# Sullivan Fatalities Incident: Technical Investigations and Findings Part 1 & 2

## 14th Annual BC MEND Workshop
## Vancouver, BC

**November 28, 2007**

O'Kane Consultants
Integrated Geotechnical Engineering Services
Specialists in Unsaturated Zone Hydrology

teckcominco

SRK Consulting
Engineers and Scientists

# Fatalities Incident

**May 15 – 17, 2006**

- **Doug Erickson**
- **Bob Newcombe**
- **Kim Weitzel**
- **Shawn Currier**

- **http://www.mediaroom.gov.bc.ca/sullivan_mine/sullivan_mine.htm**

# Technical Panel

- Technical Panel formed to investigate the incident and general lessons for industry

- Ricci Berdusco
- Bruce Dawson
- Daryl Hockley
- Al Hoffman
- Walter Kuit
- Dr. John Meech
- Mike O'Kane
- Phil Pascuzzi
- Clem Pelletier
- Mark Phillip
- Andy Robertson
- Dr. Ward Wilson

# Presentation Outline


- *Site Layout & Post Incident Hypothesis*
- *Overview of Phase 1 Monitoring System, Data and Analysis*
- *Overview of Phase 2 Monitoring System, Data and Analysis*
- *Geophysical Survey Results*

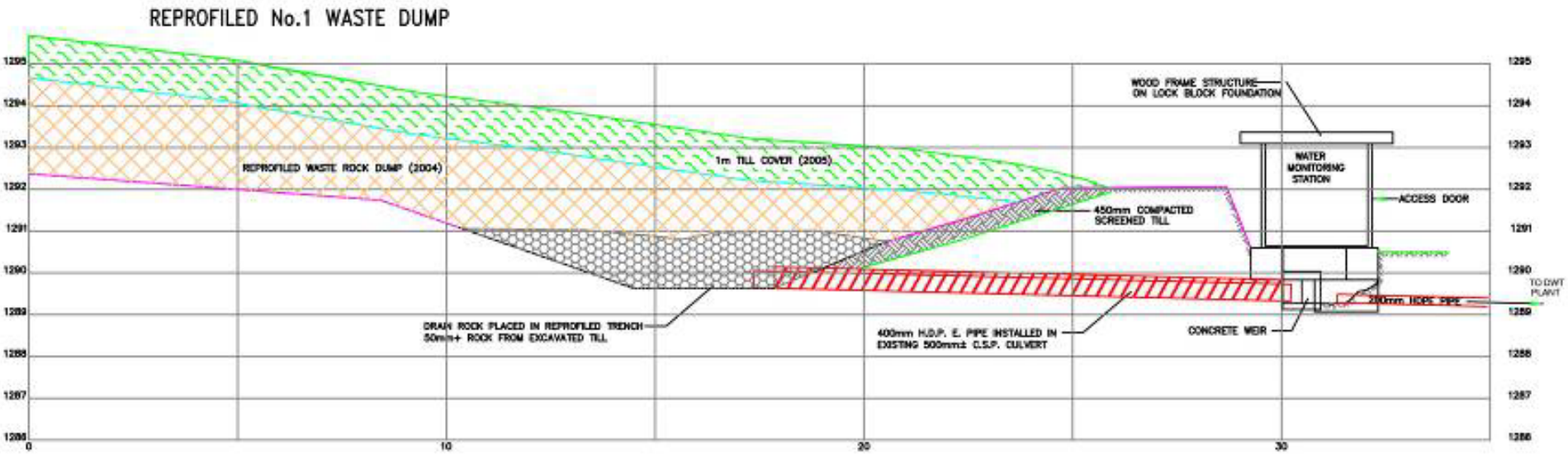
# Sullivan Mine No. 1 Waste Dump

# Sullivan Mine No. 1 Waste Dump

# Seepage Collection Ditch

# Ditch Converted to Drain

# Covered Dump Profile




teckcominco
Engineering
Kimberley, B.C.

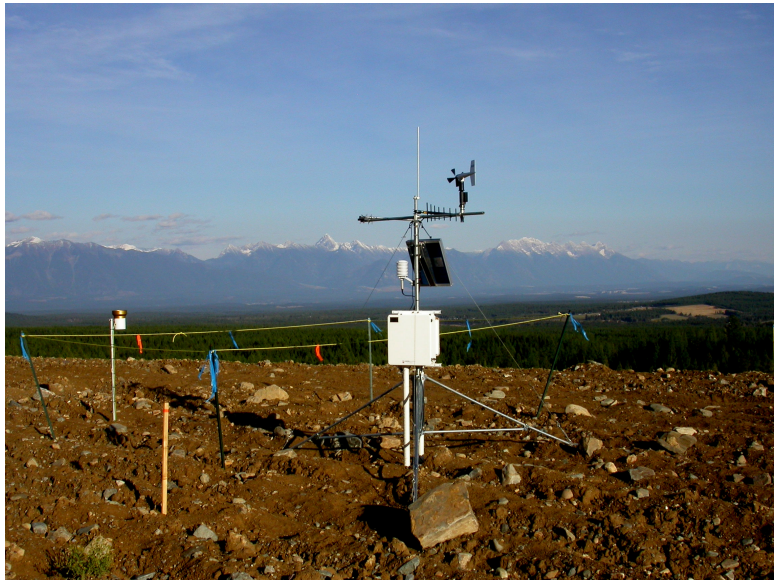
| | |
|---|---|
| Function | DWT DRAWINGS |
| Activity | MINE POST CLOSURE |
| Section | SEEPAGE COLLECTION |
| Job | No. 1 WASTE DUMP WATER MONITORING SHED ASBUILT |
| Scale 1:100 (Metric) | Date MAY 24, 2006 K100A3193 |

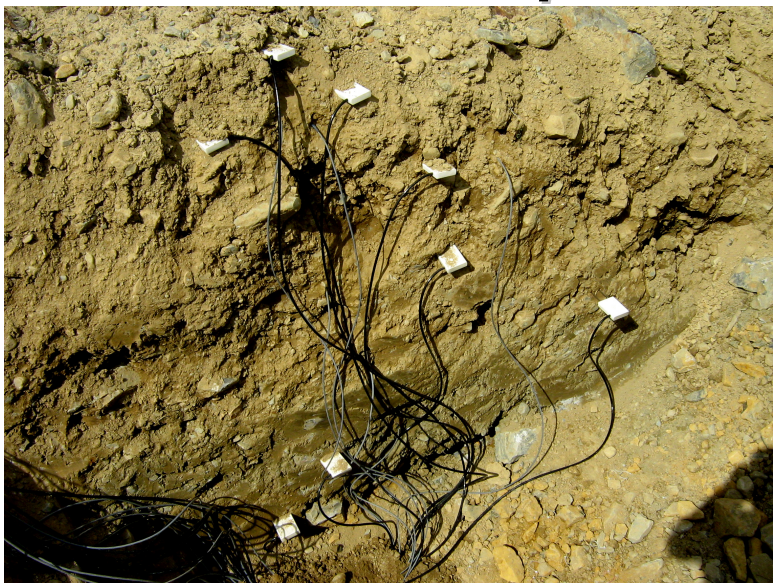
# Post Incident Hypothesis

- ***Pore-gas indicative of in situ WD1 conditions exited the dump through the 400 mm pipe, and into the shed as a result of:***
  - ***decreasing atmospheric pressure conditions prior to, during, and following the time of the four fatalities; and***
  - ***the 400 mm pipe, which terminates in the shed, likely being the primary hydraulic connection between the atmosphere and the dump.***

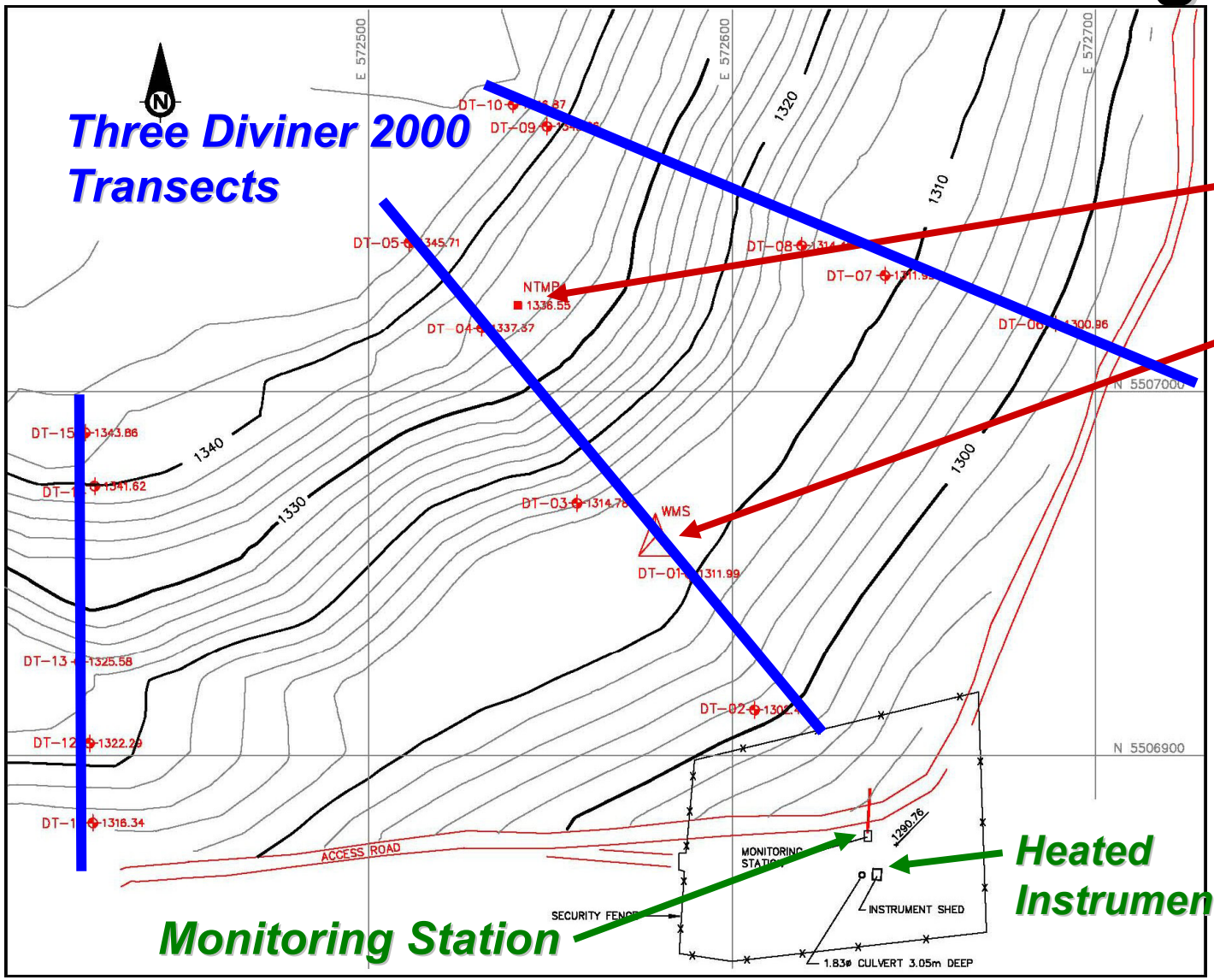
# Overview of Monitoring System

- Phase 1 Monitoring Focuses on:
  - Monitoring Station
  - Atmospheric Conditions
  - In Situ Till Cover Material Moisture and Temperature

