthest from the NICO Project site (i.e., Lion Lake and Peanut Lake sites) both indicated ambient NO_2 concentrations higher than the observed concentrations closer to the NICO Project site. However, the average concentrations at all three stations were very low due to the undeveloped state of the local environment.

Based on the ambient SO_2 observations at the site in September to December 2006 and March to September 2007, the baseline SO_2 concentration for comparison in the assessment is 0.5 µg/m³. As indicated in the discussion of ambient NO_2 concentrations, the Lion Lake and Peanut Lake stations both indicated ambient SO_2 concentrations higher than the observed concentrations closer to the NICO Project site. However, the average SO_2 concentrations at all three stations were very low given that the local environment is undeveloped.

Although the concentrations observed at the offsite stations for both NO_2 and SO_2 were slightly higher than at the onsite station, the concentrations measured at each of the sites were just above detection limits and within the margin of error of the sampling method. As such, the differences in measured data between the stations were very small and conclusions about these differences cannot be drawn.

6 PARTICULATE MATTER AT GOVERNMENT OF THE NORTHWEST TERRITORIES STATIONS

The GNWT Air Quality Monitoring Network consists of 4 permanent monitoring stations located in Yellowknife, Inuvik, Fort Liard, and Norman Wells. All 4 stations monitor $PM_{2.5}$, and PM_{10} is measured in Inuvik, Yellowknife, and Fort Liard. However, the data are not representative of the NICO Project since these stations are located within or near communities and measured concentrations are influenced by local emissions.

Short-term seasonal particulate monitoring occurs at the NWT Tundra Ecological Research Station located at Daring Lake. The Daring Lake Station monitored PM_{10} in the summer of 2002 and monitors $PM_{2.5}$ during the summer months beginning in 2003. The $PM_{2.5}$ and PM_{10} data from Daring Lake were considered representative of conditions at the NICO Project since the station is remote. None of the information from the other sites is presented here.

6.1 DARING LAKE

The closest remote air quality station to the NICO Project is the NWT Tundra Ecological Research Station at Daring Lake. Particulate matter concentration data were collected during the summers of 2002 to 2008 using a Partisol sampler. PM_{10} was measured in 2002, and $PM_{2.5}$ was measured from 2003 to 2008. Data were not collected during the summer of 2009 because the sampler was not functional. The particulate concentrations recorded at the Daring Lake station are tabulated in Table 6-1 and graphical representations of the data are presented in Figures 6-1 and 6-2.

At Daring Lake, 19 of the PM_{10} samples were collected in 2002 with 12 passing quality checks (McKay 2010, pers. comm). The maximum PM_{10} concentration was 3.3 $\mu g/m^3$.

From 2003 to 2008, 106 $PM_{2.5}$ samples were collected and 86 samples passed quality checks (McKay 2010, pers. comm). The annual average concentrations during 2003 to 2008 ranged from 0.9 to 7.1 $\mu g/m^3$. The average $PM_{2.5}$ concentration over the period was 3.1 $\mu g/m^3$ and the maximum $PM_{2.5}$ concentration was 41.5 $\mu g/m^3$ (29 July 2004). This reading was attributed to smoke from forest fires burning south of Great Slave Lake. The overall concentrations for 2007 and 2008 were similar, with a maximum $PM_{2.5}$ concentration of up to 7 $\mu g/m^3$. The 2007 and 2008 results were typical of background levels and were not influenced by forest fires as in previous years.

Table 6-1 Daring Lake 24-hour Particulate Concentration (2002 to 2008)

