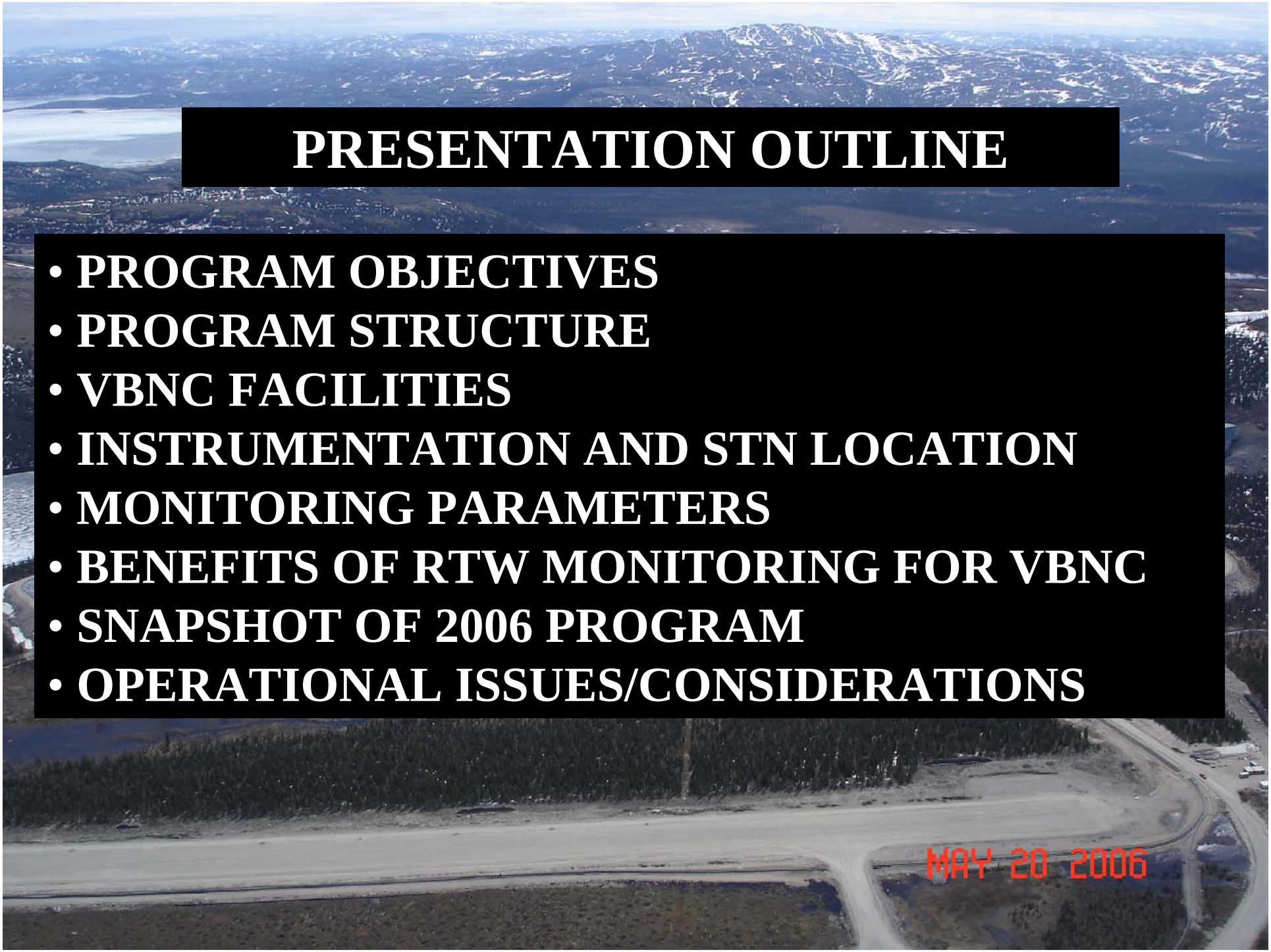
VOISEY'S BAY REAL-TIME WATER QUALITY MONITORING PROGRAM

Real-Time Water Quality Monitoring Workshop 2007
June 4th and 5th, 2007





PRESENTATION OUTLINE

- PROGRAM OBJECTIVES
- PROGRAM STRUCTURE
- VBNC FACILITIES
- INSTRUMENTATION AND STN LOCATION
- MONITORING PARAMETERS
- BENEFITS OF RTW MONITORING FOR VBNC
- SNAPSHOT OF 2006 PROGRAM
- OPERATIONAL ISSUES/CONSIDERATIONS


MAY 20 2006

Real-Time Water Quality Monitoring

Objectives

- Provide near real time water quality information for selected water bodies around the Voisey's Bay site.

- Continuous collection of water quality data can be used to
  - assist in the assessment of health of aquatic ecosystems;
  - establish trends of change;
  - determine timing and extent of specific events; and
  - help manage our activities within the environment

Real-Time Water Quality Monitoring

VBNC PROGRAM STRUCTURE

Provincial Department of Environment and Conservation – Water Resources Division	→	Data Retrieval Data Management Data Analysis and Report Generation
Environment Canada	→	Provision of stream discharge data and real-time satellite uplink
Voisey's Bay Nickel Company Ltd.	→	System field maintenance and calibration;