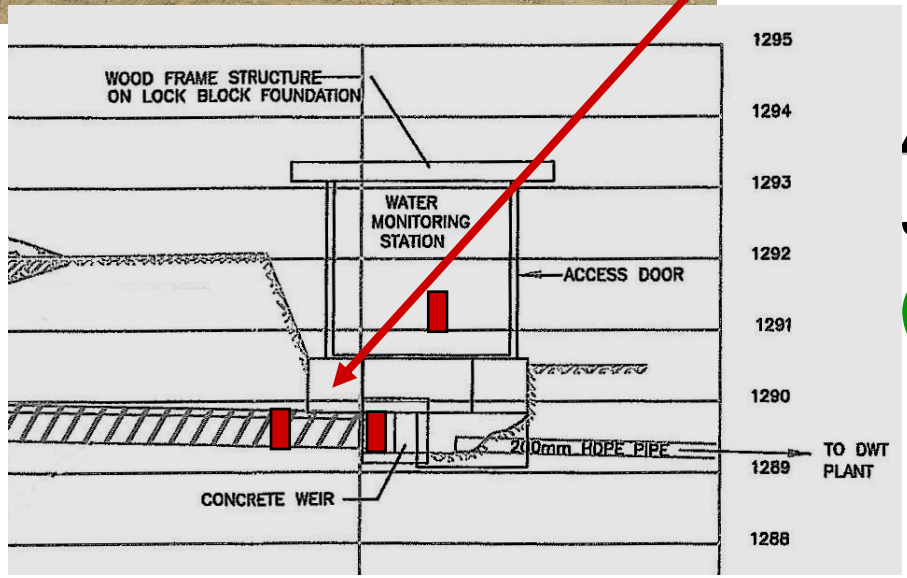




# Overview of Monitoring System



# Overview of Monitoring System



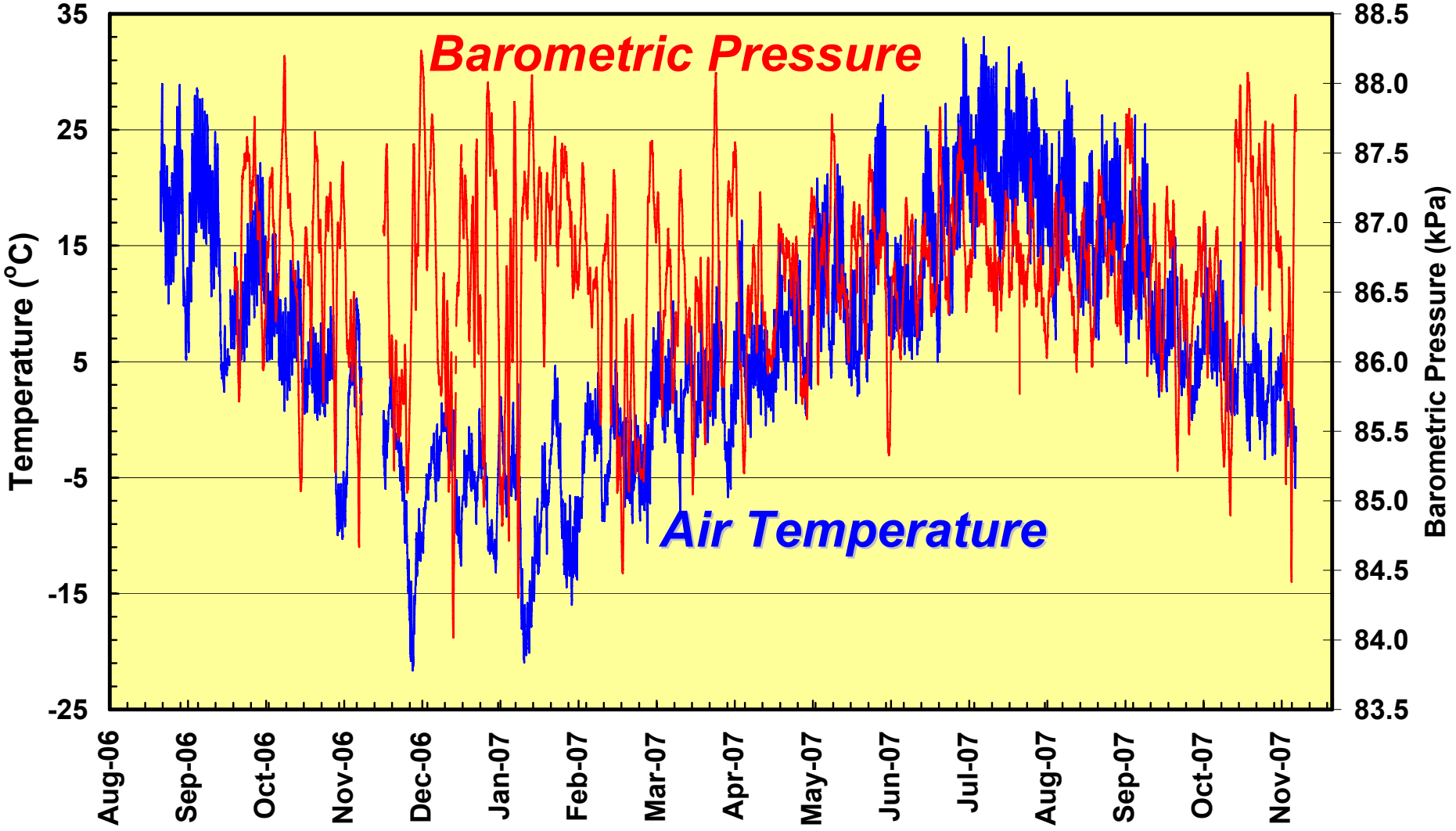

- Monitoring Station
  - August 16th to 21st, 2006
  - At three locations in MS
    2 in pipe: entrance and 8 ft in
    1 in MS structure
    - Temperature
    - Barometric pressure
    - Gas sampling points

Air velocity in pipe

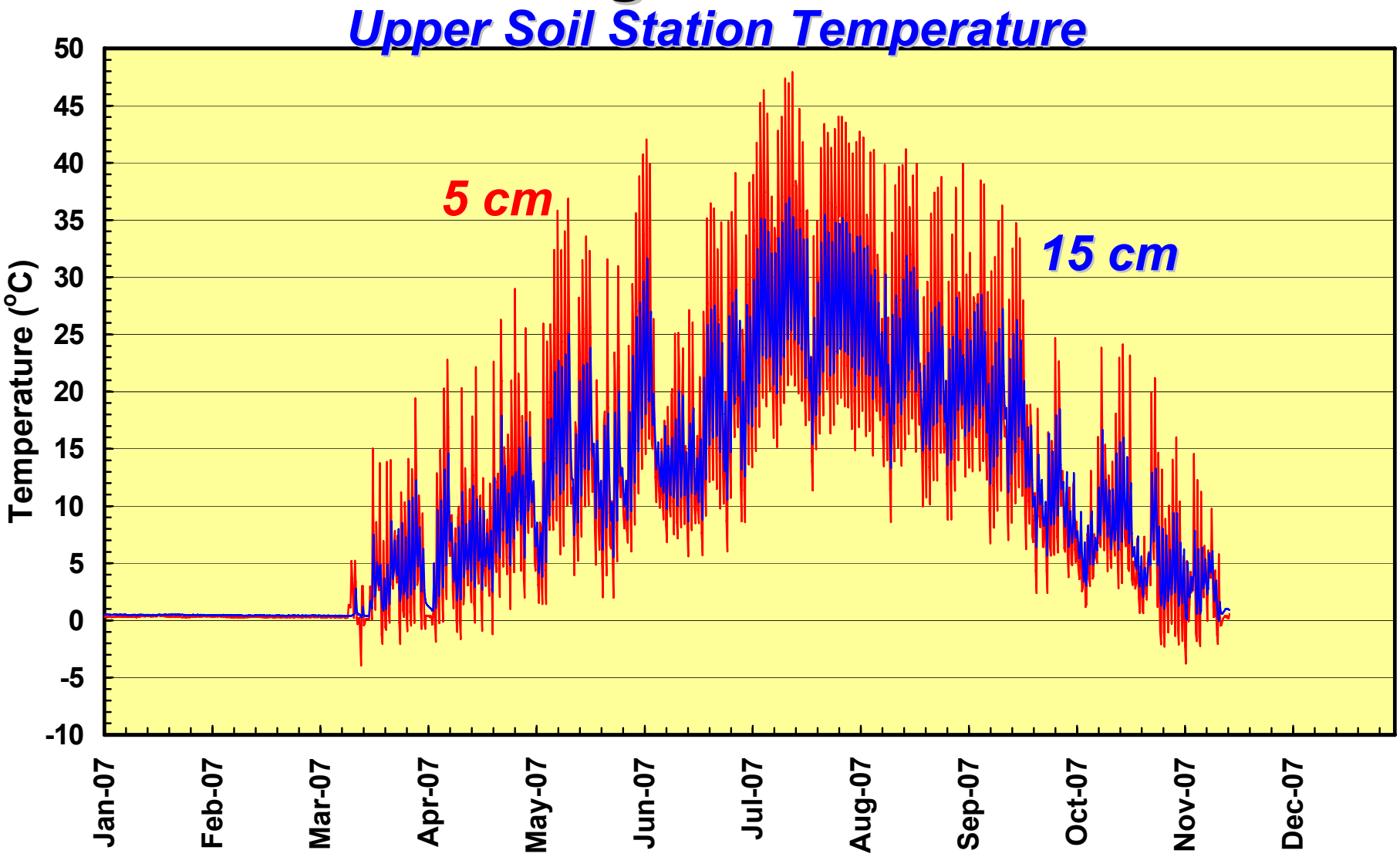
Sonic ranger (water level)

(ISCO water sampler)