Sample Date	PM_{10}	$PM_{2.5}$					
	2002	2003	2004	2005	2006	2007	2008
08-Jun	—	—	3.9	—	—	—	—
11-Jun	—	0.8	4.7	—	—	—	—
14-Jun	—	3.1	2.5	—	—	—	—
17-Jun	—	2.2	4.6	—	—	—	—
18-Jun	1.9	—	—	—	—	—	—
20-Jun	—	0.1	7.9	—	—	—	—
21-Jun	0.3	—	—	—	0.3	—	—
23-Jun	—	1.9	1.8	—	—	—	—
24-Jun	1.5	—	—	—	5.4	—	—
26-Jun	—	1.7	9.3	—	—	—	—
27-Jun	1.9	—	—	0.0	2.8	—	—
29-Jun	—	1.0	14.2	—	—	—	—
30-Jun	—	—	—	2.5	—	—	—
02-Jul	—	—	1.9	—	—	—	—
03-Jul	1.3	1.3	—	—	—	—	—
05-Jul	—	—	5.6	0.6	—	—	—
06-Jul	—	0.6	—	—	—	—	—
08-Jul	—	—	1.1	2.4	—	—	—
09-Jul	3.3	6.8	—	—	1.5	1.0	—
11-Jul	—	—	5.4	3.8	—	—	0.6
13-Jul	—	—	—	—	—	1.7	—
14-Jul	—	—	2.8	3.6	—	—	0.8
15-Jul	1.3	2.5	—	—	0.9	—	—
16-Jul	—	—	—	—	—	1.1	1.5
17-Jul	—	—	2.9	0.3	—	—	—
18-Jul	0.3	3.3	—	—	—	—	—
19-Jul	—	—	—	—	0.9	—	5.7
21-Jul	2.1	—	—	—	—	—	5.3
23-Jul	—	5.7	17.2	1.5	4.1	0.0	—
24-Jul	2.9	—	—	—	—	—	3.4
26-Jul	—	15.4	5.4	0.1	1.3	0.4	—
27-Jul	—	—	—	—	—	—	5.5
29-Jul	—	—	41.5	1.0	1.3	1.7	—
01-Aug	—	—	1.8	2.8	—	0.7	—
02-Aug	—	—	—	—	1.9	—	—
04-Aug	—	—	6.4	1.8	—	3.7	1.9
07-Aug	—	—	—	0.6	—	—	—

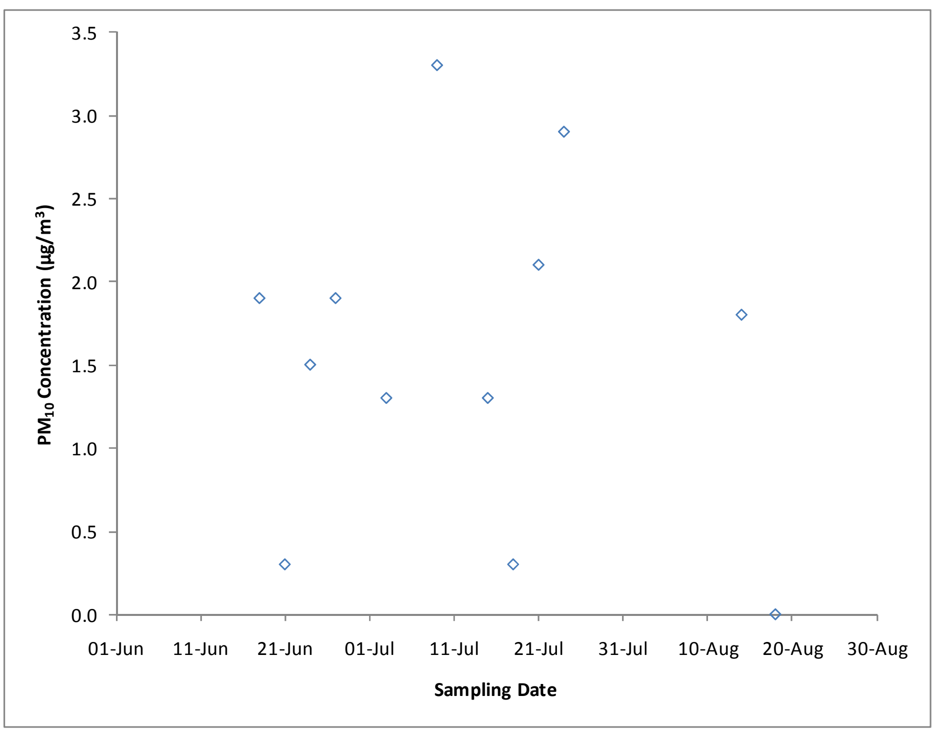
Table 6-1 Daring Lake 24-hour Particulate Concentration (2002 to 2008) (continued)

