



Environment
Canada

Environnement
Canada

Canada

Automated Water Quality Monitoring in the Oil Sands

Kerry Pippy
**Water Quality Monitoring and
Surveillance Division**
**Environment and Climate Change
Canada**

**Real-Time Water Quality
Monitoring Workshop**
St. John's
November 7th – 8th, 2018



Overview

- Oil Sands Monitoring Program
- Automated Program
- Instrumentation
- Deployment
- Site descriptions
- Challenges
- Results
- Looking forward

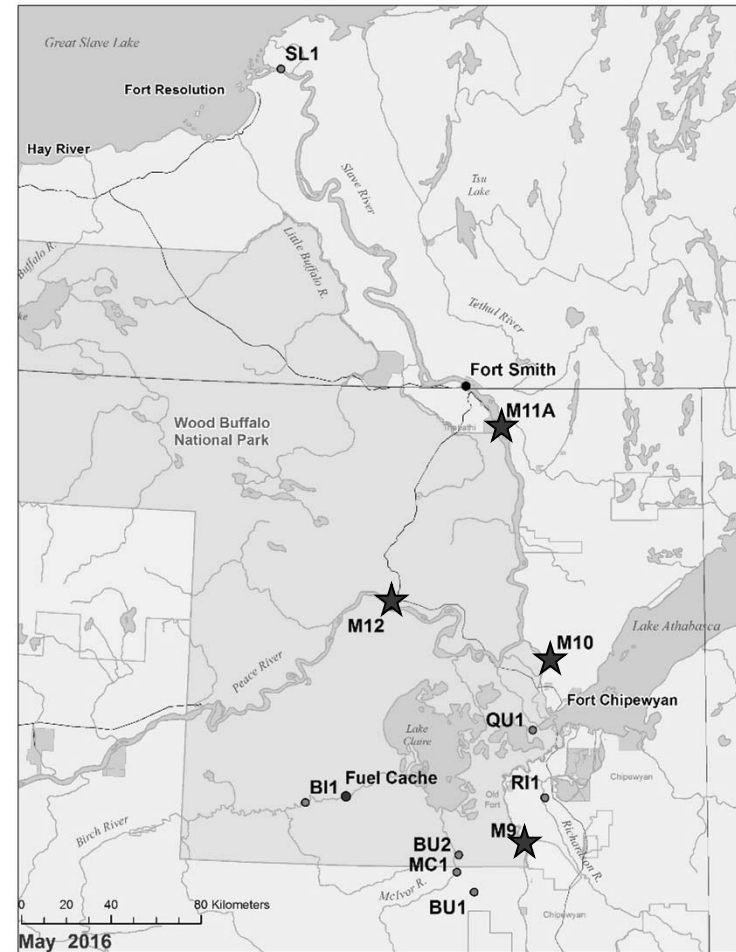
Oil Sands Monitoring Program

- The Governments of Canada and Alberta have developed a detailed, multi-media (i.e. air, water and terrestrial habitat-focused) Oil Sands Monitoring Program (OSM) which is addressing impacts within the mining area, and in downstream habitats of the Peace-Athabasca Delta and beyond.
- Water Quality monitoring considerations
 - quantify & assess the sources, transport, loadings, fates and type of oil sands contaminants
 - a mass balance approach used to define network
- Multiple Sub-components
 - Surface water sampling, mainstem loading studies, passive monitoring approaches, real-time monitoring approaches, expansion of monitoring to downstream receiving areas (EGA), suspended sediment sampling, subsurface flow (SEEPS), Monitoring Standards and Protocols, WQ Data Management.