# Monitoring Data

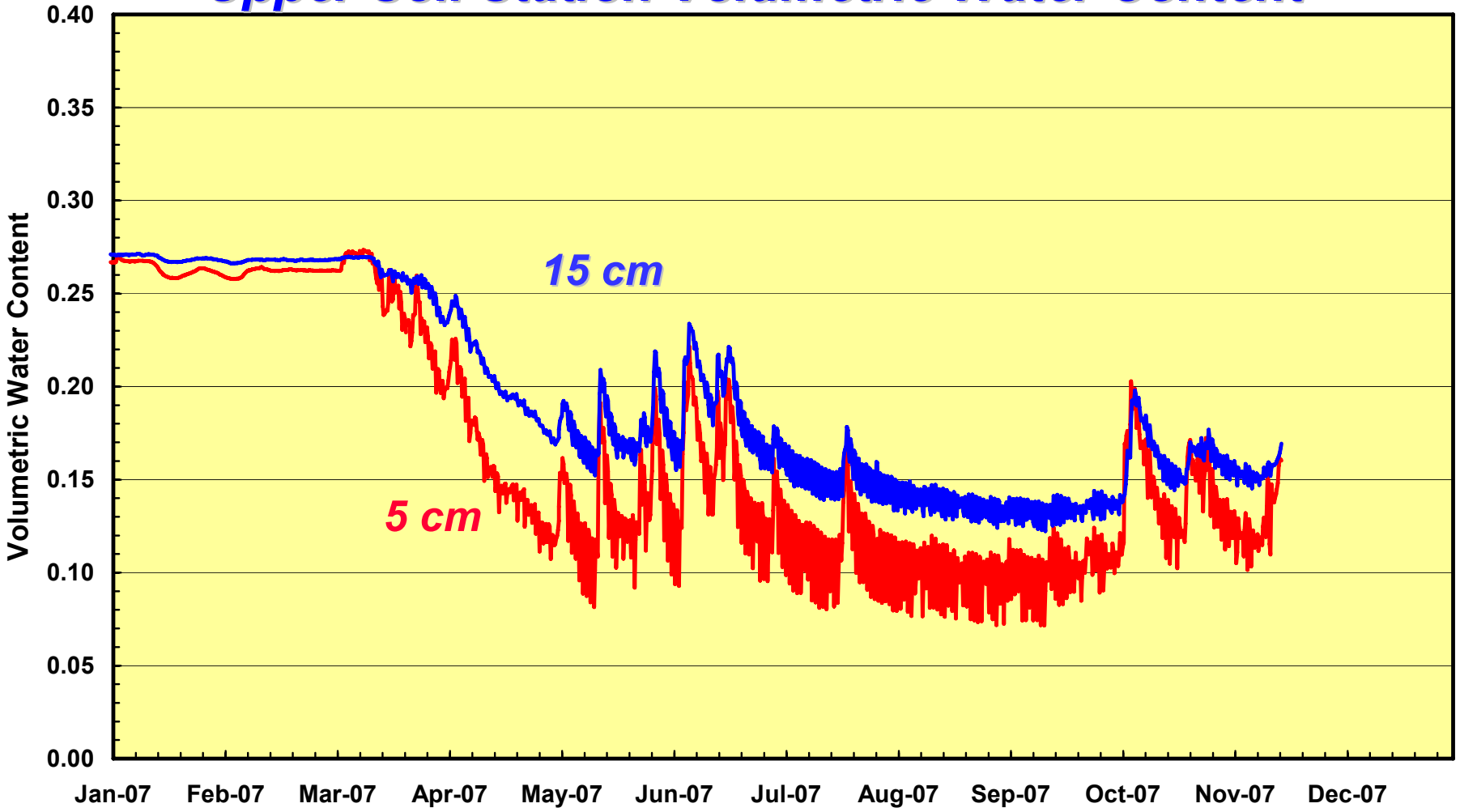


# Monitoring Data



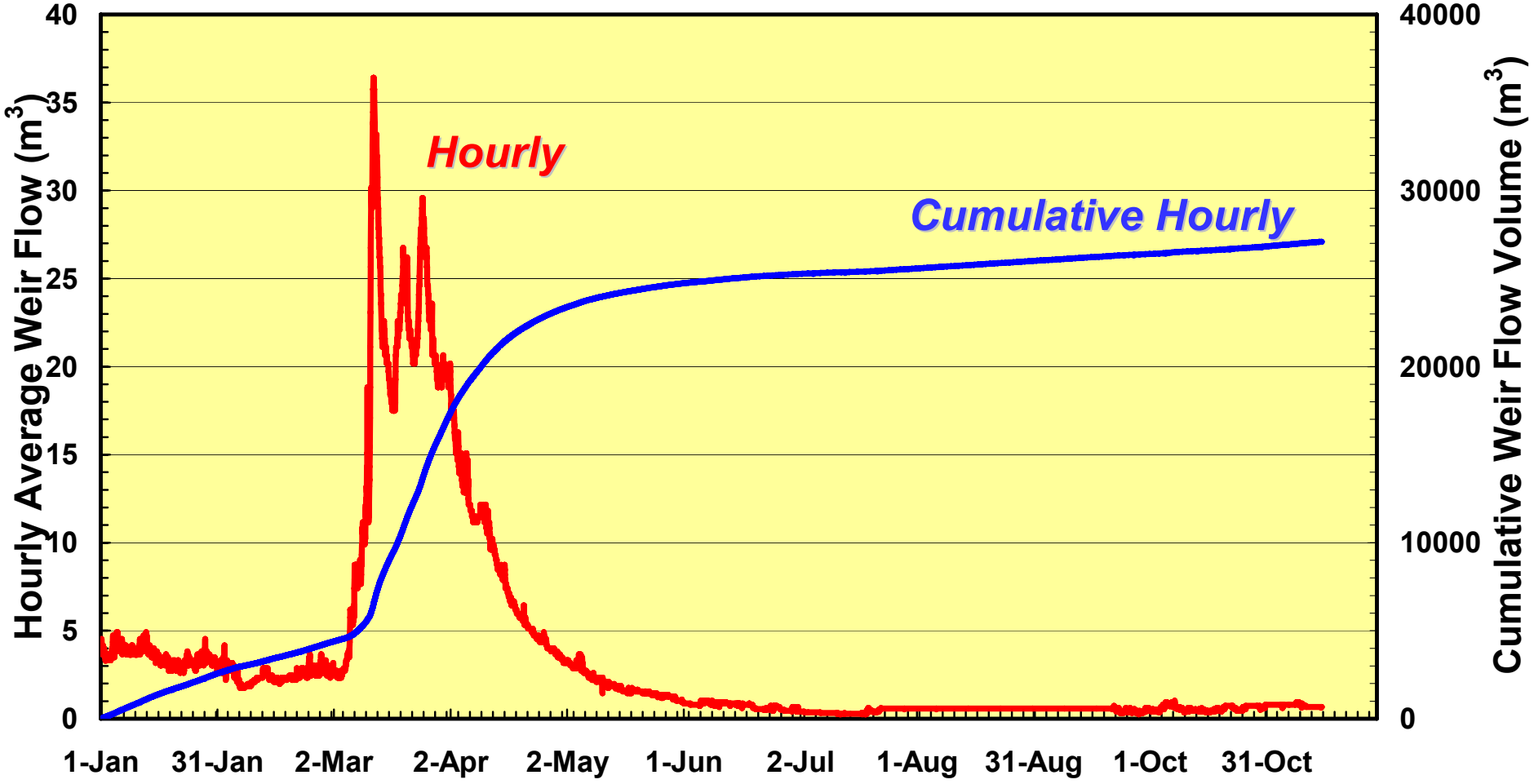
# Monitoring Data

## Upper Soil Station Volumetric Water Content



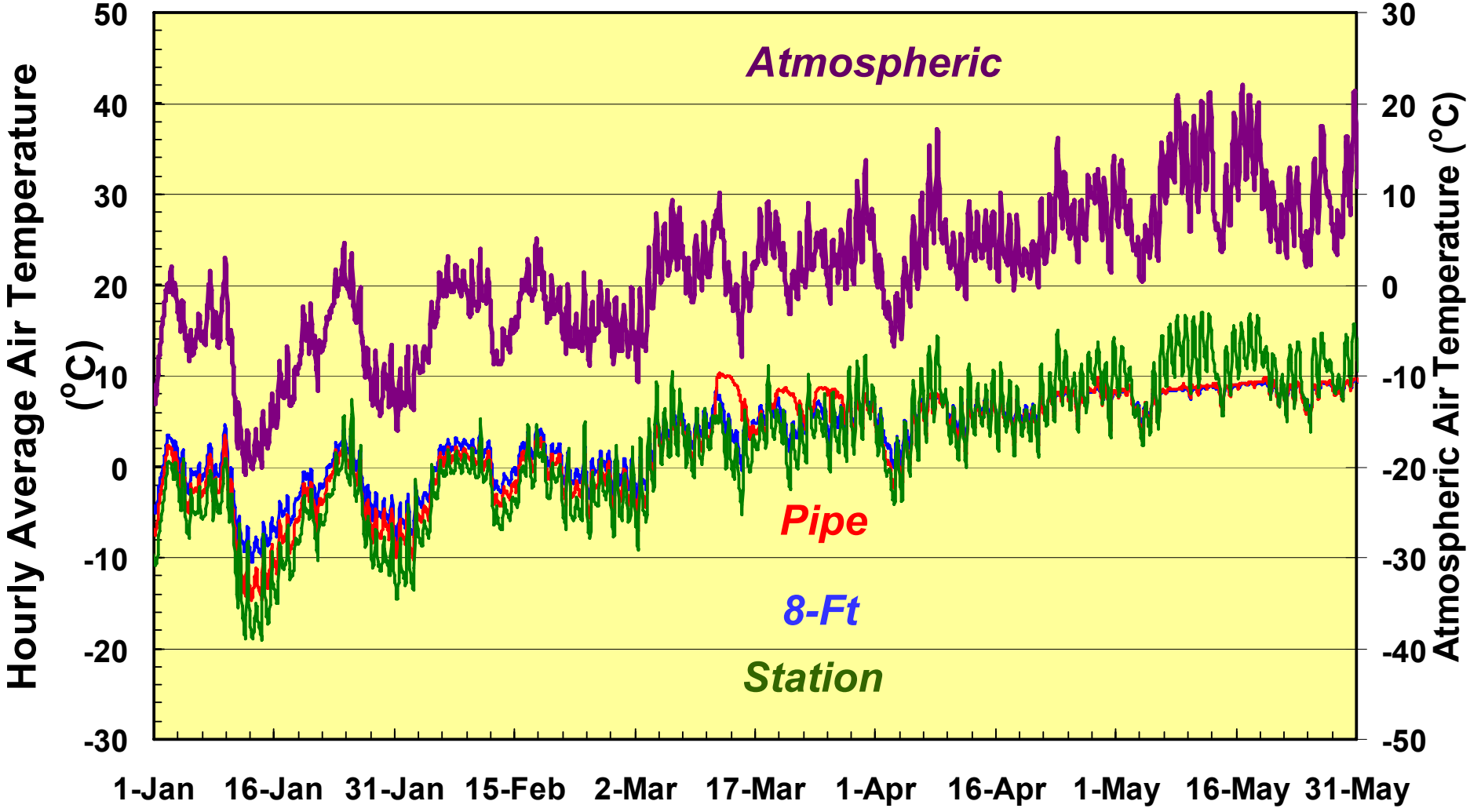
# Monitoring Data

## Weir Flow

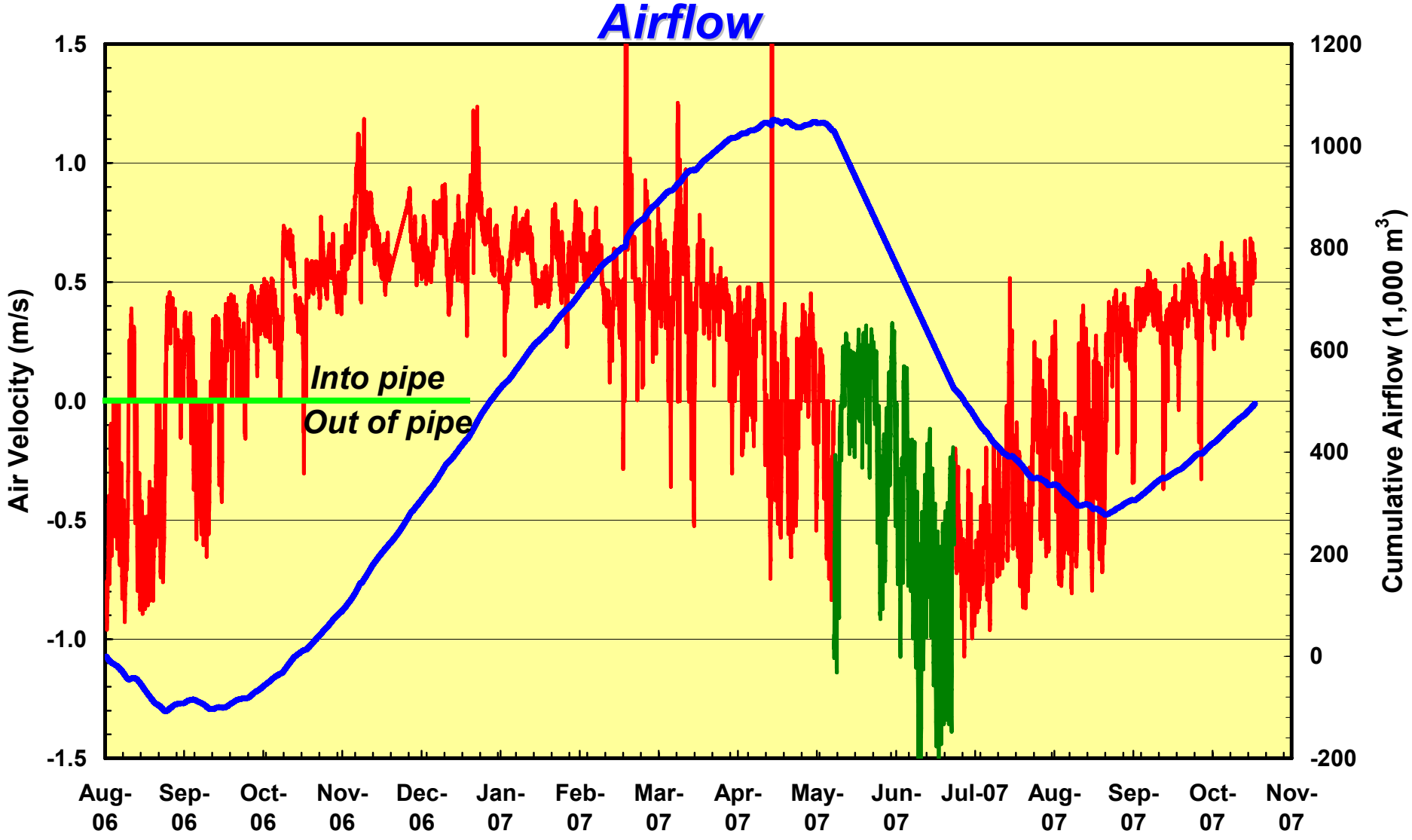


