

# Teck



## Red Dog Mine Annual Meeting

Waste Management Permit No. 0132-BA002

Reclamation Plan Approval F20099958

2014

# Agenda



- **Site Overview**
- **Production**
- **Waste Rock Management**
- **Tailings and Water Management**
- **Permafrost Monitoring**
- **Biomonitoring**
- **Reclamation**
- **Water Treatment Pilots**
- **Construction Projects**

# Site Overview



# Aqqaluk Deposit 2010



# Aqqaluk Deposit 2011



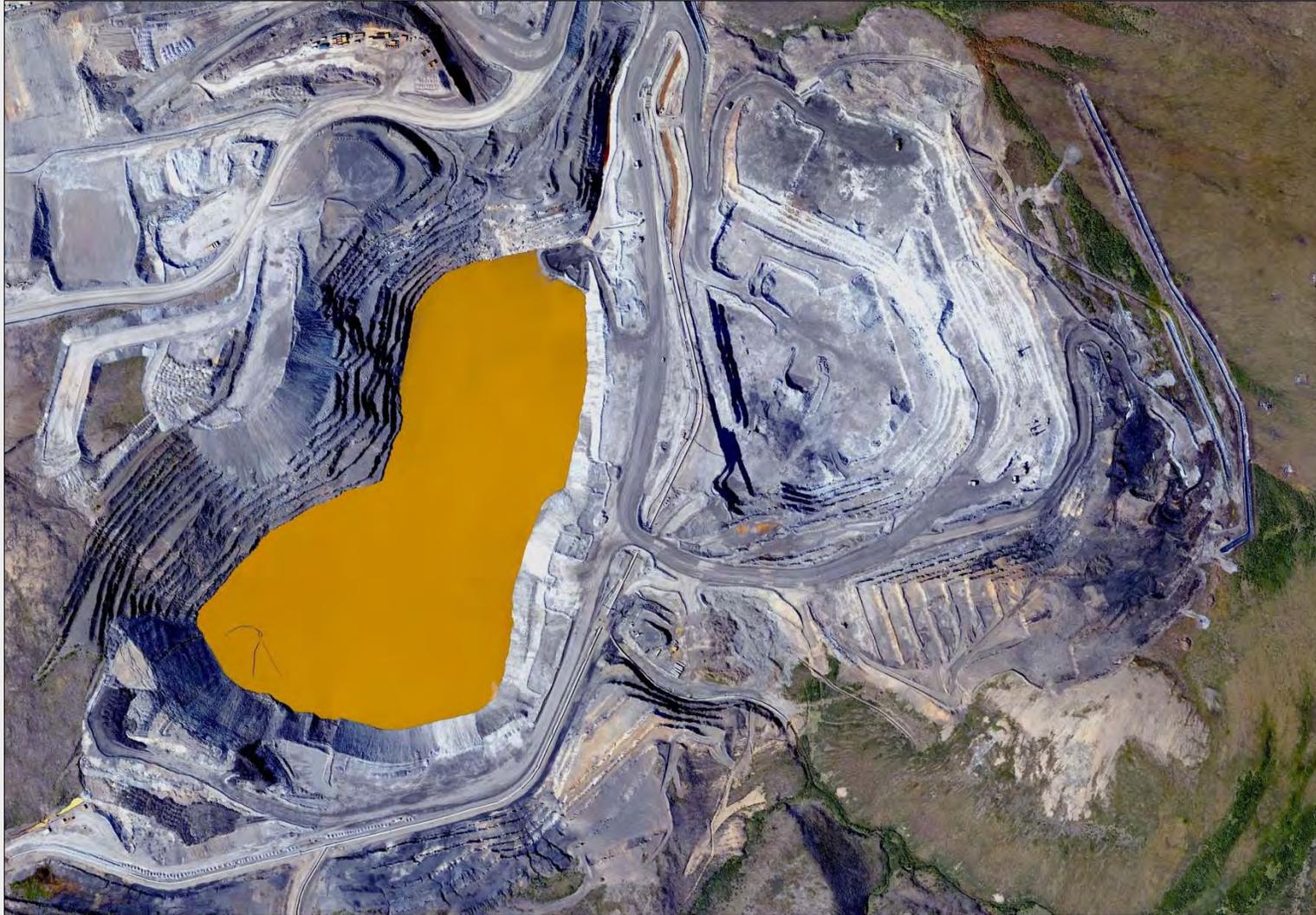
# Aqqaluk Deposit 2012



# Aqqaluk and Main Pit 2013



# Aqqaluk and Main Pit 2014



# Production



# 2014 Production



## Mine Production

- Ore Hauled 4,397,485 tonnes
- Waste Rock Hauled 8,692,145 tonnes
- Total 13,089,630 tonnes
- Strip Ratio 2 : 1

## Mill Production

- Ore Milled 4,299,495 tonnes
- Concentrate Production
  - Zinc 1,059,621 tonnes
  - Lead 219,079 tonnes