Automated Program

- Objectives:
 - Provide continuous Water Quality data to expand on surface water sample “snap shots” for baseline, trends, and early warnings.
- Sites co-located with OSM surface water monitoring stations & long-term hydrometric monitoring sites



Instrumentation

- YSI EXO2

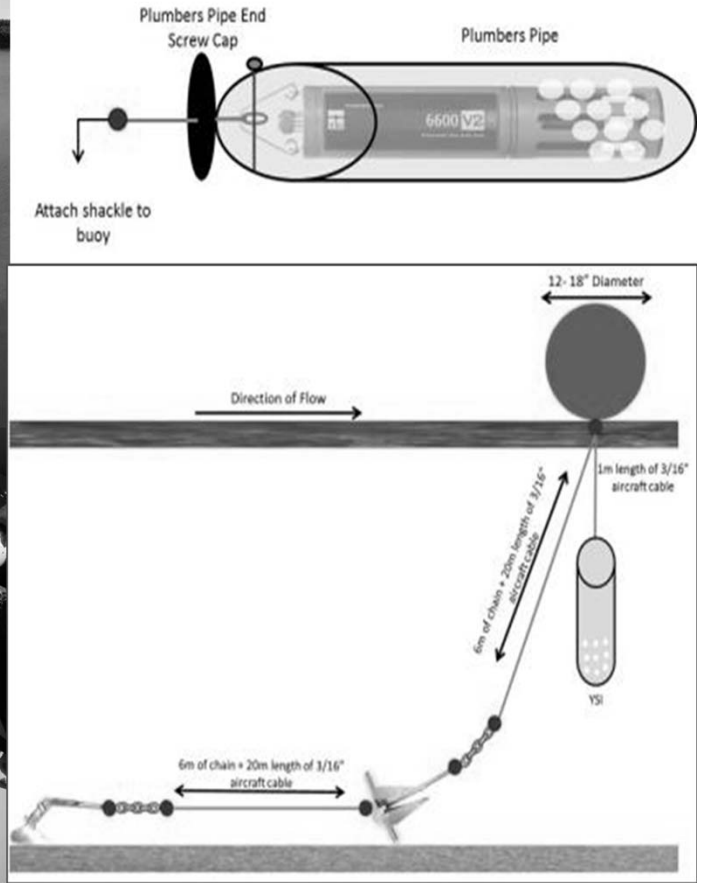
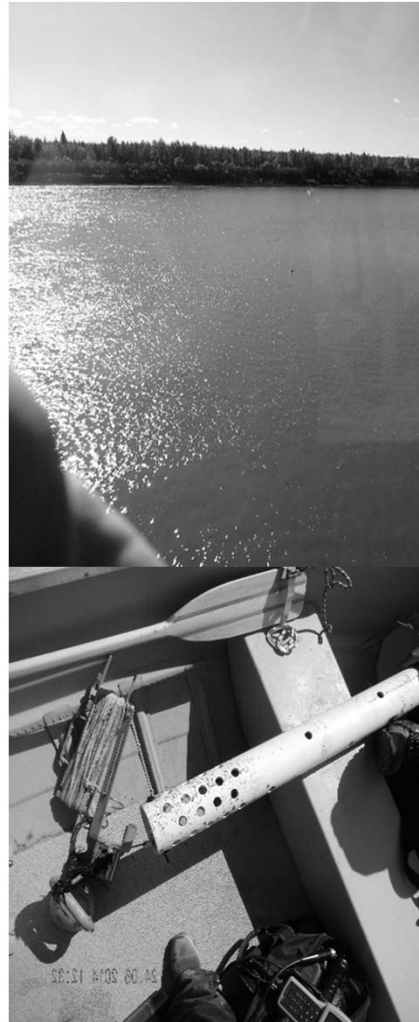