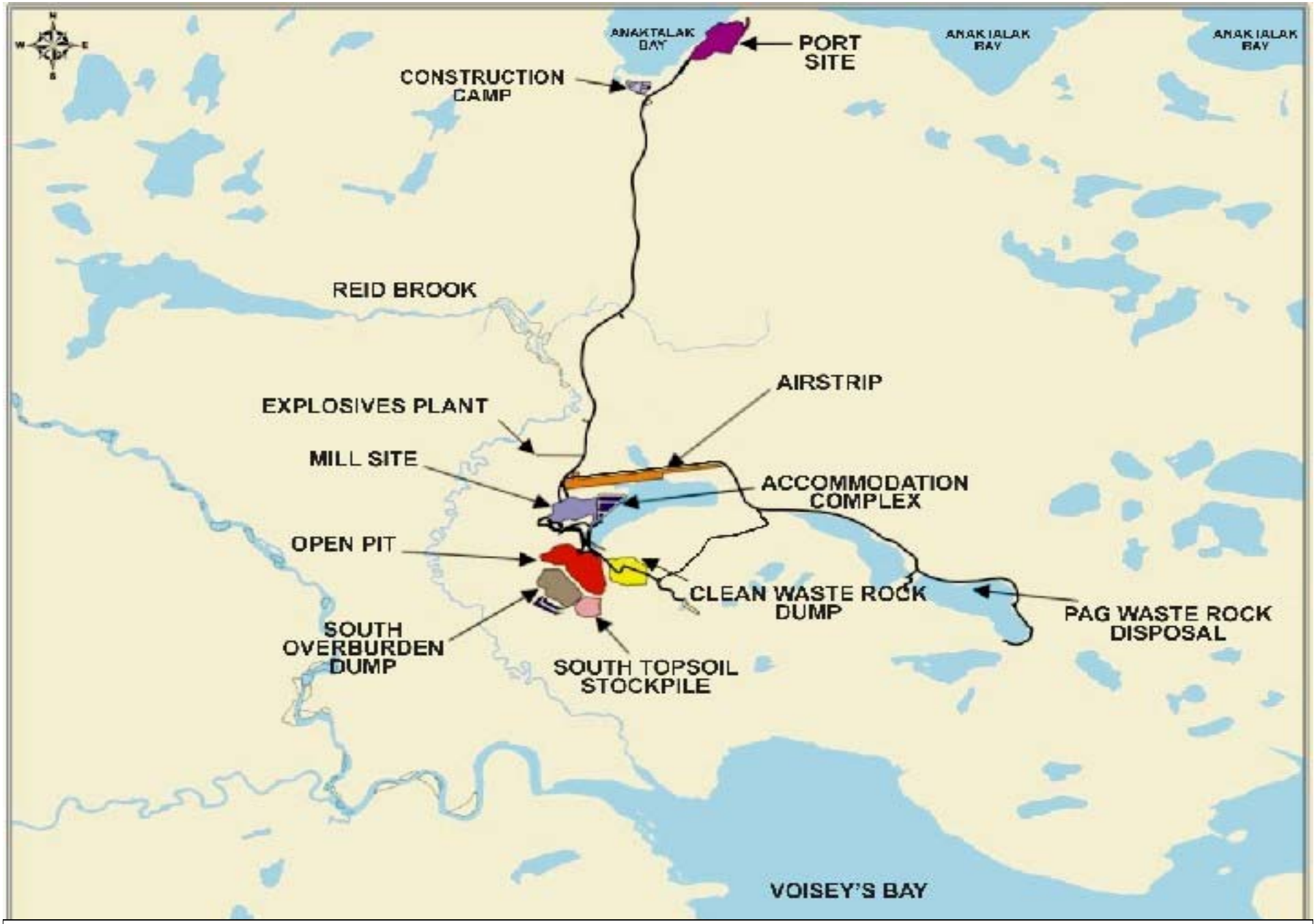


Figure 1: Site Layout – Voisey's Bay

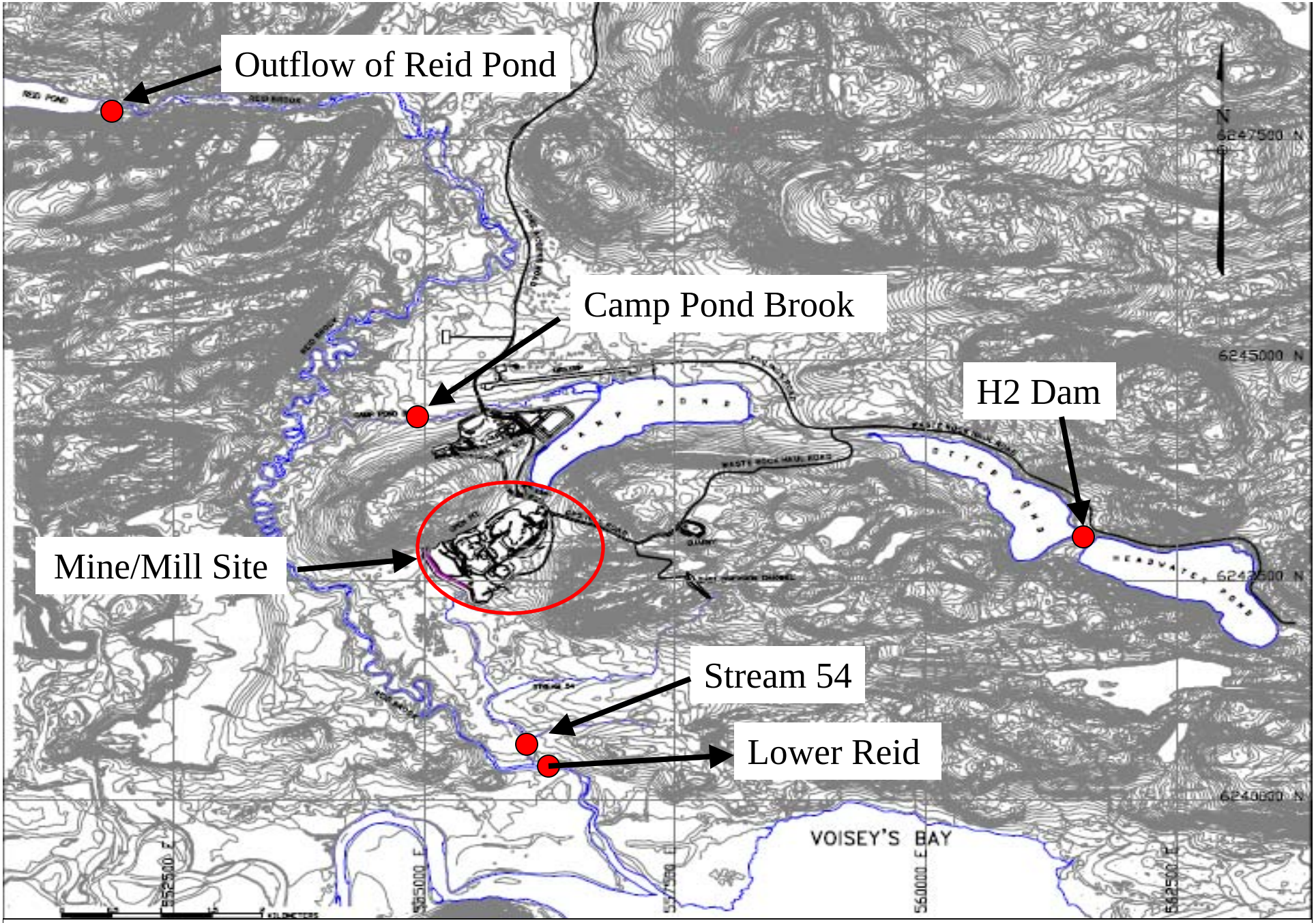


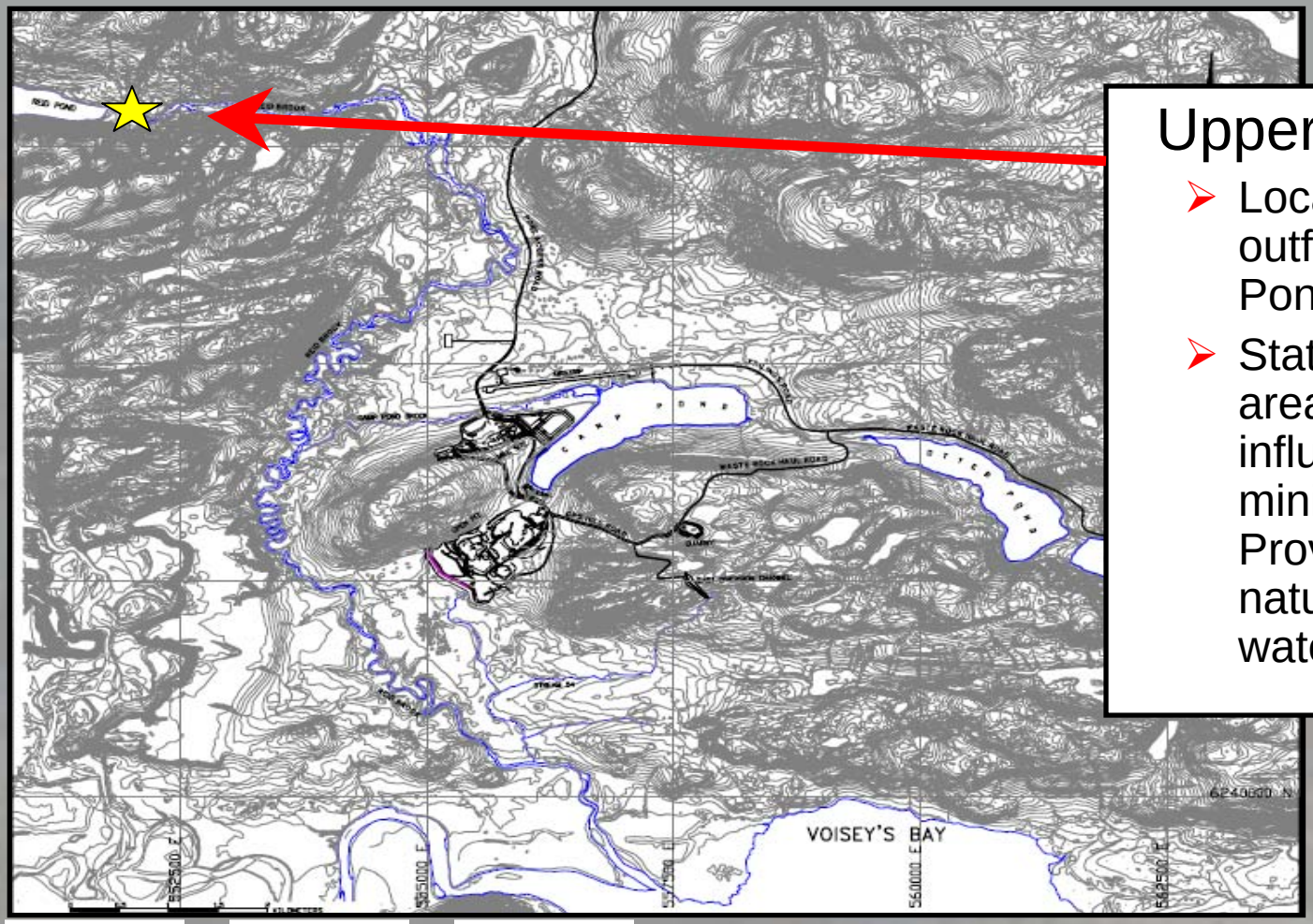
Figure 2: Location of Real-Time Water Quality Monitoring Stations

Real-Time Water Quality Monitoring

Instrumentation

- Series 4a Datasonde® Multiprobe
- Series 4a Minisonde® Multiprobe
- Series 4a Surveyor® Datalogger and Display