Sample Date	PM_{10}	$PM_{2.5}$					
	2002	2003	2004	2005	2006	2007	2008
08-Aug	—	—	1.0	—	—	—	—
09-Aug	—	—	—	—	—	0.1	—
10-Aug	—	—	—	0.1	—	—	7.0
11-Aug	—	—	—	—	0.4	—	—
12-Aug	—	—	—	—	—	0.0	—
14-Aug	1.8	—	—	—	1.2	—	—
16-Aug	—	—	—	0.8	—	—	—
17-Aug	—	—	—	—	1.3	—	—
18-Aug	0.0	—	—	1.4	—	—	—
19-Aug	—	—	—	—	—	0	—
Minimum	0.0	0.1	1.0	0.0	0.3	0.0	0.6
Maximum	3.3	15.4	41.5	3.8	5.4	3.7	7.0
Median	1.7	2.1	4.7	1.2	1.3	0.7	3.4
Average	1.6	3.3	7.1	1.5	1.8	0.9	3.5

Source: McKay, 2010, pers. comm.

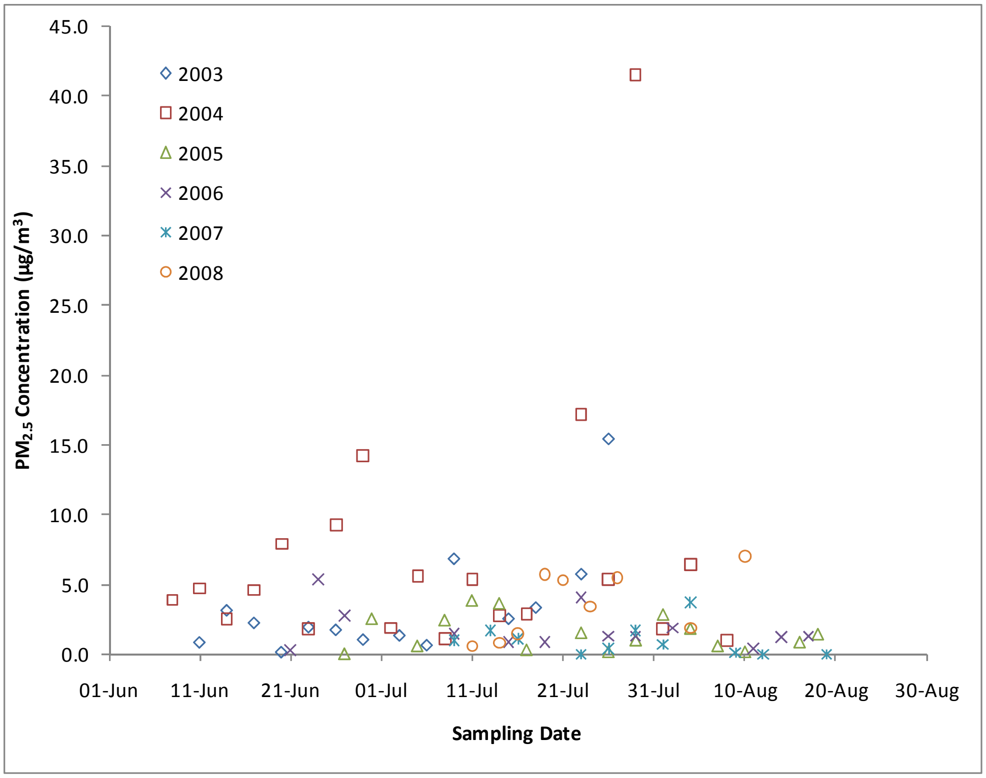
— = no data collected or invalid measurement.

Figure 6-1 Daring Lake PM_{10} Concentrations (2002)



Source: McKay, 2010, pers. comm.

Figure 6-2 Daring Lake $PM_{2.5}$ Concentrations (2003-2008)



Source: McKay, 2010, pers. comm.

7 OZONE CONCENTRATIONS AT GOVERNMENT OF THE NORTHWEST TERRITORIES STATIONS

Ozone is monitored continuously at the 4 monitoring stations: Yellowknife, Inuvik, Fort Liard, and Norman Wells. Of the 4 stations, the station in Yellowknife is the closest to the NICO Project, and hence ozone concentrations are presented for the Yellowknife station only.