- YSI 6600EDSV2 Sonde



Deployment

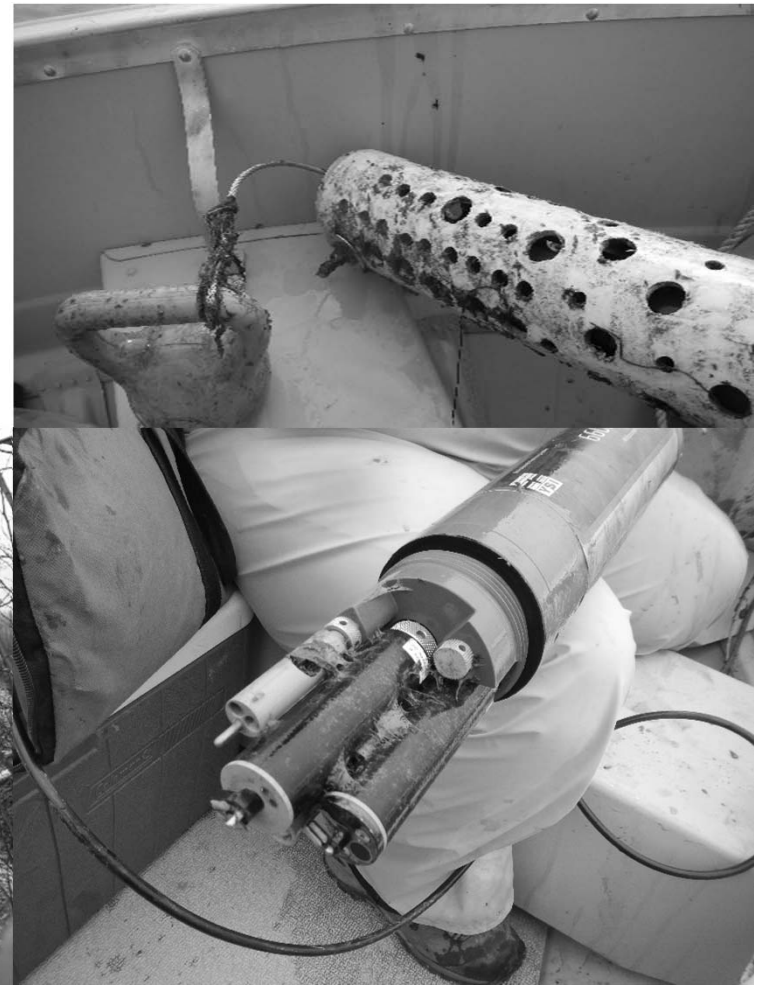
- Sondes are deployed as soon as possible after breakup
- A PVC tube attached to a buoy makes up the deployment housing for the sondes
- Data is logged internally and downloaded manually



(Photos by WQMS Yellowknife)

Deployment – con't

- We visit each automated monitoring station every 4-6 weeks to perform cleaning, maintenance and QA/QC measures
- We remove sondes as close as we can estimate to freeze up