# Waste Rock Management



Waste Rock Hauled 8,692,145 tonnes

Main Waste Stockpile  
42,364 tonnes

Main Pit Stockpile  
8,272,382 tonnes

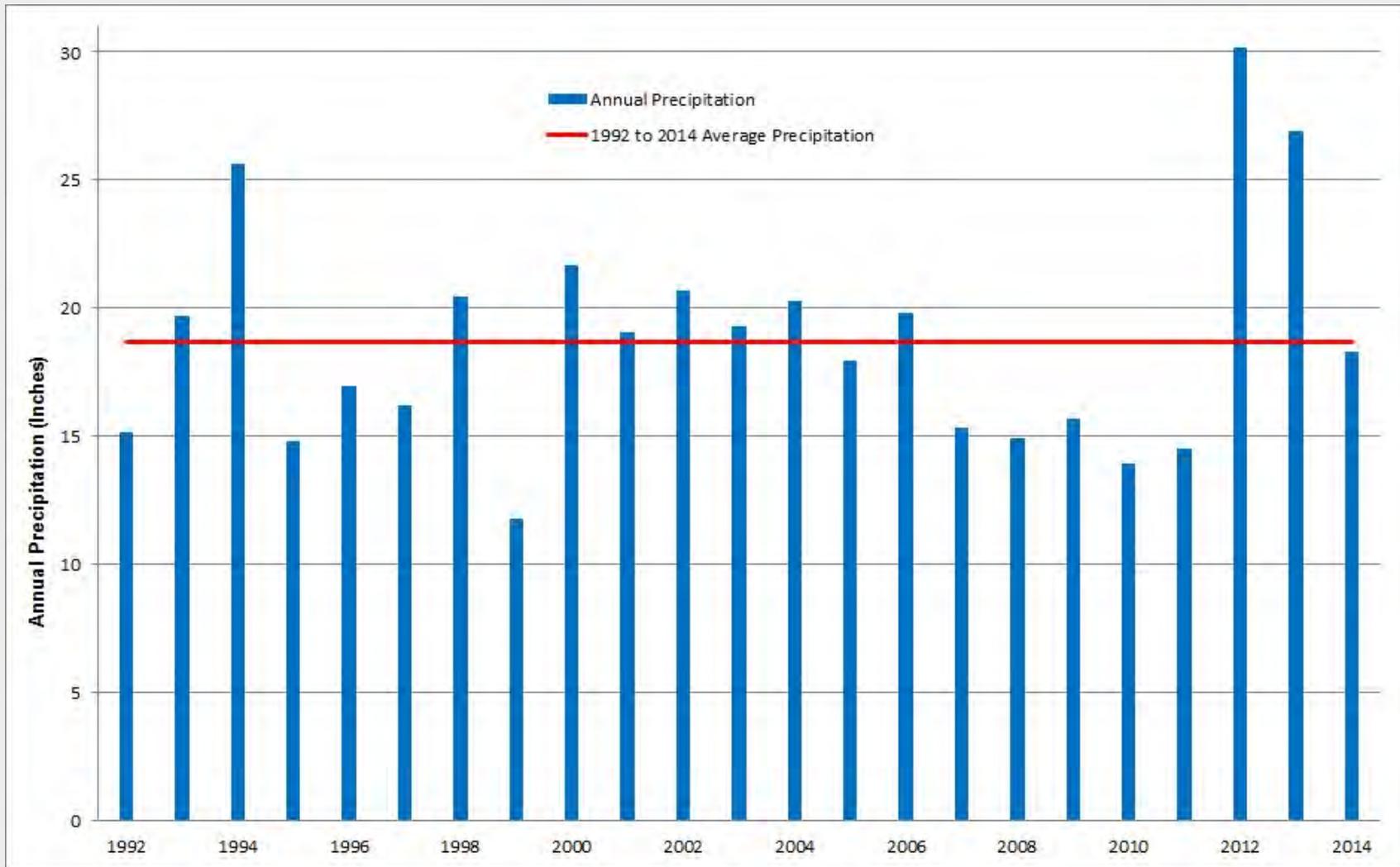
In pit use / disposal  