# Monitoring Data

## Air Temperature

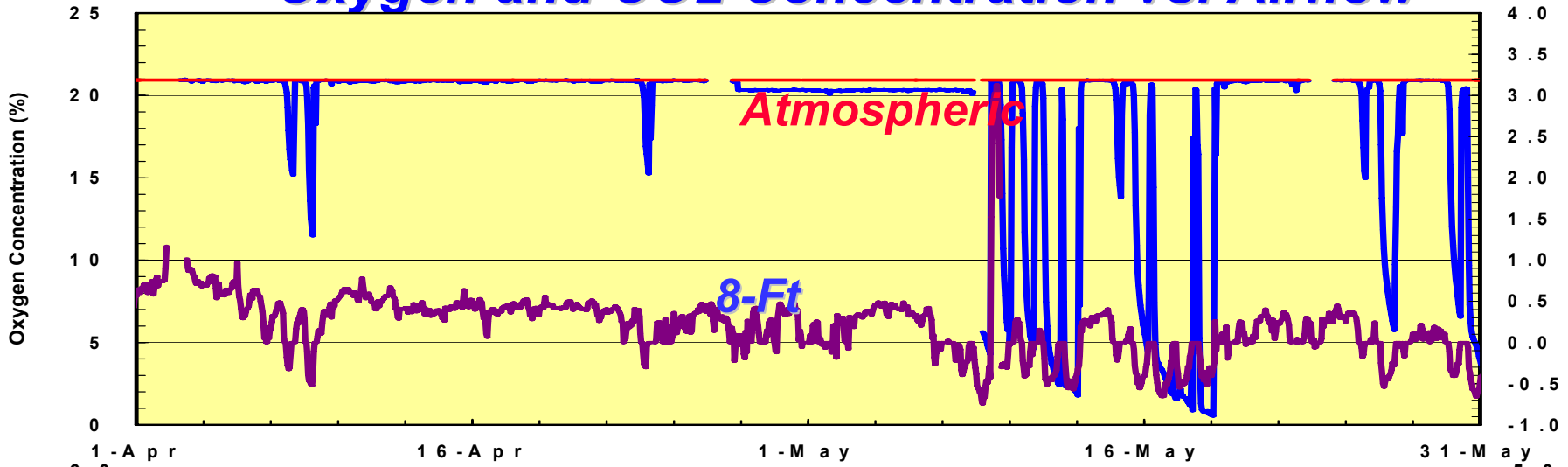


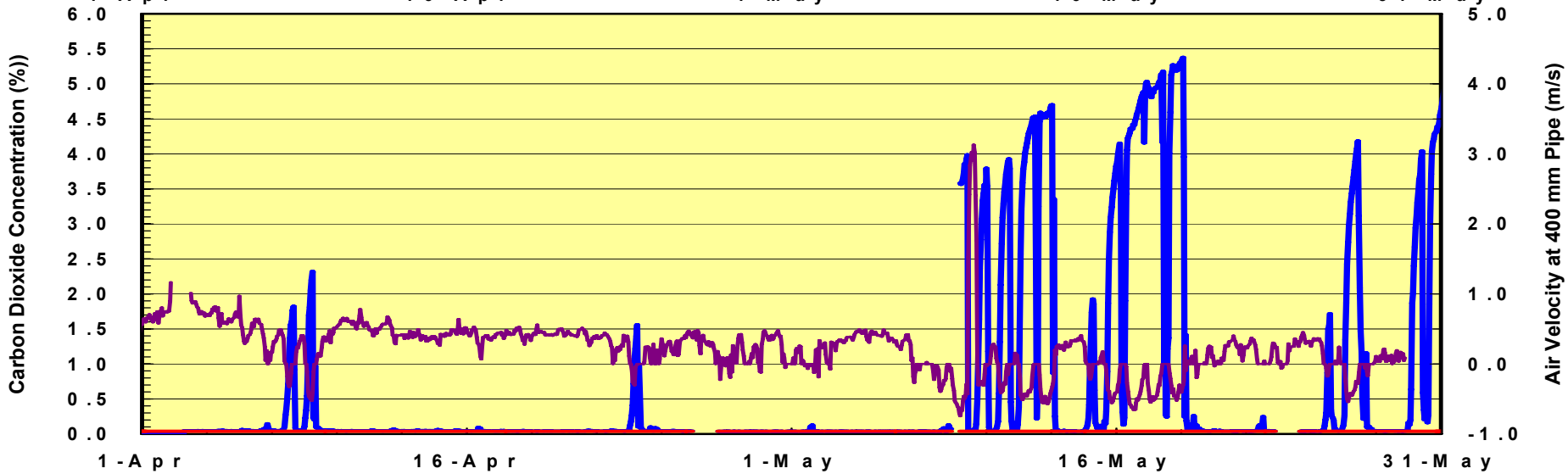
# Monitoring Data



# Monitoring Data

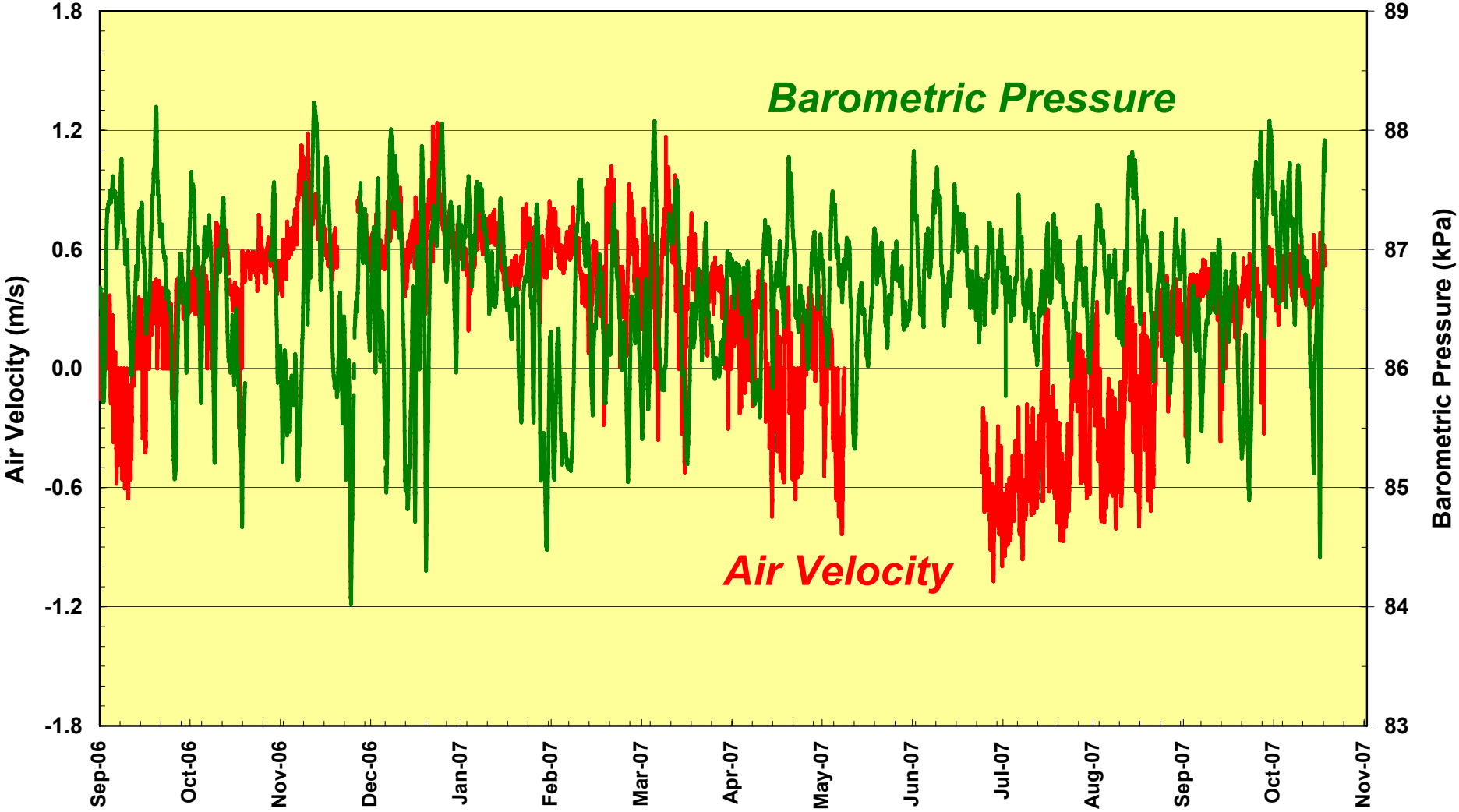
## Oxygen and CO2 Concentration vs. Airflow