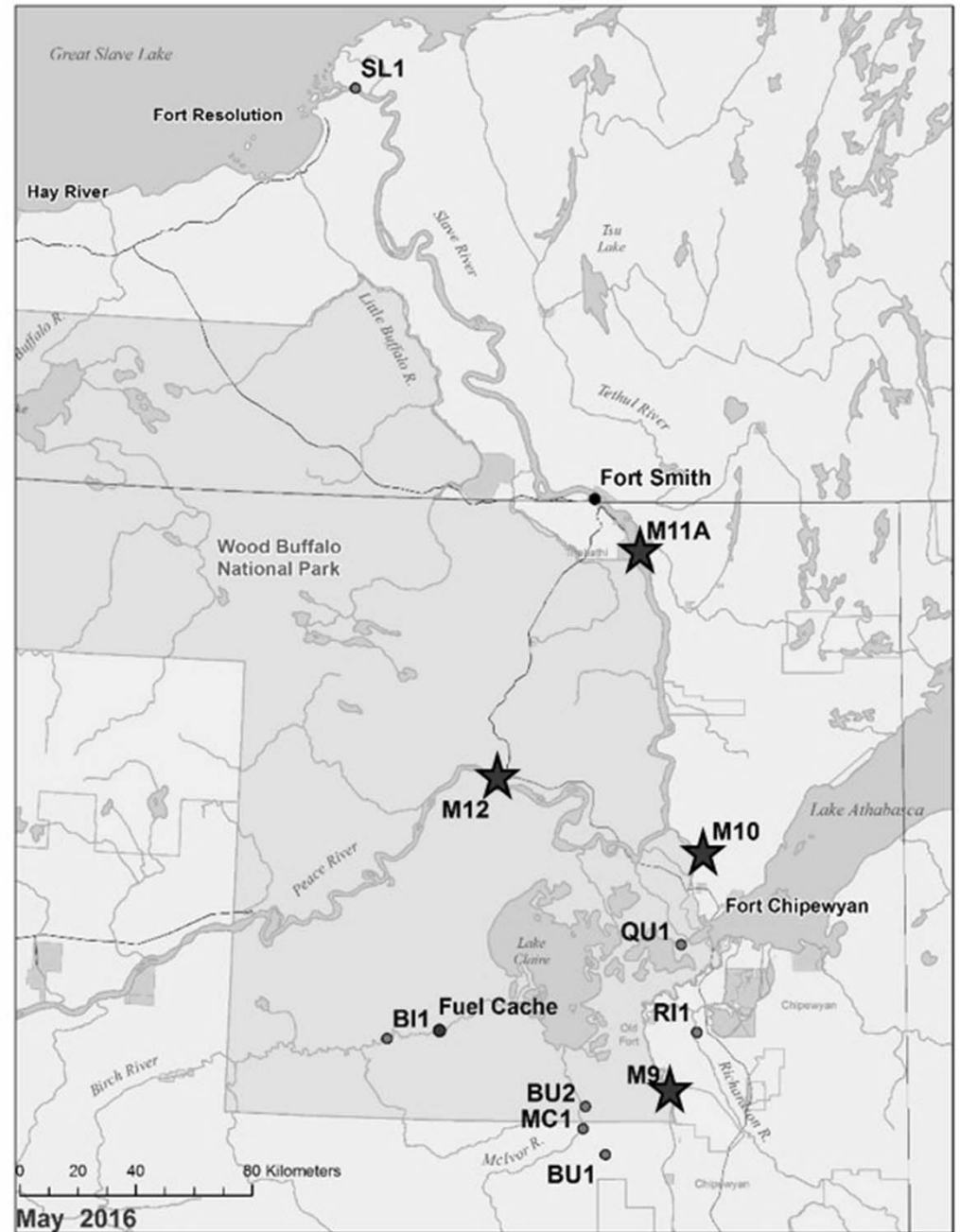


Photos by WQMS Yellowknife

Site Descriptions

All sites are considered to be Mainstem sites in the OSM program.

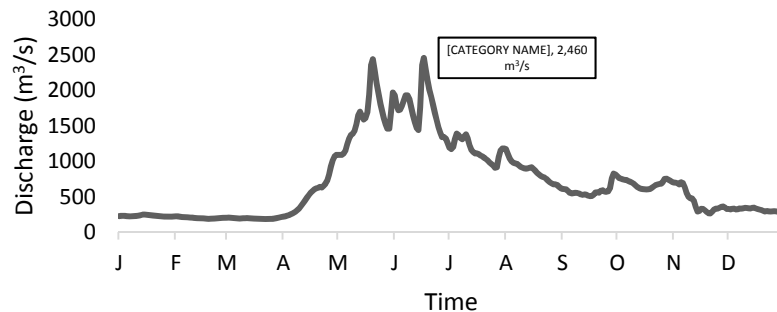
- Athabasca River at 27th Baseline (M9)
- Rivière des Rochers (M10)
- Slave River at Fitzgerald (M11a)
- Peace River at Peace Point (M12)