1,691 tonnes

Construction use  
225,832 tonnes

Most Reactive Waste  
1,667,464 tonnes  
4.6% Zn  
2.8% Pb  
5.6% Fe



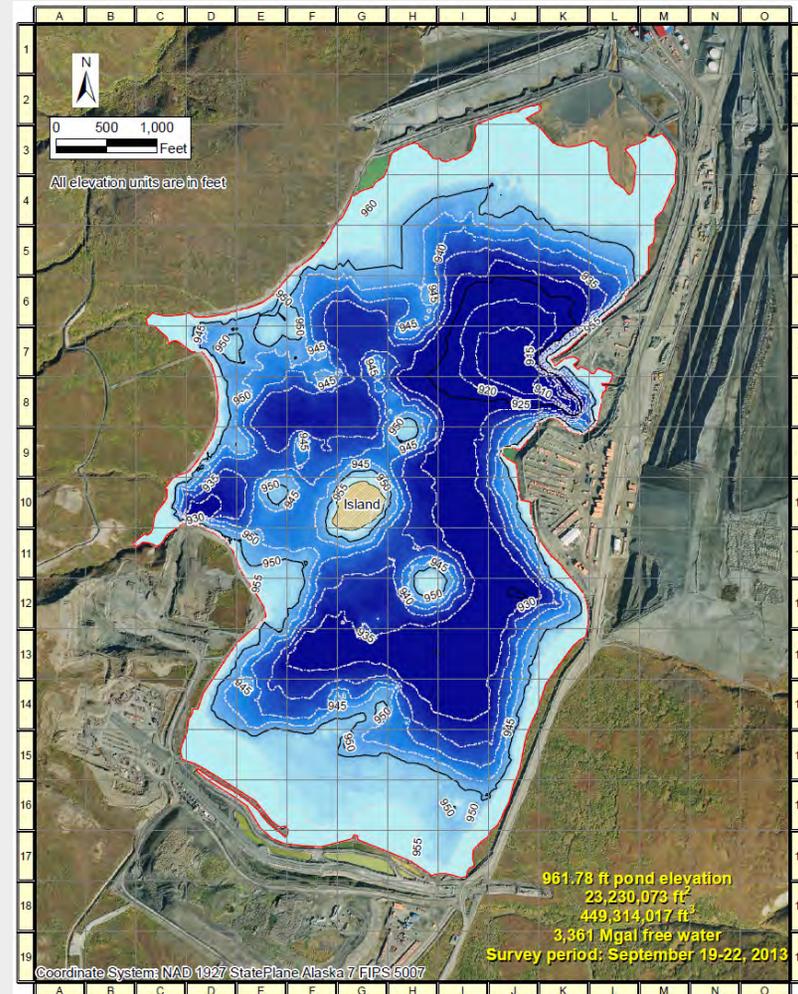
# Red Dog Yearly Precipitation