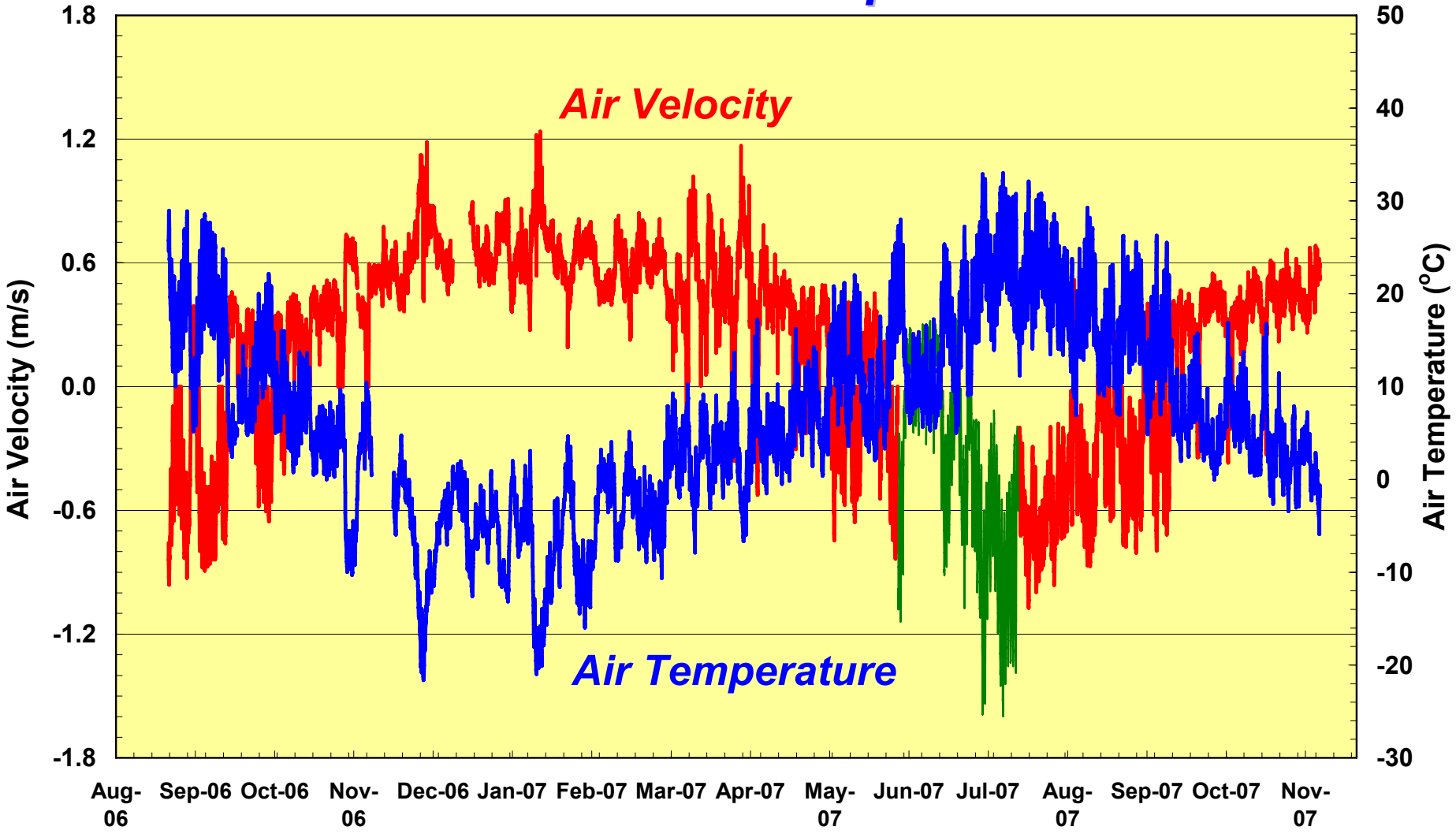
# Data Analysis

## Airflow and Barometric Pressure



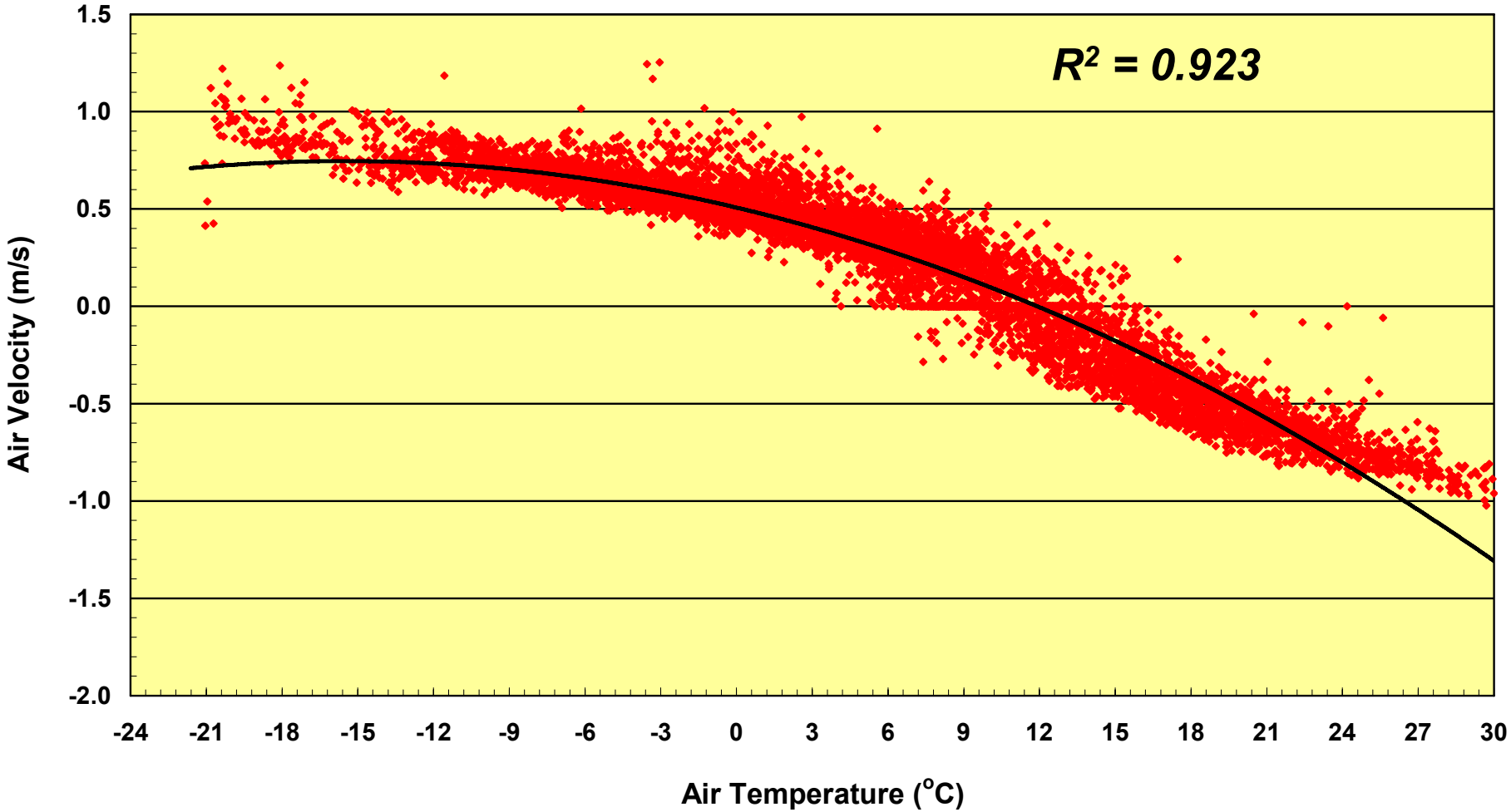
# Data Analysis

## Airflow and Air Temperature



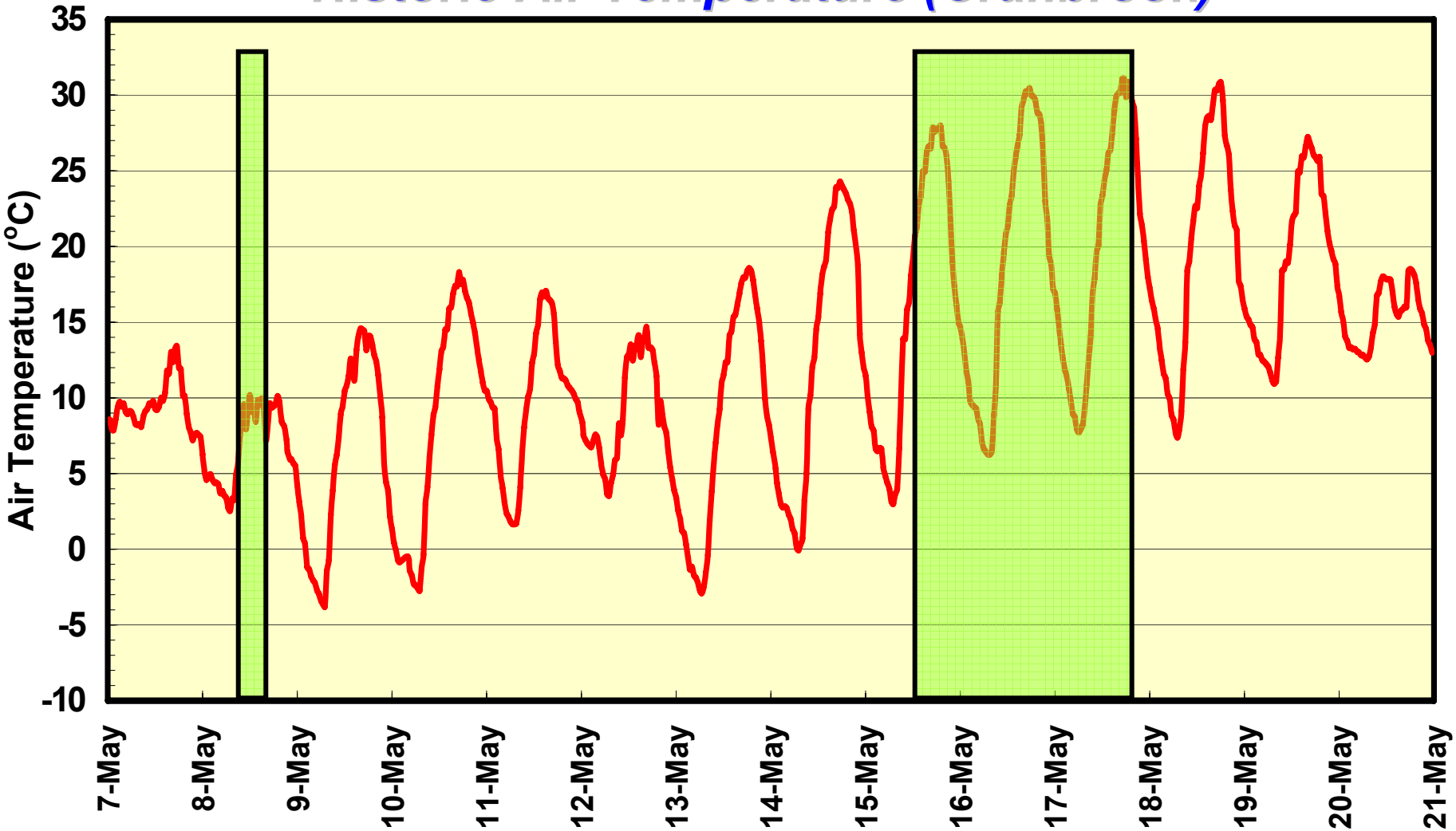
# Data Analysis

## Airflow and Air Temperature

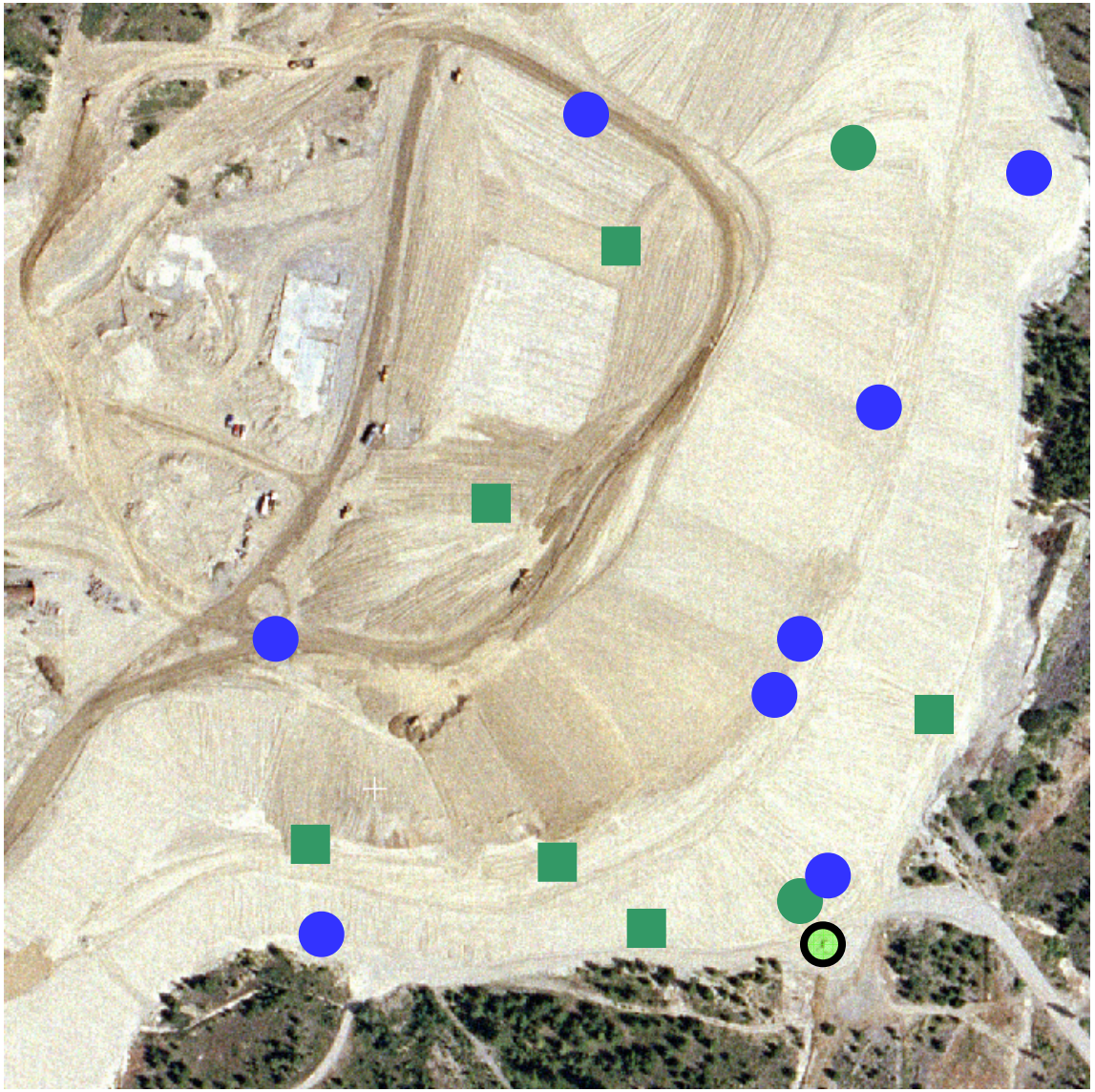


# Incident Air Temperature

## Historic Air Temperature (Cranbrook)

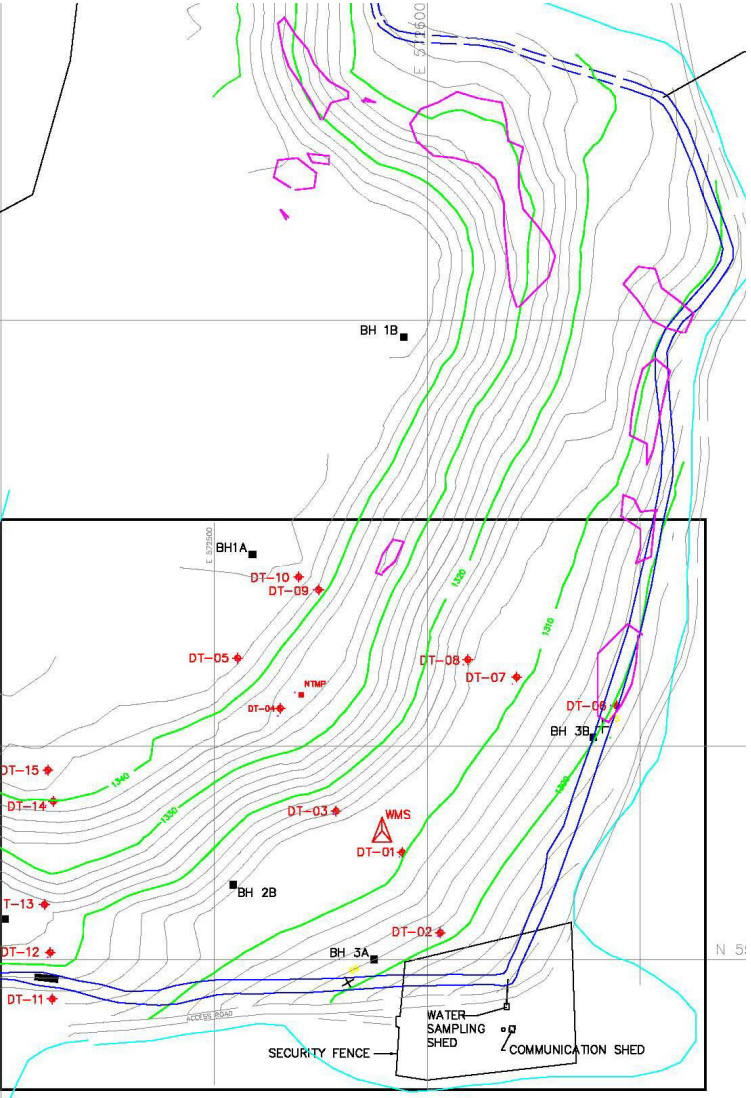


# Phase 2 Installation - Internal

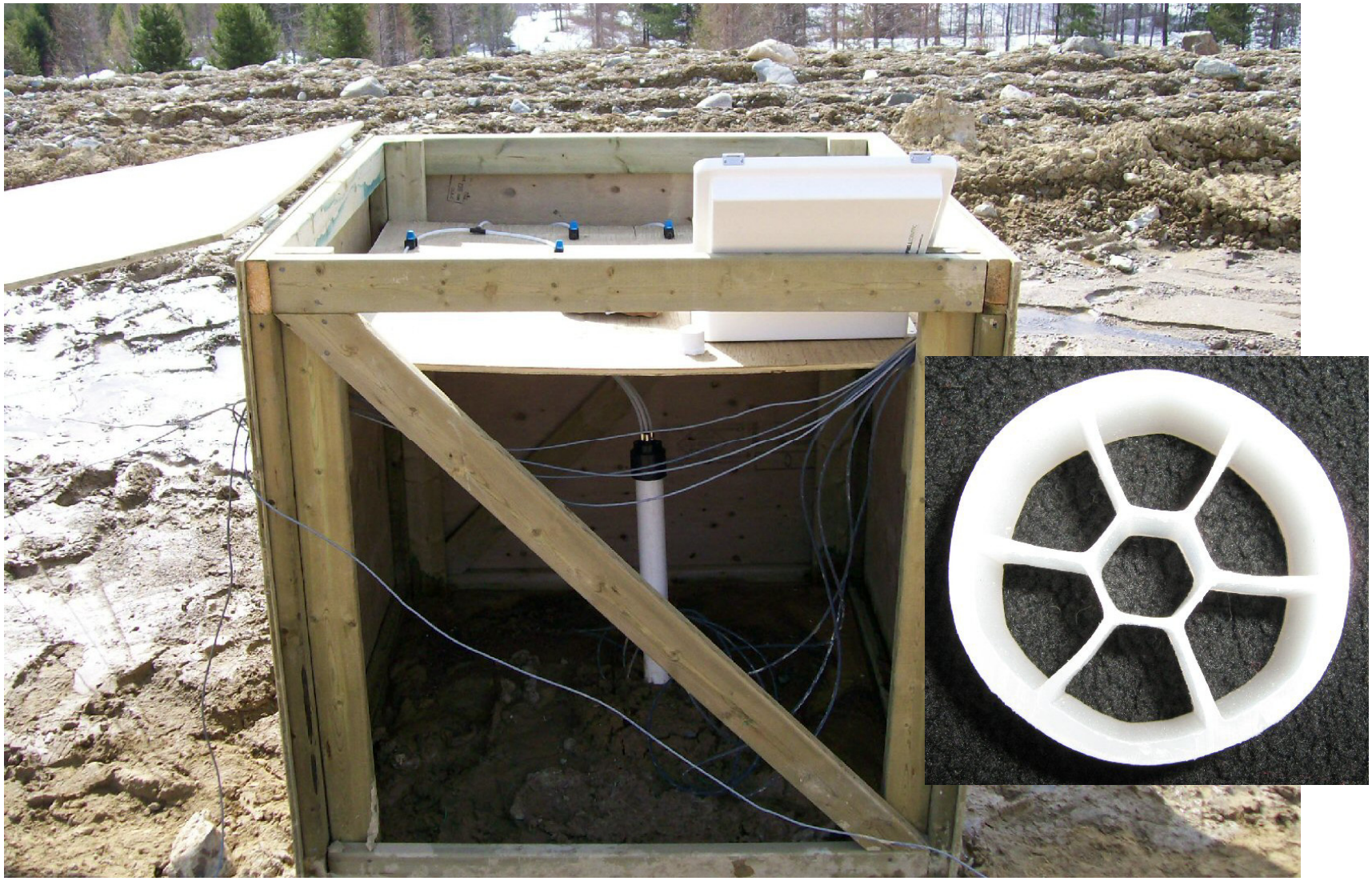