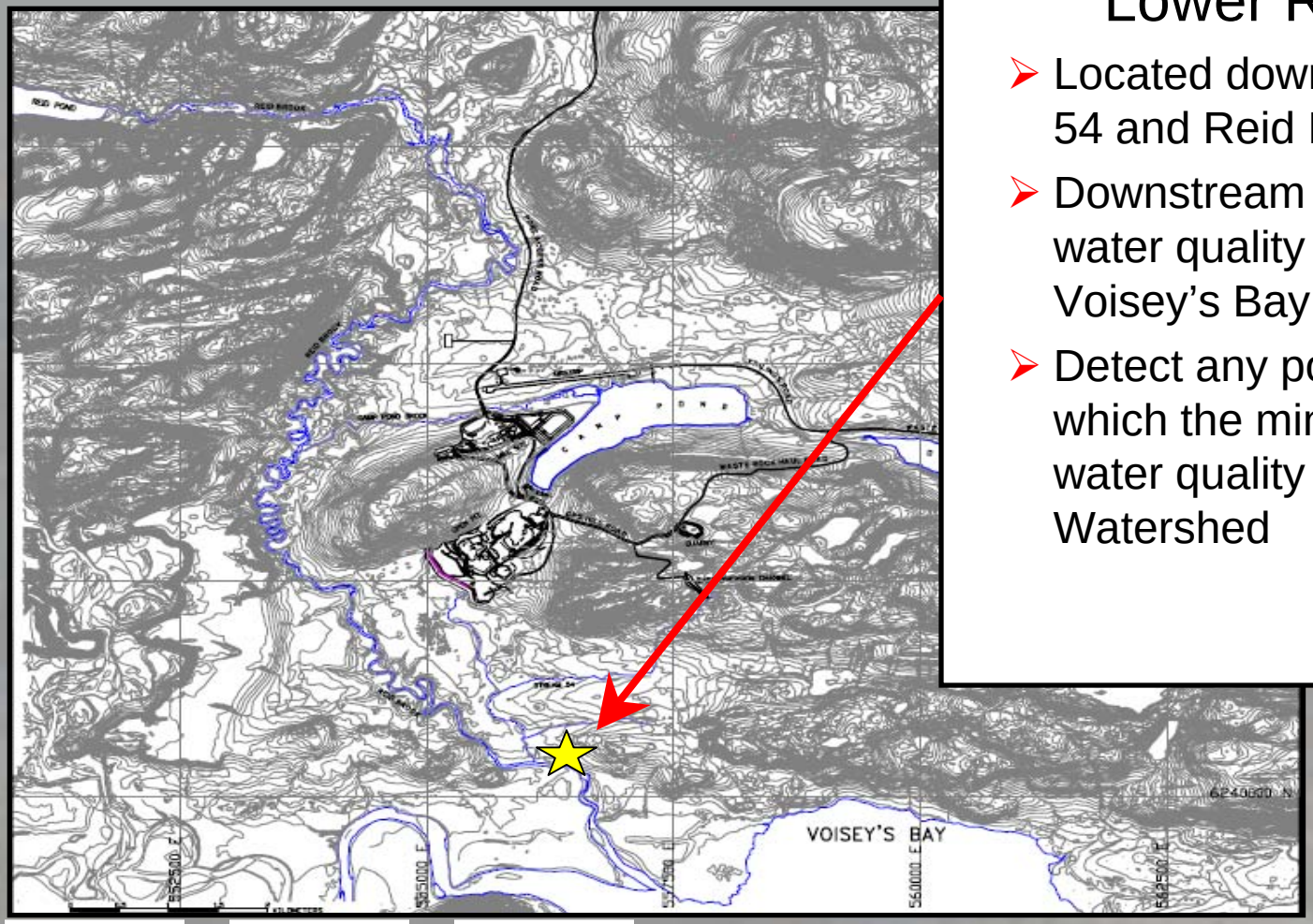
Real-Time Station Locations



Upper Reid Brook

- Located at the outflow of Reid Pond;
- Station is outside of area of potential influence from mining operations. Provides reliable natural background water quality data.

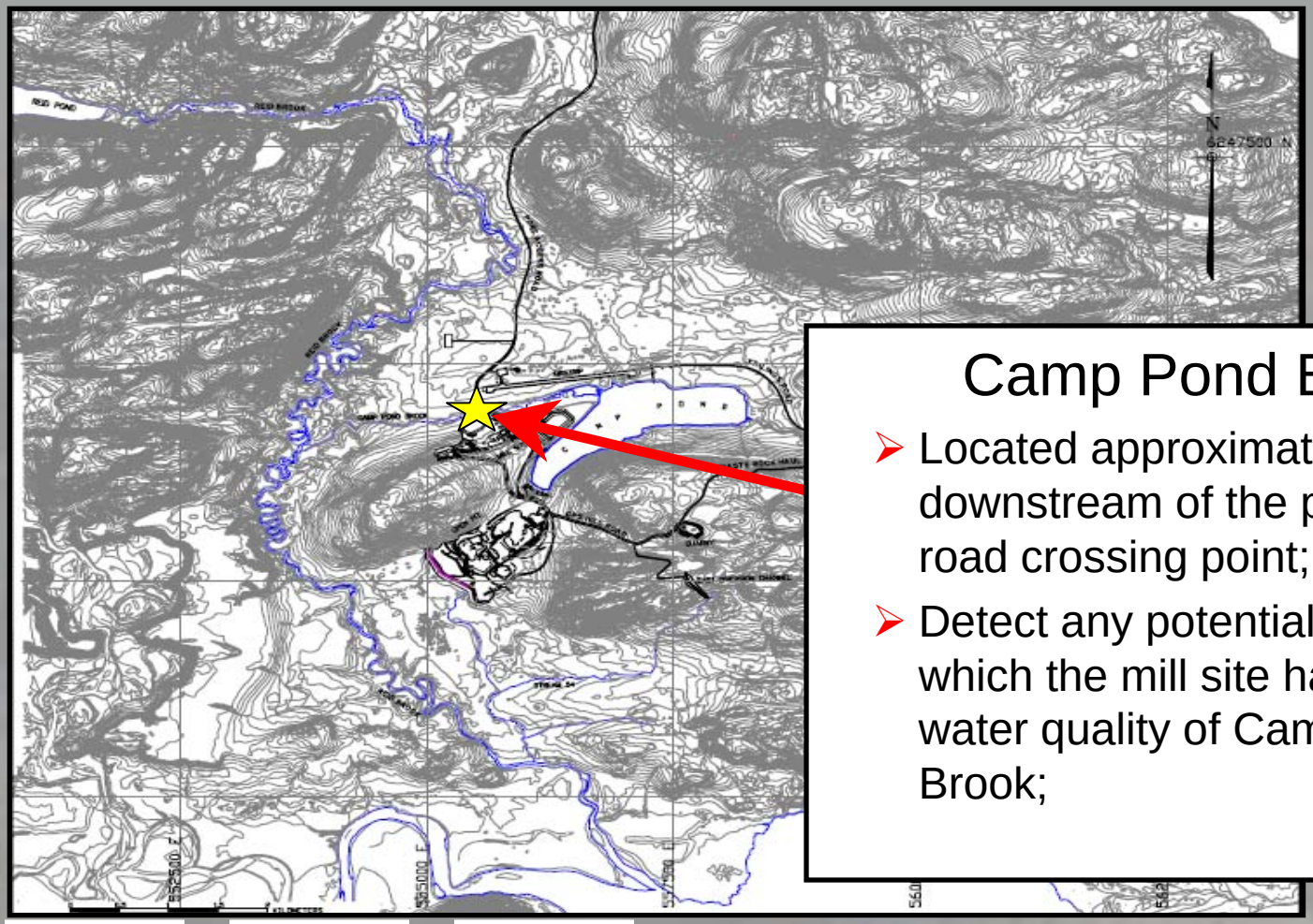
Real-Time Station Locations



Lower Reid Brook

- Located downstream of Stream 54 and Reid Brook intersection;
- Downstream of all potential water quality influences from Voisey's Bay Mining activities;
- Detect any potential influences which the mine site has on the water quality of the Reid Brook Watershed