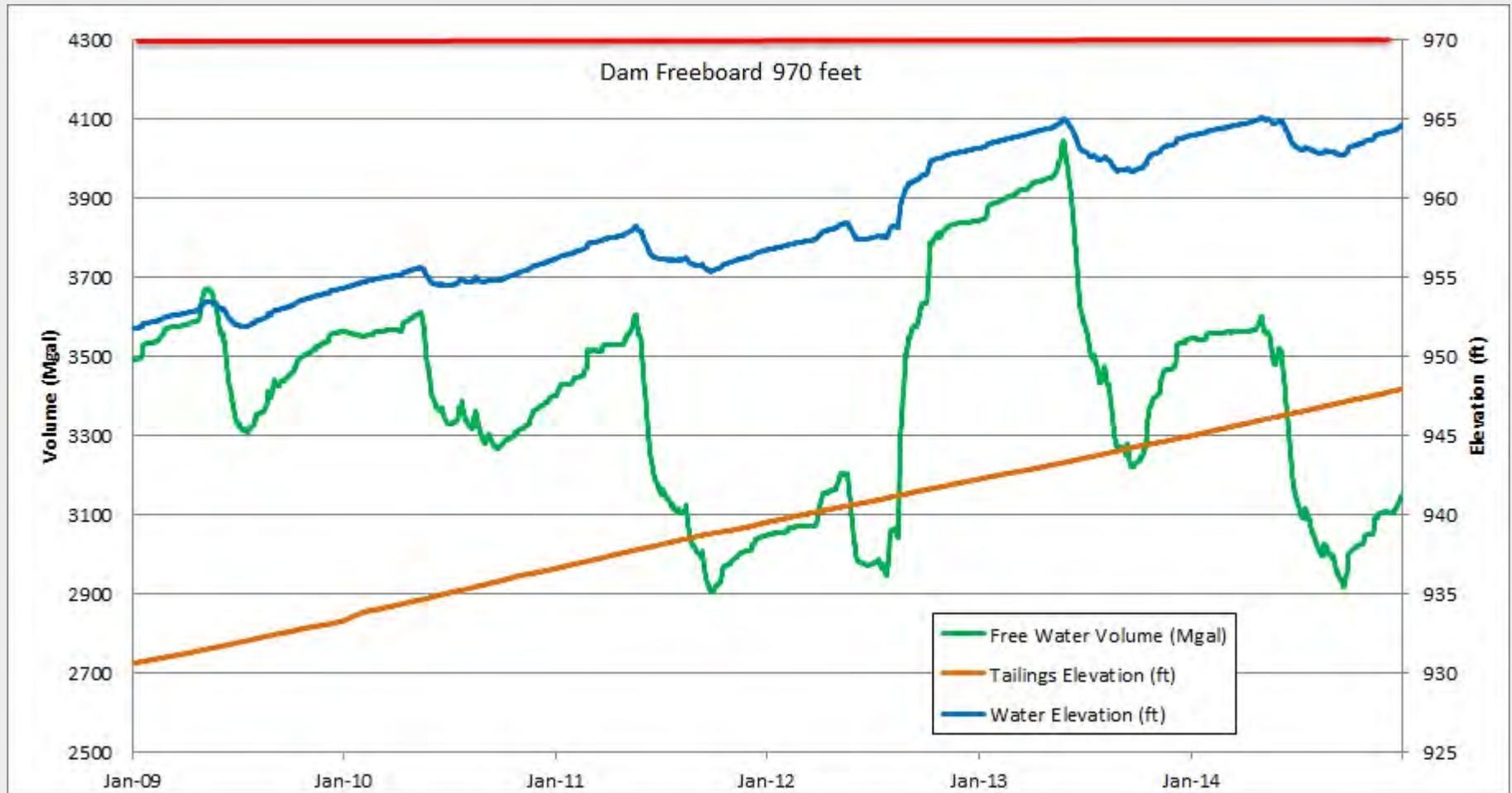
# 2014 Bathymetric Survey



- **2014 Survey**
  - Aug-Sep 2014
  - 3,035 Mgal free Water
- **2013 Survey**
  - Sept 19-22, 2013
  - 3,361 Mgal free water