Site Description – Athabasca River at 27th Baseline

- 60 minute helicopter ride from Fort Smith, located within Wood Buffalo National Park
- Auto-monitor is 25km upstream of hydrometric gauge
- Mean annual discharge of ~710 m³/s, with a peak discharge of ~1,500 m³/s

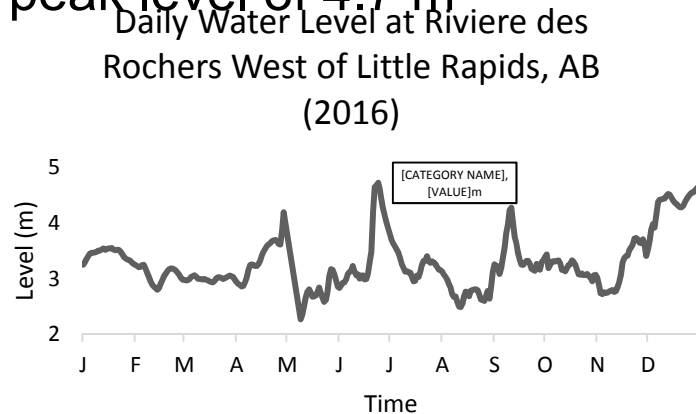
Daily Discharge at the Athabasca River at Embarras Airport, AB (2017)



Photos by WQMS Yellowknife

Site Description – Rivière des Rochers Below Little Rapids

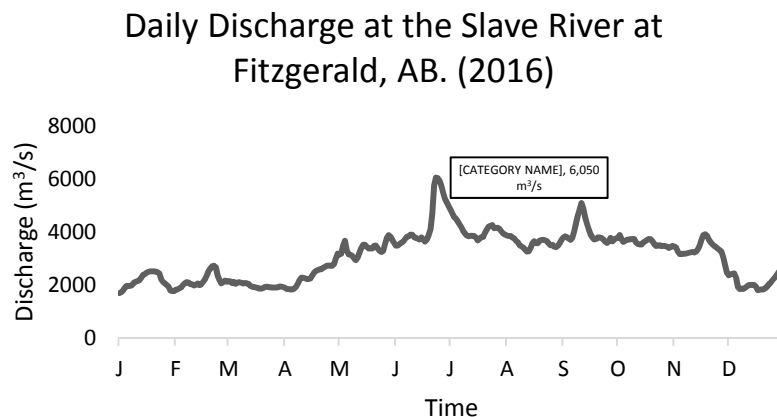
- 30 minute helicopter ride from Fort Smith, located within Wood Buffalo National Park
- Auto-monitor is co-located with hydrometric gauge
- Mean water level of 3.3 m, with a peak level of 4.7 m



Photos by WQMS Yellowknife

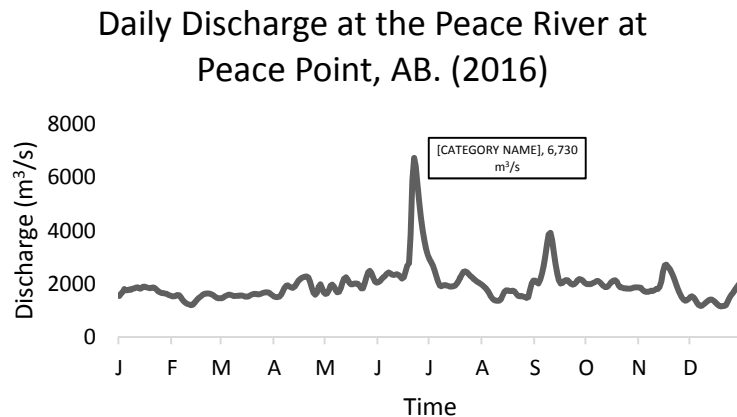
Site Description – Slave River at Fitzgerald

- 25 minute drive from Fort Smith
- Auto-monitor is located 1.7 km upstream of hydrometric gauge, 3.7 km upstream of Cassette Rapids
- Mean annual discharge of $\sim 3,400 \text{ m}^3/\text{s}$, with a peak discharge of $\sim 6,000 \text{ m}^3/\text{s}$