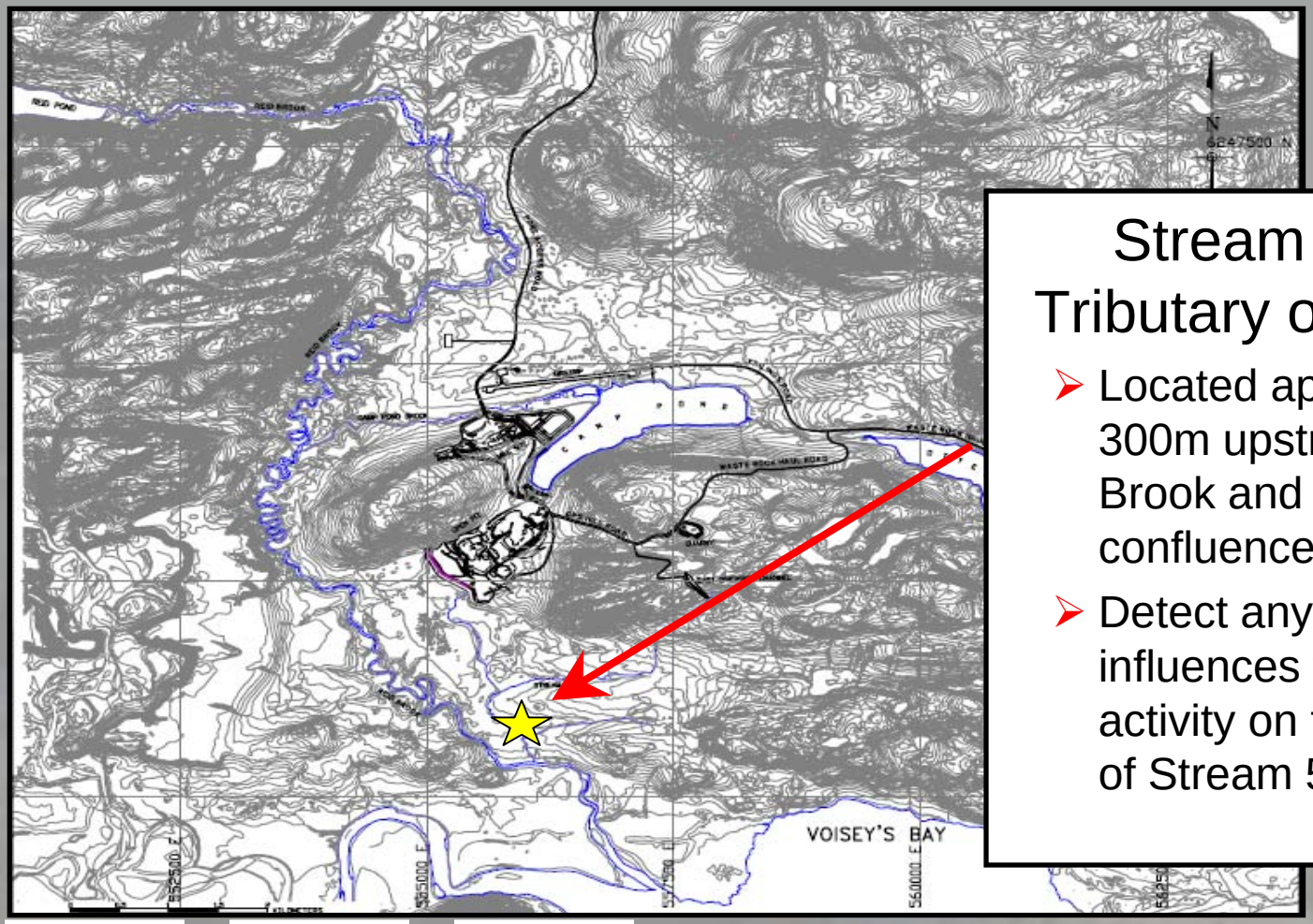
Real-Time Station Locations



Camp Pond Brook

- Located approximately 500m downstream of the port access road crossing point;
- Detect any potential influences which the mill site has on the water quality of Camp Pond Brook;

Real-Time Station Locations



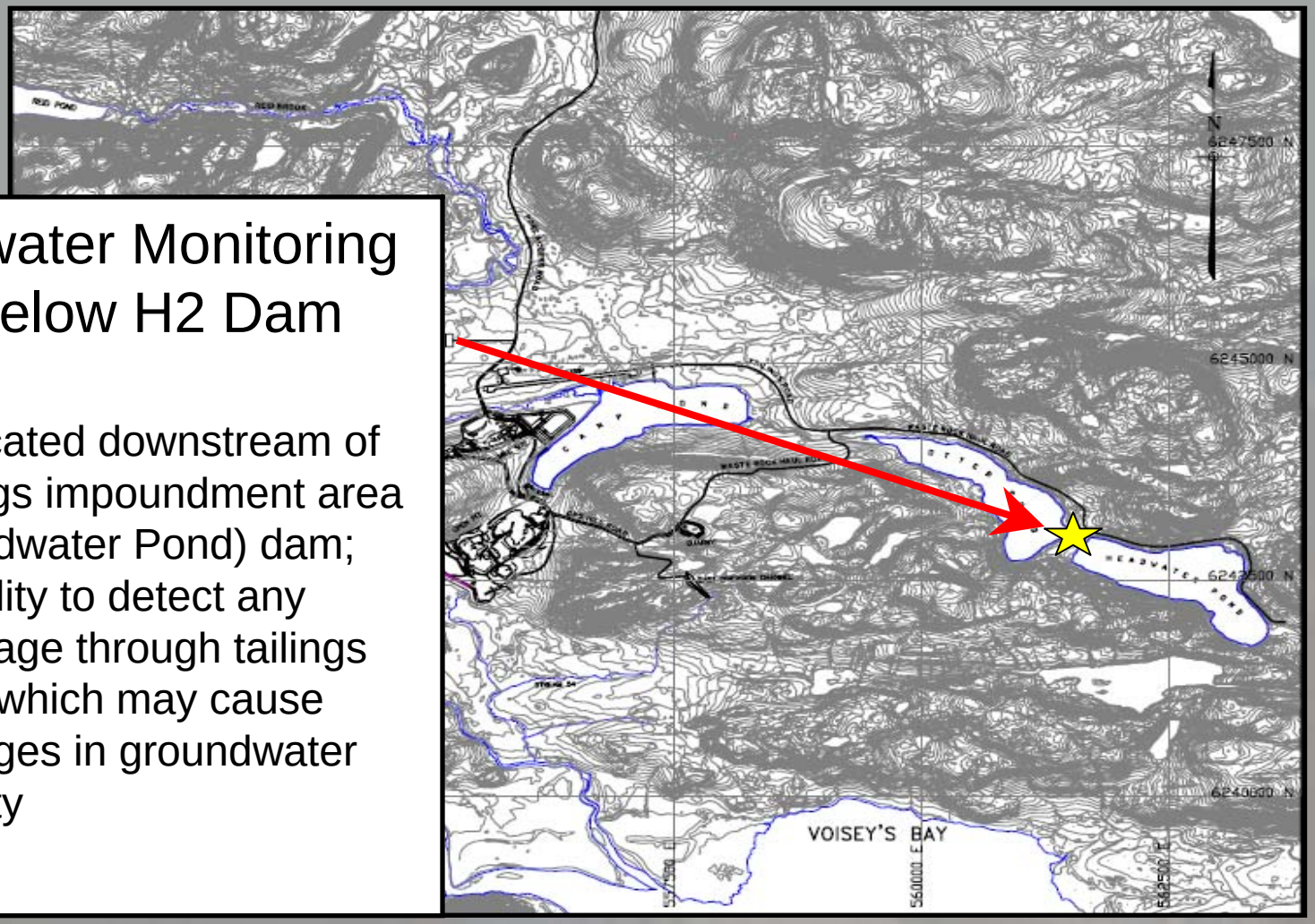
Stream 54 – First Tributary of Reid Brook

- Located approximately 300m upstream of Reid Brook and Stream 54 confluence
- Detect any potential influences from mining activity on the water quality of Stream 54 watershed.