The hourly ozone concentrations monitored at the Yellowknife station are summarized in Table 7-1 for the 2007 to 2009 period. The maximum hourly concentration for the period was 63 ppb (123 μg/m^3), indicating that the 8-hour ambient air quality guideline of 65 ppb (127 μg/m^3) was met. Typical monthly ozone concentrations at remote sites in Canada range between 40 and 80μg/m^3, and Yellowknife concentrations for all 3 years fell below or within this range, indicating that most of the O_3 detected is likely naturally occurring or background concentrations (GNWT 2008).

Table 7-1 Hourly Ozone Concentrations in Yellowknife, 2008

Month	2007			2008			2009		
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
January	3	35	25	2	35	22	14	35	27
February	1	38	25	1	36	25	0	38	24
March	1	43	23	1	40	24	1	42	26
April	1	50	34	1	48	32	6	49	29
May	6	48	28	4	56	38	2	44	24
June	10	41	28	8	46	27	2	40	25
July	7	40	24	9	40	24	2	34	20
August	1	37	21	0	42	18	1	33	18
September	0	63	21	0	31	17	0	28	15
October	1	35	19	0	30	18	0	35	20
November	5	36	27	2	31	23	4	35	23
December	1	41	23	2	29	20	2	34	24

Source: GNWT 2008.

8 SUMMARY

8.1 METEOROLOGY AND CLIMATE

Baseline meteorological information was available from data collected at the NICO Project and data obtained from Yellowknife during the period of October 2004 through April 2008. Long-term measurements from 1971 to 2000 were also available from Yellowknife.

Hourly meteorological measurements were collected year-round using an automatic weather observation station with sensors to measure wind speed, wind direction, solar radiation, rainfall, and relative humidity mounted on a 10 m tower. Table 8-1 shows a list of the instruments installed at the NICO Project.

Table 8-1 NICO Project Meteorological Measurement Instruments

Parameter	Instrumentation
Temperature	
Average air temperature -55 degrees Celsius [°C] to +50°C	Campbell Scientific YSI 44002A thermistor mounted at 2.5 metres (m) on the tower
Wind	
Wind speed in kilometres per hour [km/h]	R.M. Young 05103 Wind Monitor (10 m)
Wind direction degrees [°]	R.M. Young 05103 Wind Monitor (10 m)
Standard deviation of wind direction degrees [°][a]	R.M. Young 05103 Wind Monitor (10 m)
Solar Radiation	
Incoming solar radiation in watts per square metre [W/m²]	Kipp and Zonen SP Lite (2.5 m)
Precipitation	
Rainfall in millimetres [mm]	Texas Electronics TE525 WS Tipping Bucket Rain Gauge (2 m)
Relative Humidity	
Relative humidity in percent [%]	Vaisala capacitive relative humidity sensor (2.5 m)
Data Storage and Retrieval	
Datalogger	Campbell Scientific CR10X (Cold Spec)
Power supply	Solar panel and battery back-up
Instrument mounting	10 m tower

[a] The Standard Deviation of wind direction [°] is calculated internally in the datalogger using the Yamartino Algorithm.

The data recorded from the NICO Project meteorological station indicate the following:

- **Wind Speed and Wind Direction**: Winds were most frequently observed along the north-northwest/south-southeast axis. Winds were frequently recorded throughout the measurement period at greater than 30 km/h. The wind data are suitable for inclusion in dispersion modelling.
- **Rainfall**: The bulk of the rainfall was recorded in the summer months of June, July, and August. The greatest monthly rainfall (65.6 mm) during the period was observed in July of 2007, but 2006 was the wettest year.
- **Temperature:** Average temperatures at the NICO Project ranged from a low of near -25°C in January and February to a high of about 16°C in July and August. Average temperatures observed at Yellowknife between 1971 and 2000 ranged between -27°C in January and 17°C in July.
- **Relative Humidity**: As expected, higher summer temperature variability led to higher diurnal variations in relative humidity. Relative humidity values ranged from approximately 47% in June of 2007 to near 100% in April of 2008.
- **Solar Radiation**: Average solar radiation levels peaked during May 2005 and in June of both 2006 and 2007 at between 250 and 300 W/m^2.

8.2 BACKGROUND AIR QUALITY

An important aspect of the baseline air quality analysis was to develop estimates of appropriate background concentrations near the proposed NICO Project. In the environmental assessment these background concentrations were added to predicted air quality concentrations due to NICO Project and other anthropogenic emissions as part of a cumulative effects assessment.

