Automated Water Quality Monitoring in the Oil Sands

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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
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 m$^3$/s, with a peak discharge of ~1,500 m$^3$/s

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

![Daily Water Level at Riviere des Rochers West of Little Rapids, AB (2016)](image)

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 ~3,400 m$^3$/s, with a peak discharge of ~6,000 m$^3$/s

Daily Discharge at the Slave River at Fitzgerald, AB. (2016)
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 ~2,065 m³/s, with a peak discharge of ~6,500 m³/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!