- *Locations altered based on initial gas results and discovery of bare spots*

# Phase 2 Location Selection

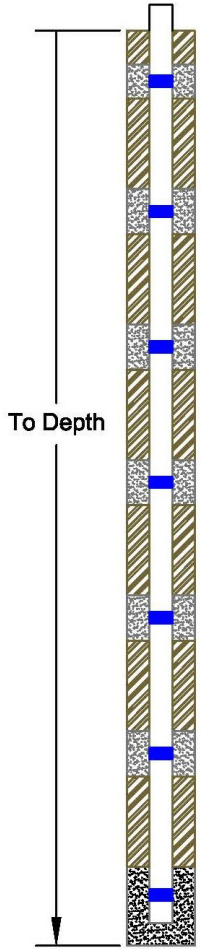


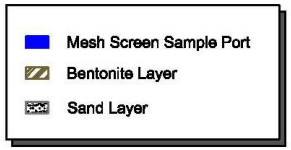

# Phase 2 Instrumentation

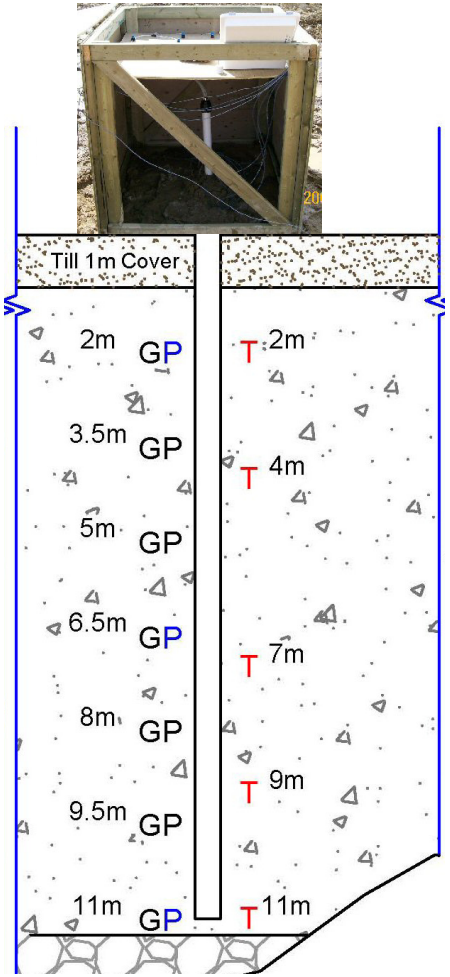


# Phase 2 Instrumentation

BASIC INSTALLATION OF
CONTINUOUS MULTICHANNEL TUBING



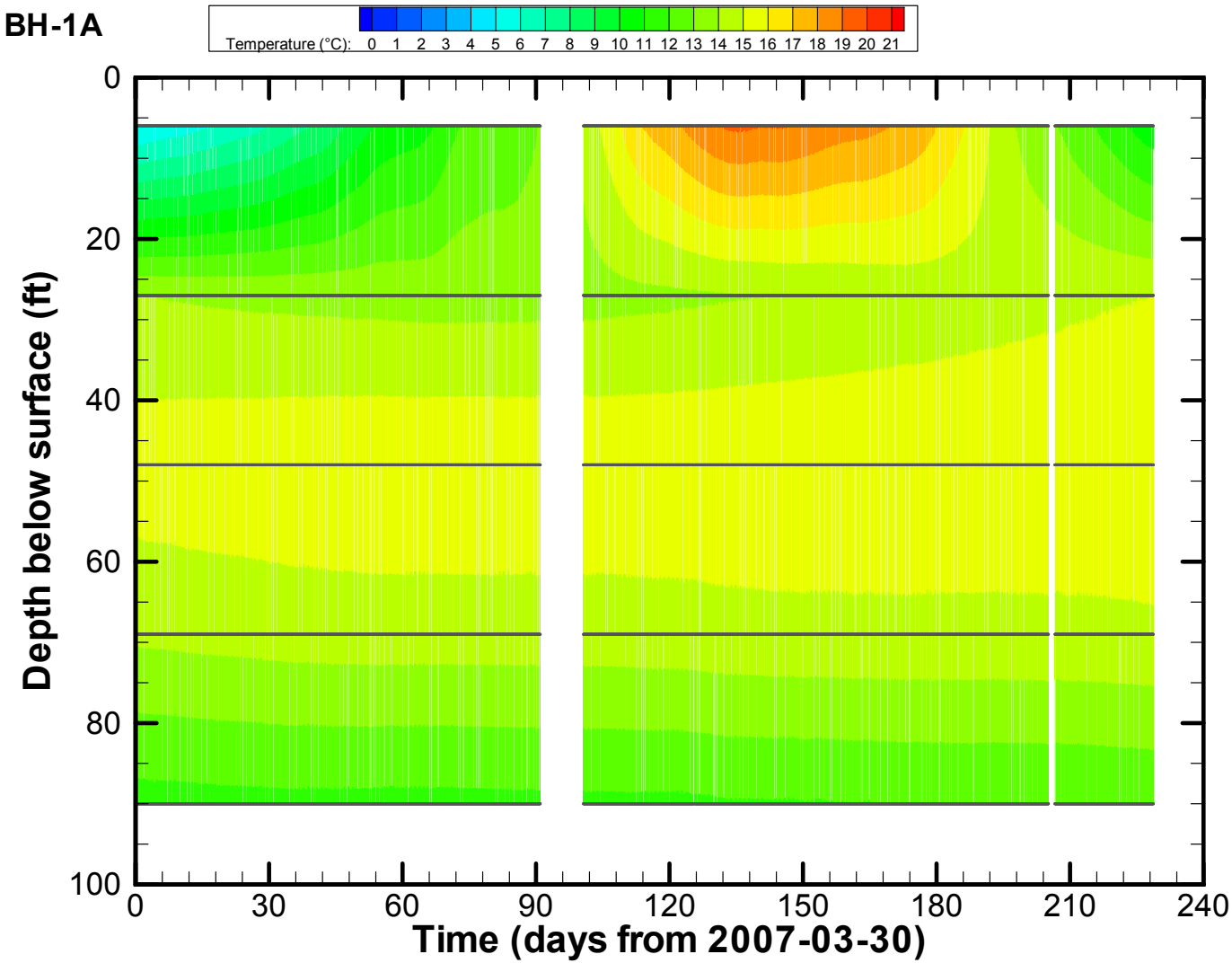




G - Gas Sampling
P - Pressure Sampling
P - Automated Pressure Sampling
T - Automated Temperature Sampling