A passive ambient air quality monitoring program was undertaken during the summers of 2006 and 2007. Sulphur dioxide and NO_2 data were collected intermittently using passive air quality samplers from October 2006 to September 2007. Passive sensors are designed to provide average concentrations measured over a 30-day period. After field exposure, the cartridges are retrieved from a weather shelter and analyzed at certified laboratory. The results are provided as an average concentration prorated to a 30-day exposure period. The average background concentrations estimated from the program are as follows:

- nitrogen dioxide – 1.0 $\mu g/m^3$; and
- sulphur dioxide – 0.5 $\mu g/m^3$.

Ambient particulate concentrations including total suspended particulate, and particles with a nominal aerodynamic diameter less than 10 µm and 2.5 µm (PM_{10} and $PM_{2.5}$ respectively) were not measured at the NICO Project per discussions with the Northwest Territories regulators (Fox 2008, pers. comm.). It is expected that in the absence of development, particulate concentrations will be at background levels. Furthermore, it was also suggested that monitoring from community locations "near" the site may substantially over-represent the concentrations at the NICO Project site. Other compounds including VOCs and ozone were not measured because of the remoteness of the site and the lack of industrial development in the region.

The remoteness of the NICO Project; however, does not preclude the possibility that measurable ambient particulate matter levels may be present in the NICO Project area. Local and regional forest fires, pollen, and other aerosols may contribute to local ambient concentrations. Background air quality measurements were taken during a period of relatively low activity at the NICO Project. An underground bulk ore sampling program was undertaken concurrently, but the level of activity at the site was low relative to what would be expected during construction and operation of the NICO Project.

9 REFERENCES

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10 GLOSSARY OF TERMS

Ambient air	Outdoor or open air beyond the developed industrial footprint.
Carbon monoxide (CO)	Also known as carbonic oxide, CO is a colourless, odourless, toxic gas at standard conditions. CO is a product of incomplete combustion of fossil fuels. It is also an effective reducing agent in various metal-smelting operations and is also encountered for the production of several synthesis gases.
Daily average	The arithmetic mean based on a data set of 24 1-hour averages for each day. Daily averages are only calculated for days with eighteen or more valid hours of data in the day.
Emission	The act of releasing or discharging air pollutants into the ambient air from any source.
Nitrogen oxides (NO_X)	Consist of nitric oxide (NO) and nitrogen dioxide (NO_2) and are reported as equivalent NO_2.
Particulate matter	Any aerosol that is released to the atmosphere in either solid or liquid form.
Volatile organic compounds (VOC)	VOC refer to photochemically reactive hydrocarbons, excluding methane, ethane, acetone, methylene chloride, methyl chloroform and several chlorinated organics, because of their low reactivity in the atmosphere. This is the same definition as the one used by U.S. Environmental Protection Act.
$PM_{2.5}$	Particulate matter with particle diameter nominally smaller than 2.5 micrometres (µm).
PM_{10}	Particulate matter with particle diameter nominally smaller than 10 µm.

10.1 ABBREVIATIONS AND ACRONYMS

CCME	Canadian Council of Ministers of the Environment
CO	carbon monoxide
CO_2	carbon dioxide
CWS	Canada Wide Standard
E	east
EA	environmental assessment
Fortune	Fortune Minerals Limited
Golder	Golder Associates Ltd.
GNWT	Government of the Northwest Territories
H_2O vapour	water vapour
N	north
NE	northeast
NW	northwest
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NWT	Northwest Territories
O_3	ozone
PM	particulate matter
PM_{10}	particulate matter with particle diameter nominally smaller than 10 µm
$PM_{2.5}$	particulate matter with particle diameter nominally smaller than 2.5 µm
S	south
SE	southeast
SW	southwest
SO_2	sulphur dioxide
TSP	total suspended particulates
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compounds
W	west

10.2 UNITS OF MEASURE

%	percent
°C	degrees Celsius
µg/m^3	micrograms per cubic metre
µm	micrometre
km	kilometre
km/h	kilometres per hour
m	metre
m/s	metres per second
mm	millimetre
ppb	parts per billion (by volume)
W/m^2	watts per square metre