# Tailings Pond Trends



# Mine Water Quality



# Water Treatment



# 2014 ARD Collection & Treatment – TDS Reduction

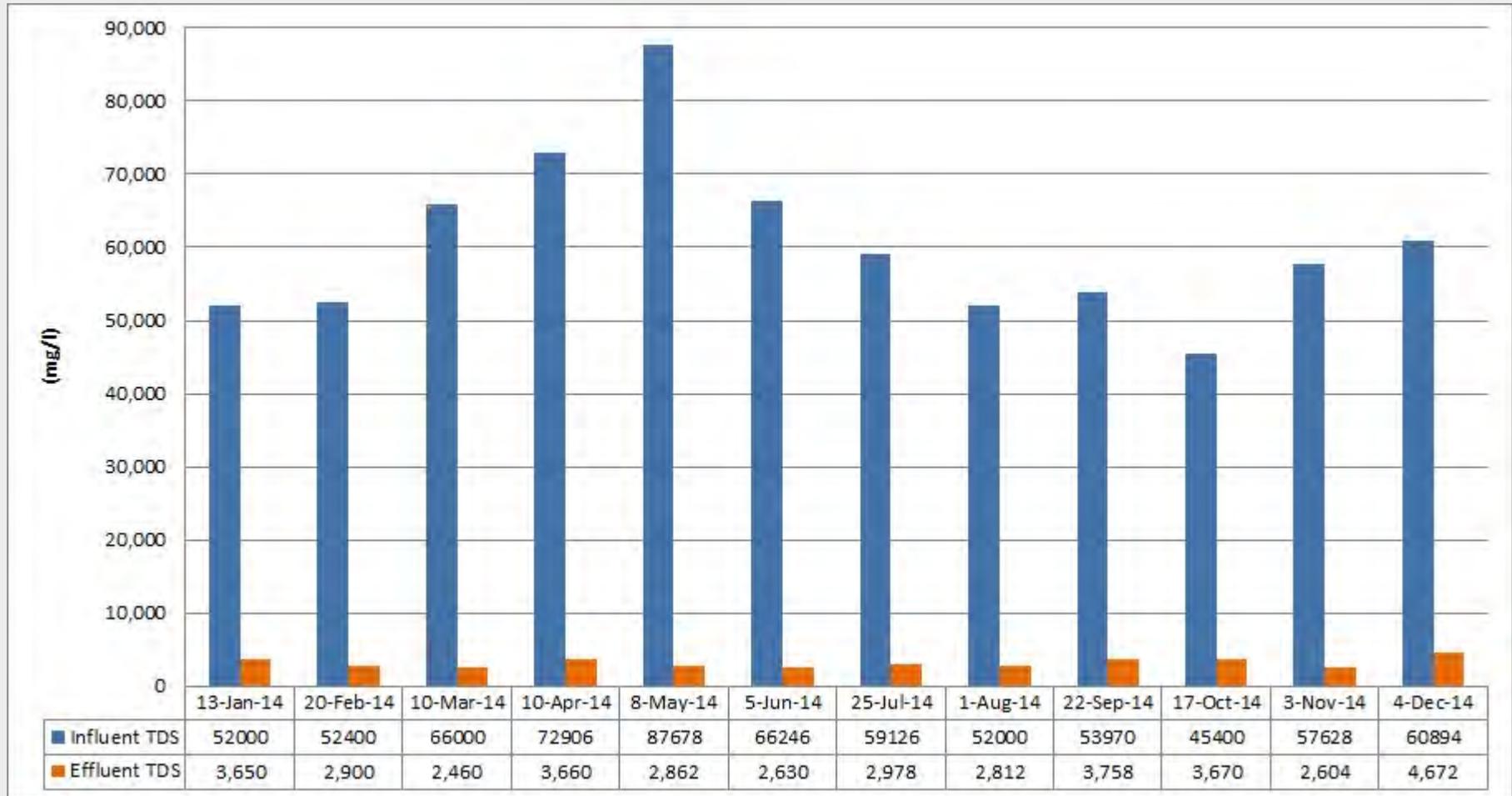


- 2014 Treatment
  - 68.4 Mgal treated
  - 16,820 tonnes TDS removed
  - 8.2 Mgal diverted to MPL
  - 1,930 tonnes TDS diverted