Real-Time Station Locations

Groundwater Monitoring Well below H2 Dam

- Located downstream of tailings impoundment area (Headwater Pond) dam;
- Ability to detect any seepage through tailings dam which may cause changes in groundwater quality



Real-Time Water Quality Parameters

Surface Water Sites

- **Temperature;**
- **pH;**
- **Specific Conductance** - measure of the ability of water to pass an electrical current;
- **Dissolved Oxygen** - Measure of the amount of oxygen dissolved in water;
- **Turbidity** - measure of the extent to which light is either absorbed or scattered in water. Influenced by suspended solids, organic matter, colour, and detritus;



Real-Time Water Quality Parameters

Surface Water Sites contd…

- **Percent O_2 Saturation** - Amount of Dissolved Oxygen (DO) in the water sample compared to the maximum amount that could be present at the same temperature;
- **Total Dissolved Solids** - Measure of all the dissolved solids in the water, organic and inorganic;
- **Water level (stage)**



Real-Time Water Quality Monitoring

- Additional Parameters at Stream 54 Station
  - Ammonium
  - Nitrate
- Station upgrade in 2007 will include the following:
  - Camp Pond Brook – Ammonium and Nitrate
  - Lower Reid Brook - Ammonium



Real-Time Water Quality Parameters

Groundwater Monitoring Well

H2 Dam

- Temperature;
- pH;
- Specific Conductance;
- Oxygen Reduction Potential; and
- Salinity



Real-Time Water Quality Monitoring

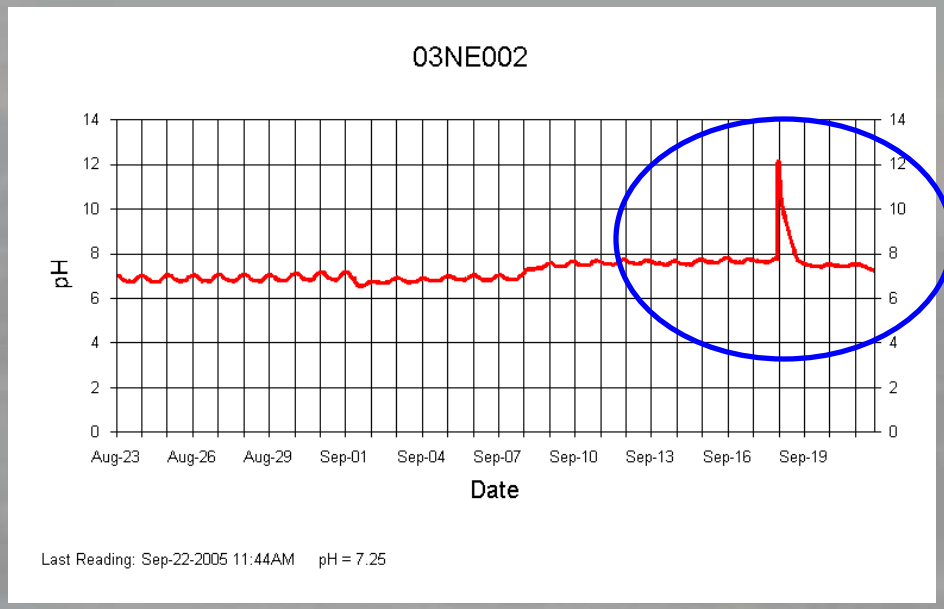
Benefits of Program

- Allows for real-time water quality data collection during unplanned operational upset where water quality is, or has the potential to be affected;
- Provides verification regarding the duration and extent of changes to water quality during unplanned operational upset;