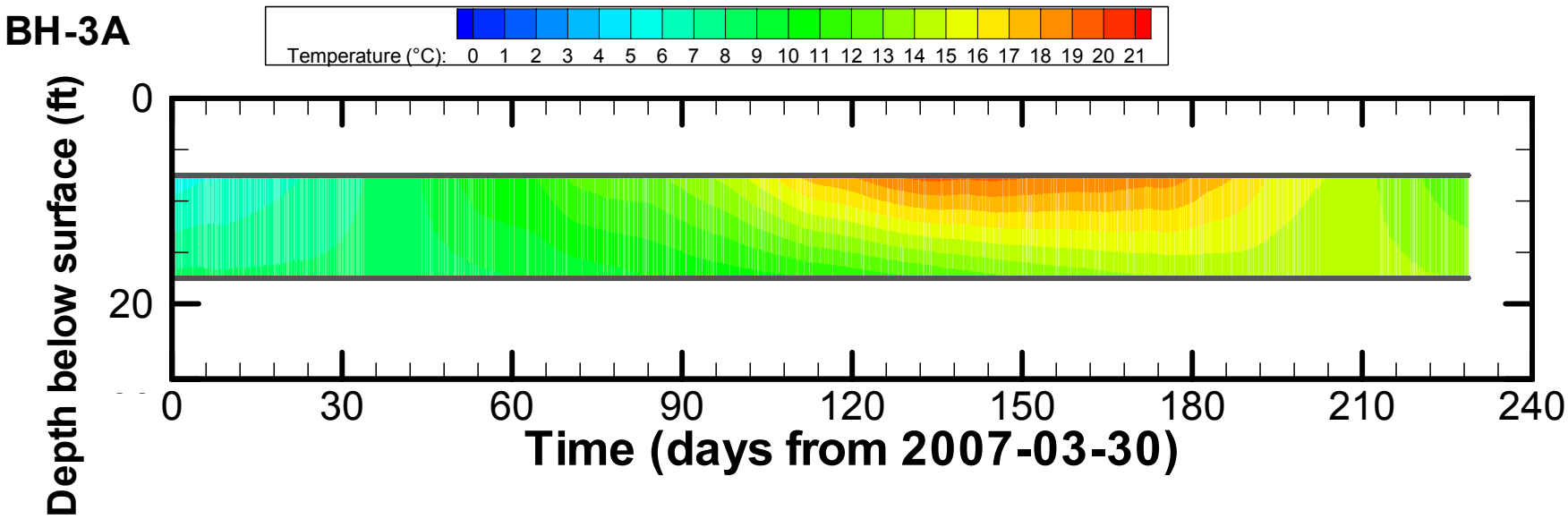
# Phase 2 Instrumentation


## Push-in Piezometers

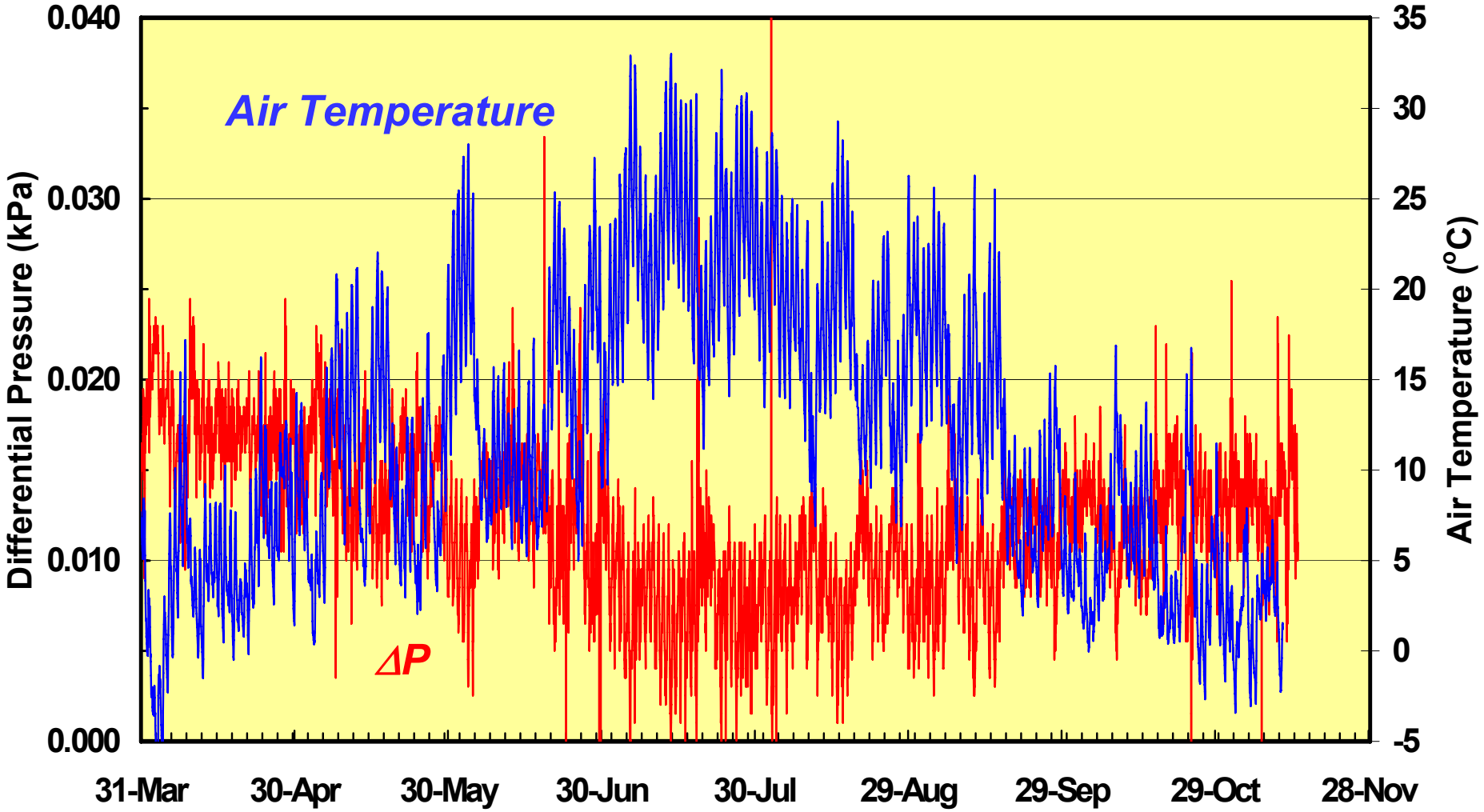
# Phase 2 Temperature Data



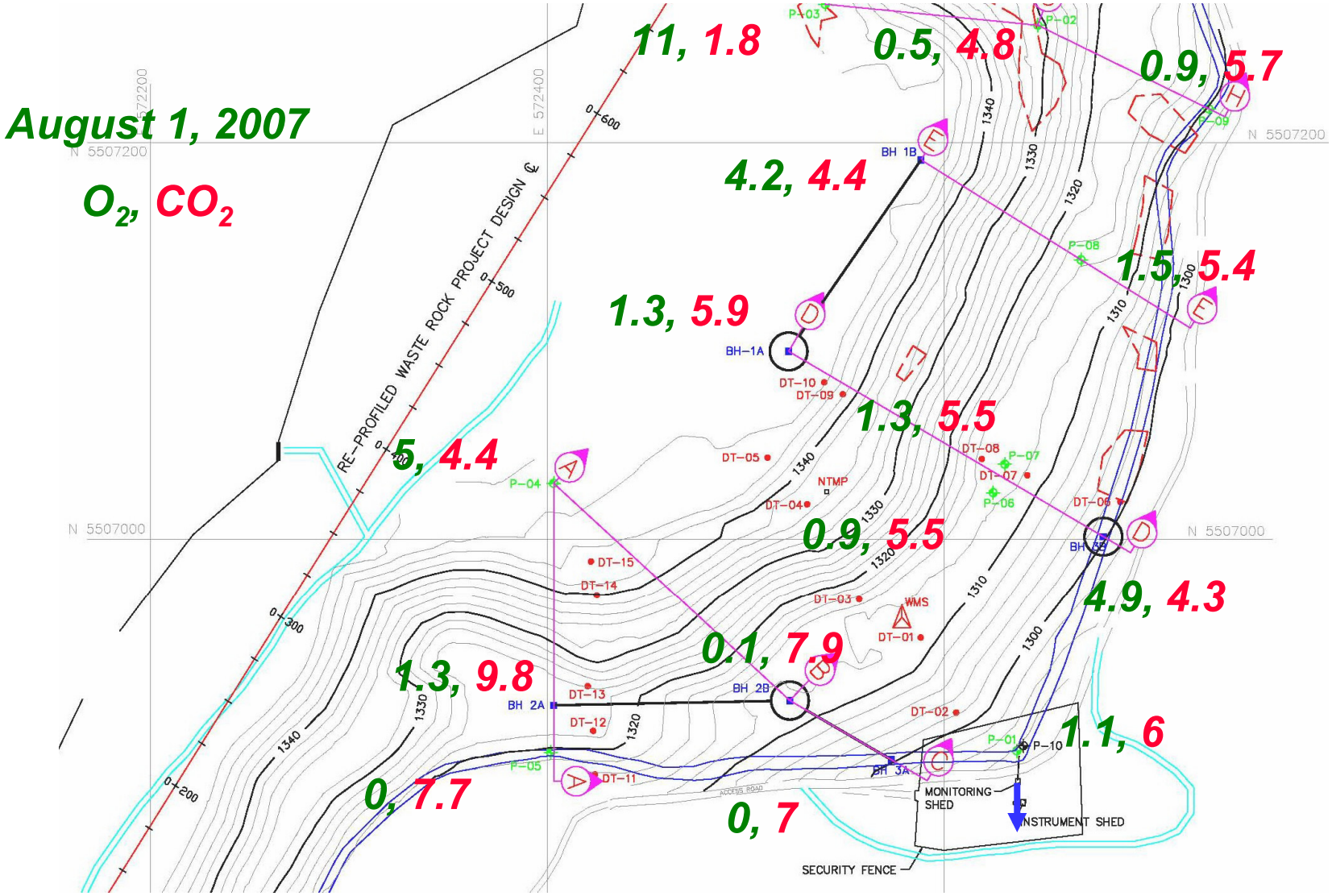