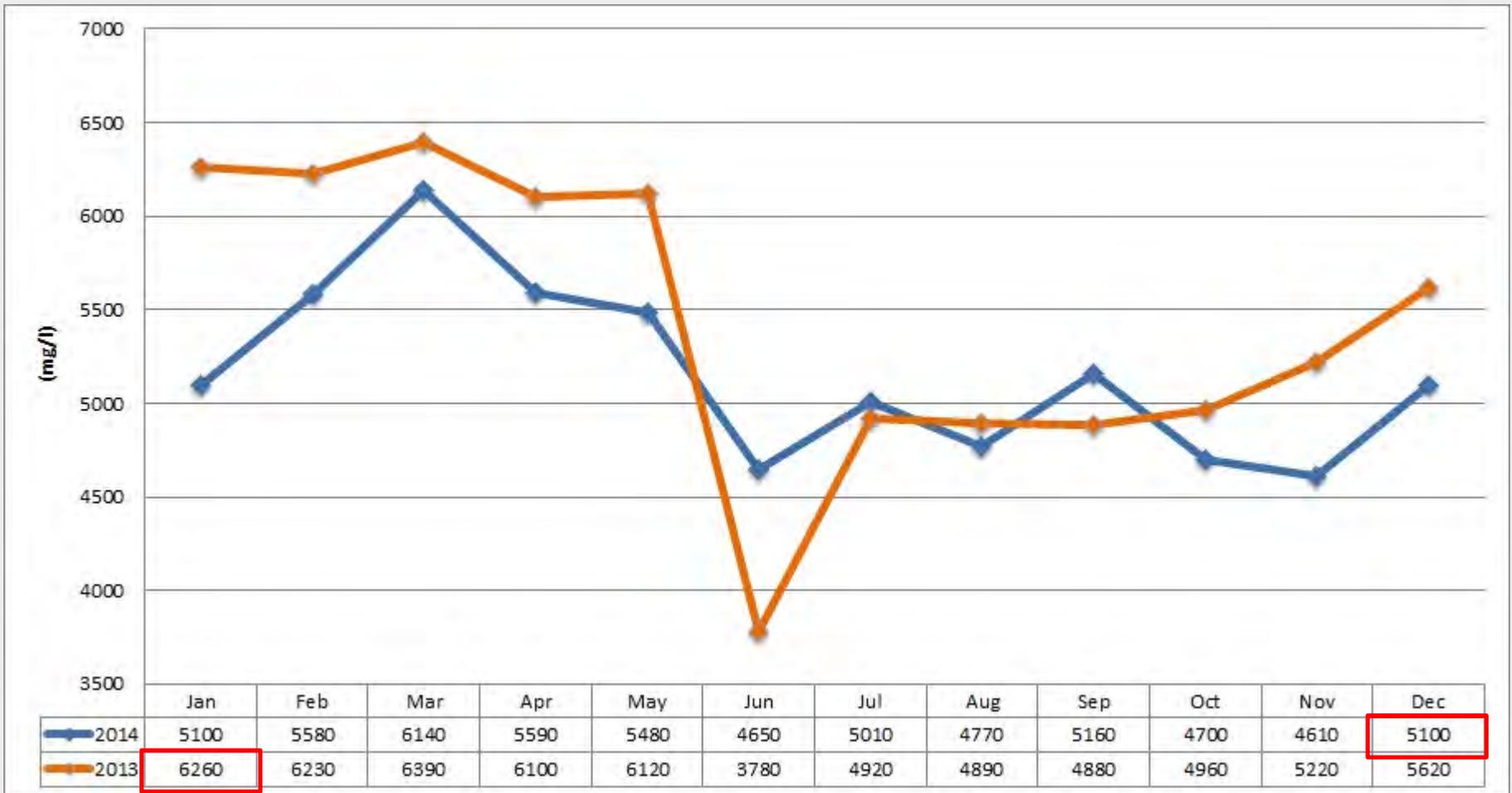


Year	2007	2008	2009	2010	2011	2012	2013	2014
mgal ARD (treated & diverted)	31.6	19.8	20.9	13.6	24.1	74.1	82.2	76.6
Annual Percent Capture	24.2%	15.7%	15.7%	11.4%	19.4%	27.8%	35.6%	47%