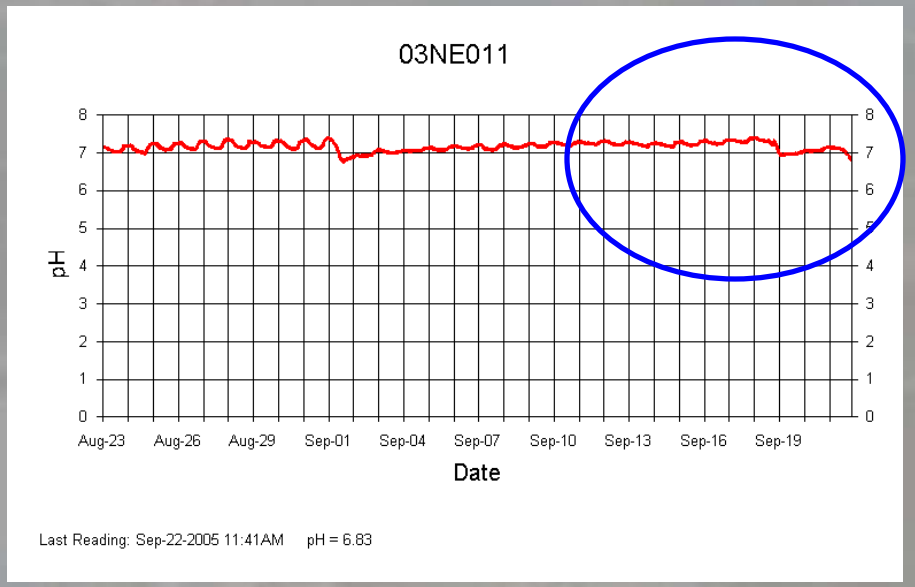


Real-Time Water Quality Monitoring

Example: September 18, 2005 Process Water Release into Camp Pond Brook

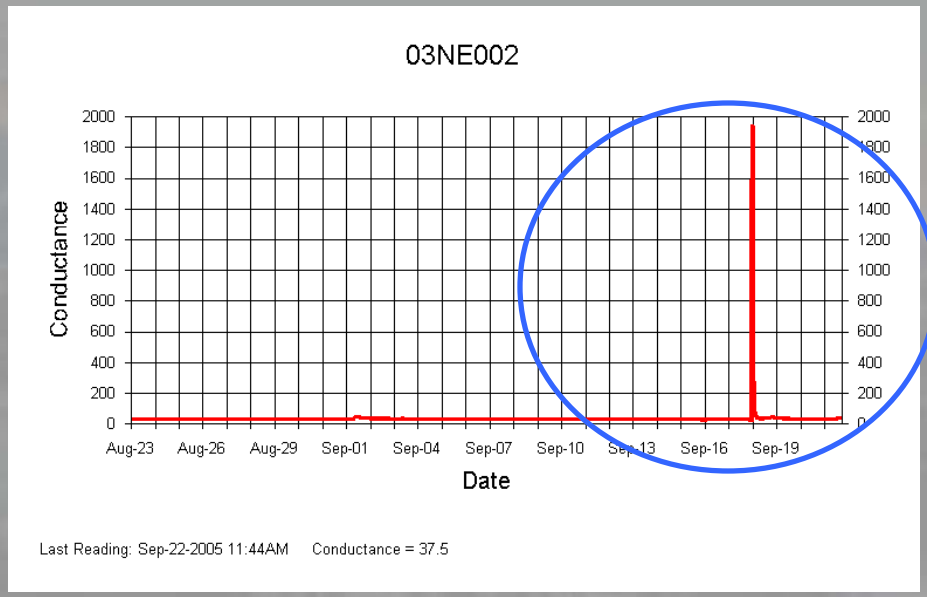


pH effects were not detected by Lower Reid Brook Station

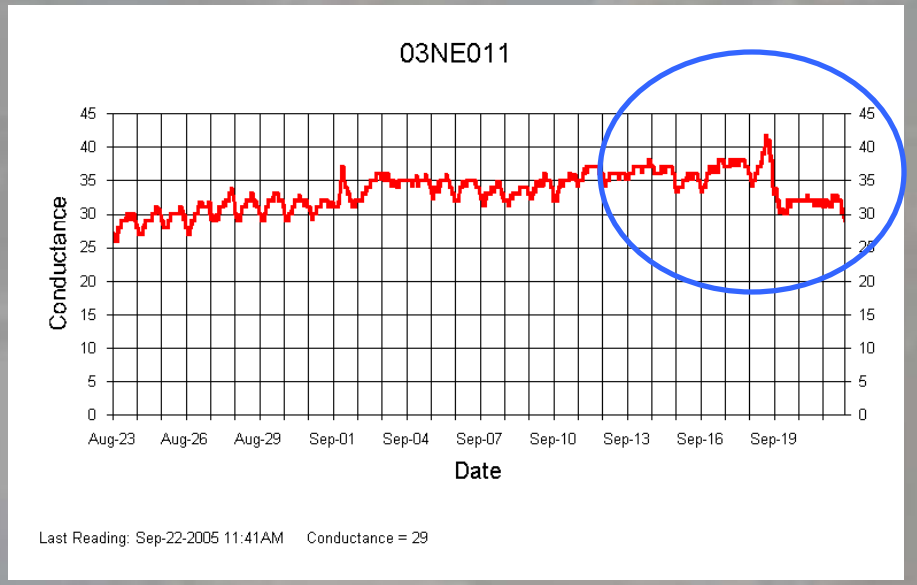


Real-Time Water Quality Monitoring

Example: September 18, 2005 Wastewater Release into Camp Pond Brook



Specific conductance effects were detected by Lower Reid Brook Station, but lower in magnitude



Real-Time Water Quality Monitoring

Benefits of Program contd…

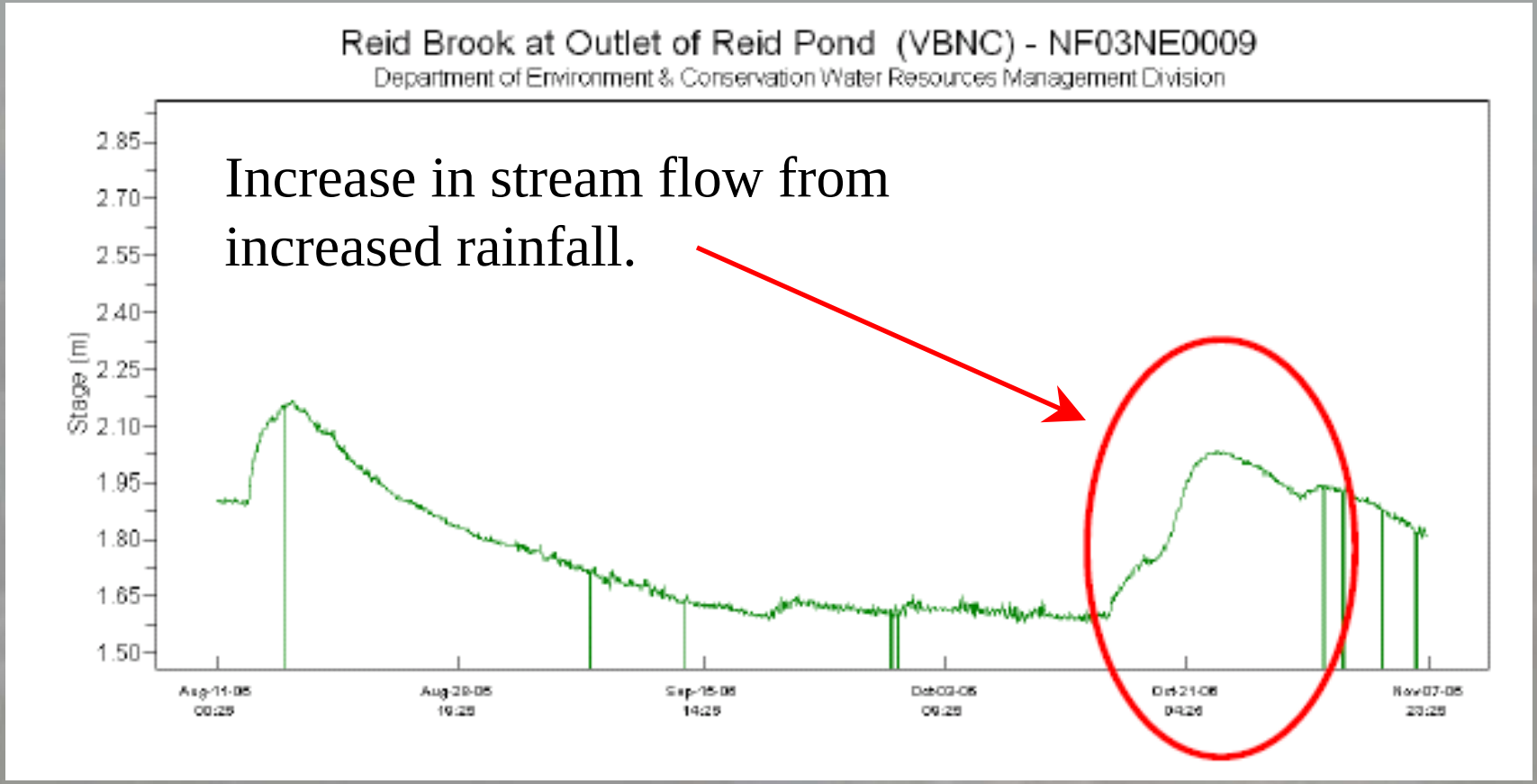
- Captures changes in water quality that may be attributed to natural causes;

Increased rainfall often increases suspended solids levels.