Site Description – Peace River at Peace Point

- 90 minute drive from Fort Smith, located within Wood Buffalo National Park
- Auto-monitor is located 1 km upstream of hydrometric gauge
- Mean discharge of $\sim 2,065 \text{ m}^3/\text{s}$, with a peak discharge of $\sim 6,500 \text{ m}^3/\text{s}$



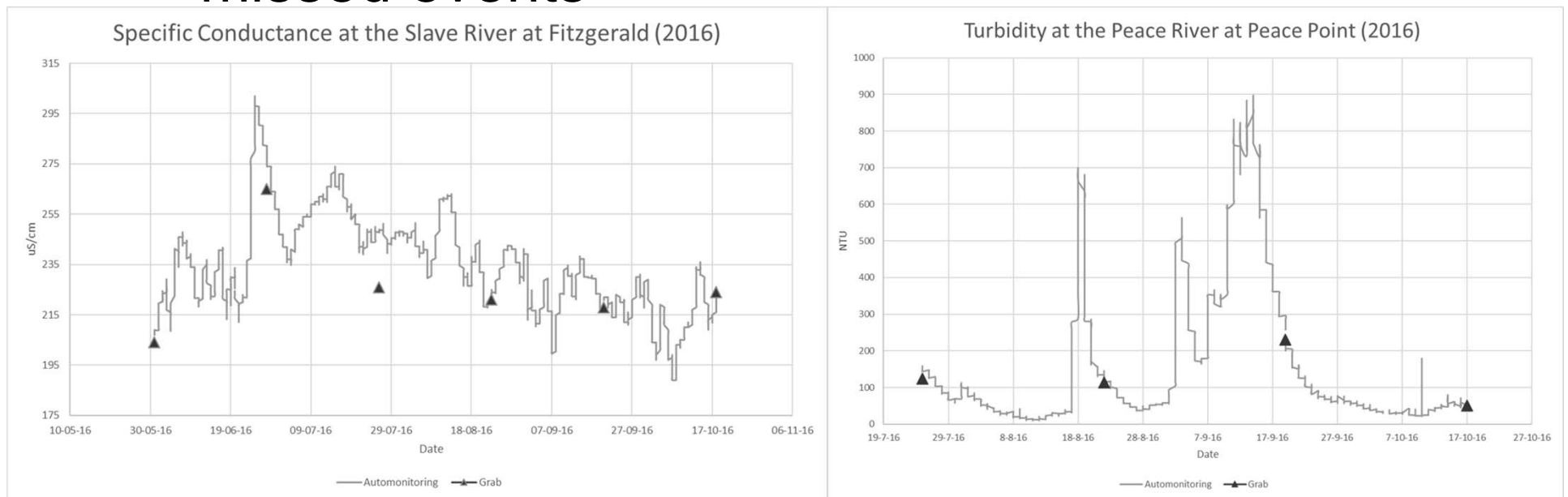
Challenges

- Extreme remote locations
 - Single maintenance trip = 5 days
- Extreme cost
 - Single maintenance trip = \$20K
- Extreme environment
 - Massive debris causes damage and loss of equipment
 - Weather often causes delays
 - Auto-monitoring in southern stations can be carried out year-round. Impossible in the north.
 - Rivers freeze to bottom
 - Break-up would scour away sondes



What do we get from the data?

- Baseline status
- Timely measures of change
- Support grab sample monitoring and highlight missed events



Looking forward

- Expand the network into the Lower Athabasca and Oil Sands Minable Area
- Retrofit and test existing assets to accommodate extreme conditions
- Involve local community and gather Traditional Knowledge to inform best placement of station, as well as assist with deployment, maintenance and evaluation
- Move towards Real-Time monitoring using satellite data transmission



Thank You!