# Phase 2 Temperature Data



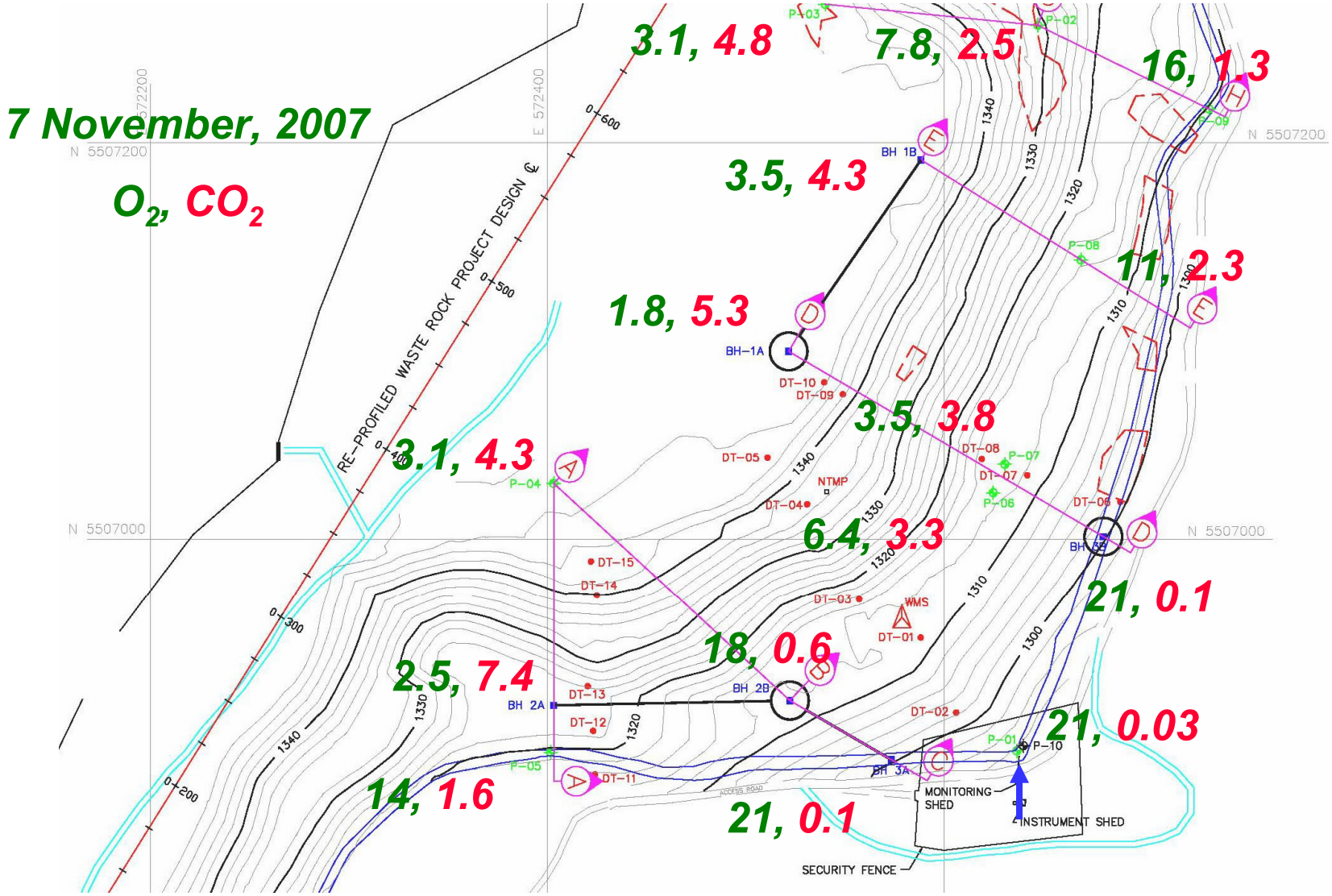
# Phase 2 ΔP Data



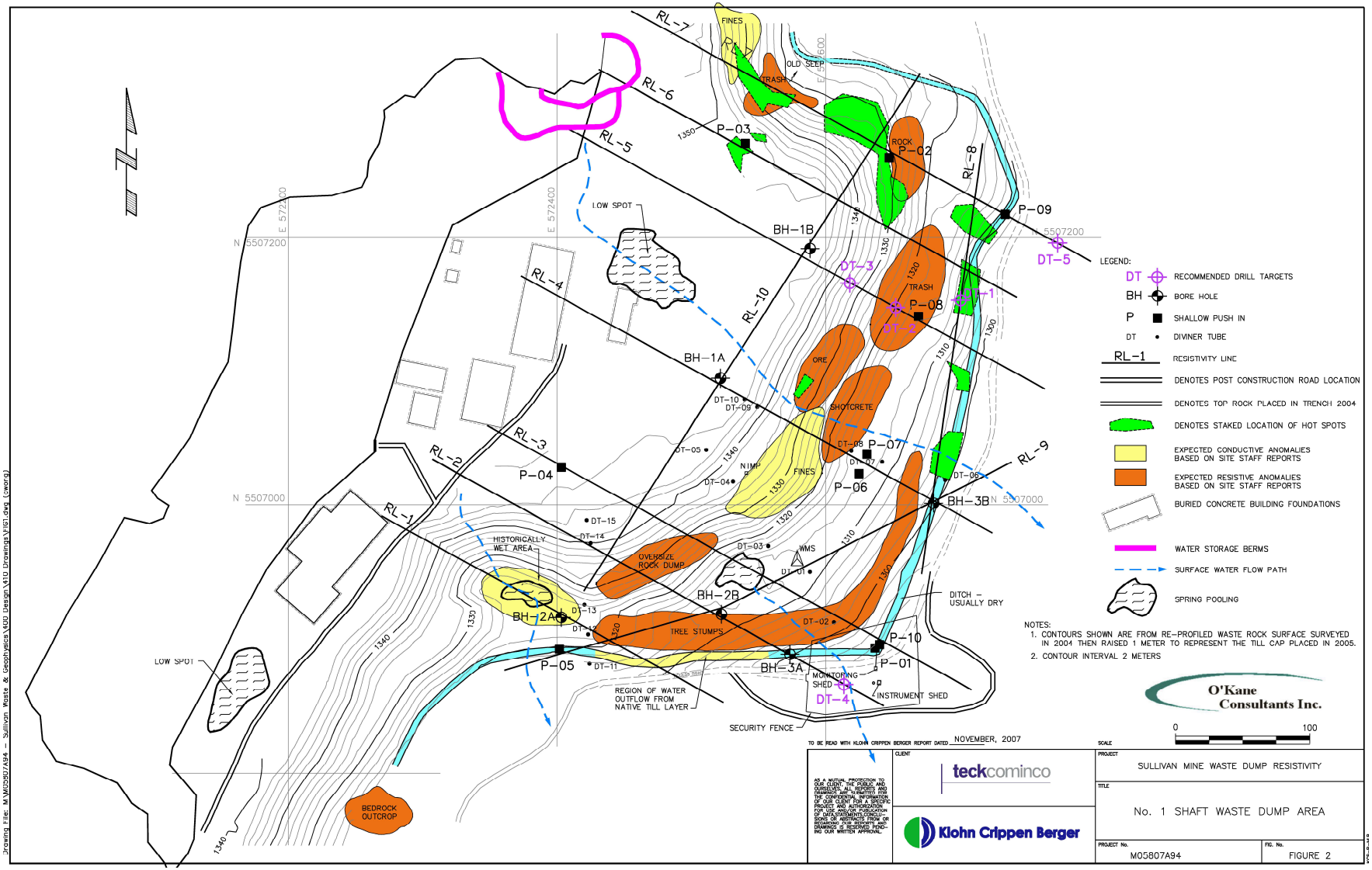
# Phase 2 Gas Data *(negative velocity)*



# Phase 2 Gas Data (positive velocity)



# Geophysical Survey



# Geophysical Survey