Real-Time Water Quality Monitoring

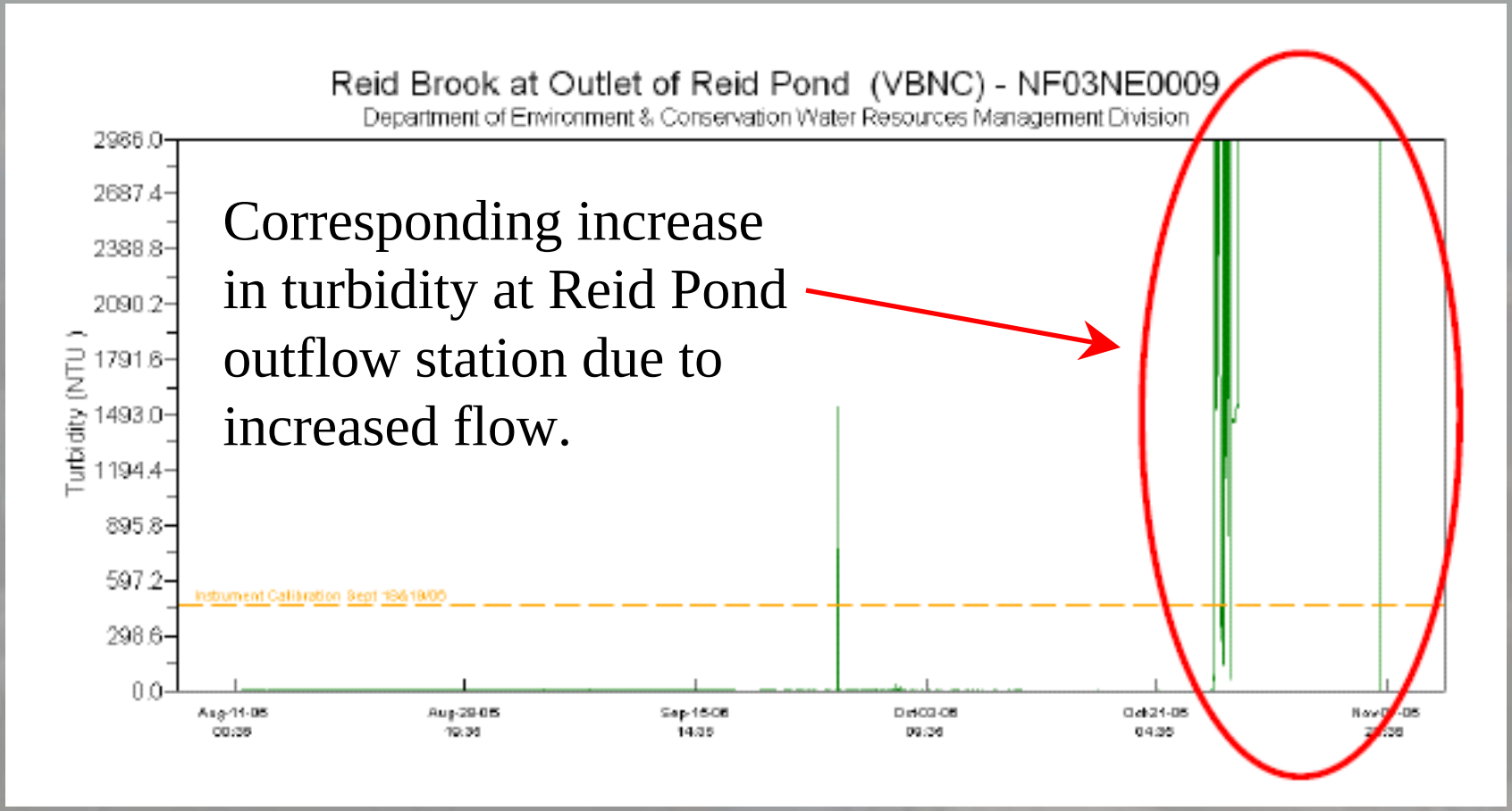
Example of natural influences on station at Reid Pond Outflow.





Real-Time Water Quality Monitoring

Example: Natural influences on station at Reid Pond Outflow contd…





Real-Time Water Quality Monitoring

Benefits of Program contd…

- Identifies variances in water quality that might not be detectable over time through periodic grab sampling and analysis;
- Ensures transparency in relationship with regulatory agencies and the public – our data is accessible through the internet



Real-Time Water Quality Monitoring

Overview of 2006 Program

- Date of Installation
  - May 26 – Camp Pond Brook and Lower Reid
  - July 6 – Tributary of Reid Brook and GMW downstream of H2 Dam (new installations)
  - August 11 – Upper Reid Brook
- Date of Removal - November 7 (prior to freeze-up)
- Water quality meters were calibrated and cleaned at regular monthly intervals during the season



Real-Time Water Quality Monitoring

Overview of 2006 Results

- Upper Reid Brook
  - Consistent values for all major parameters over the deployment period
- Camp Pond Brook, Lower Reid , and Stream 54
  - Water quality remained fairly consistent throughout deployment period
  - Changes in specific conductance and turbidity attributed to increased flow due to increased precipitation events.
  - Parameters typically slightly higher than Upper Reid.
  - Detected release of water containing sediment into Camp Pond Brook through increase in turbidity.



Real Time Water Quality Monitoring

Overview of 2006 Results contd…

- H2 Dam
  - All parameters remained consistent with very little activity throughout the sampling season
  - Sampling Season provided a baseline record of the groundwater quality in the area of the tailings pond.



Real-Time Water Quality Monitoring

Operational Issues Encountered

- Wildlife such as Black bears and porcupine sometimes cause significant damage resulting in station down-time

Eg. Chewed cables, damaged transmission equipment, damage to shelters,

Real-Time Water Quality Monitoring

Operational Issues Encountered

- Climate is not conducive to instrumentation operation during winter freeze-up (locations completely freeze)



THANK YOU