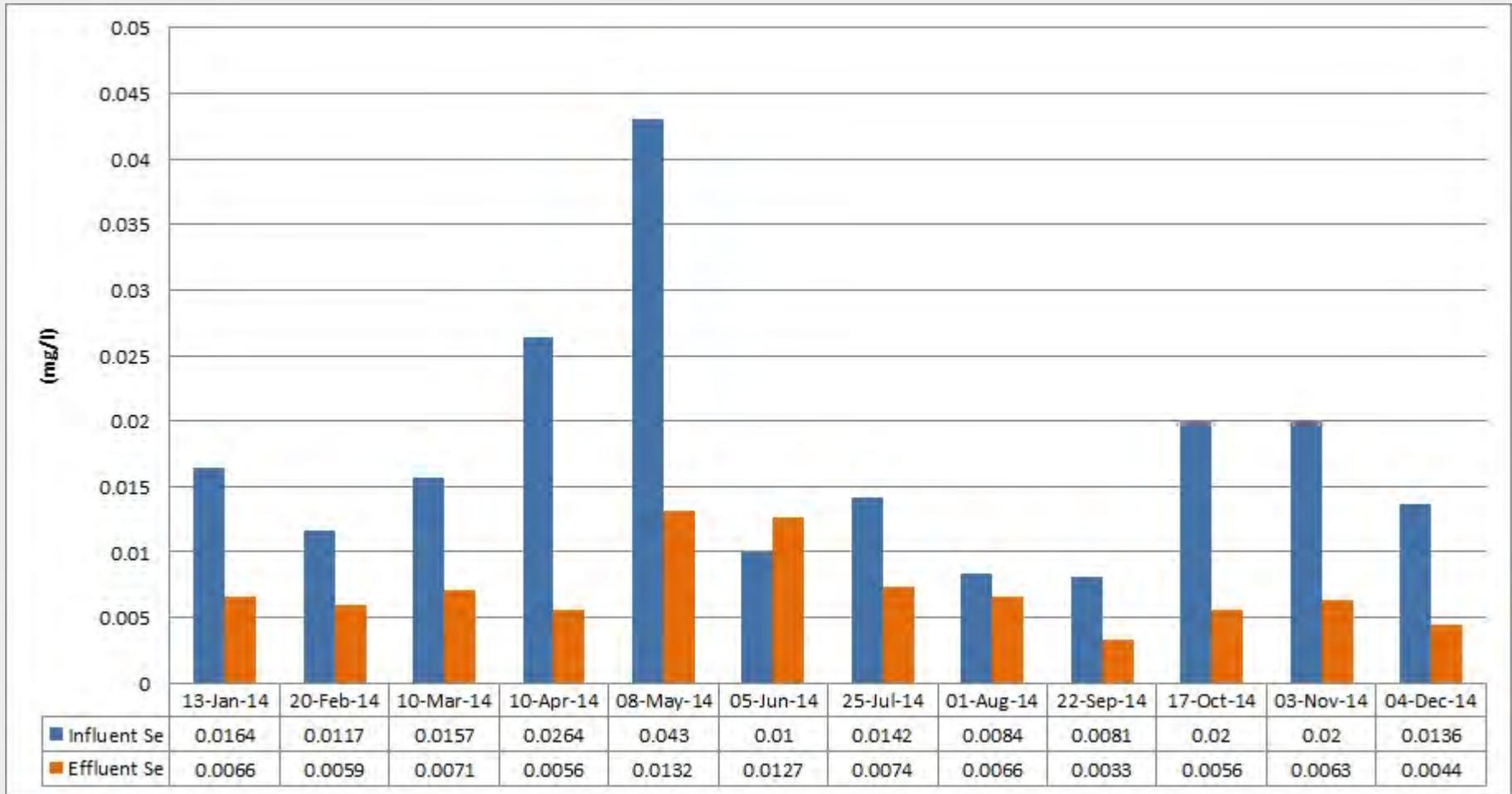
# High Density Sludge Treatment of ARD Water (TDS mg/L)



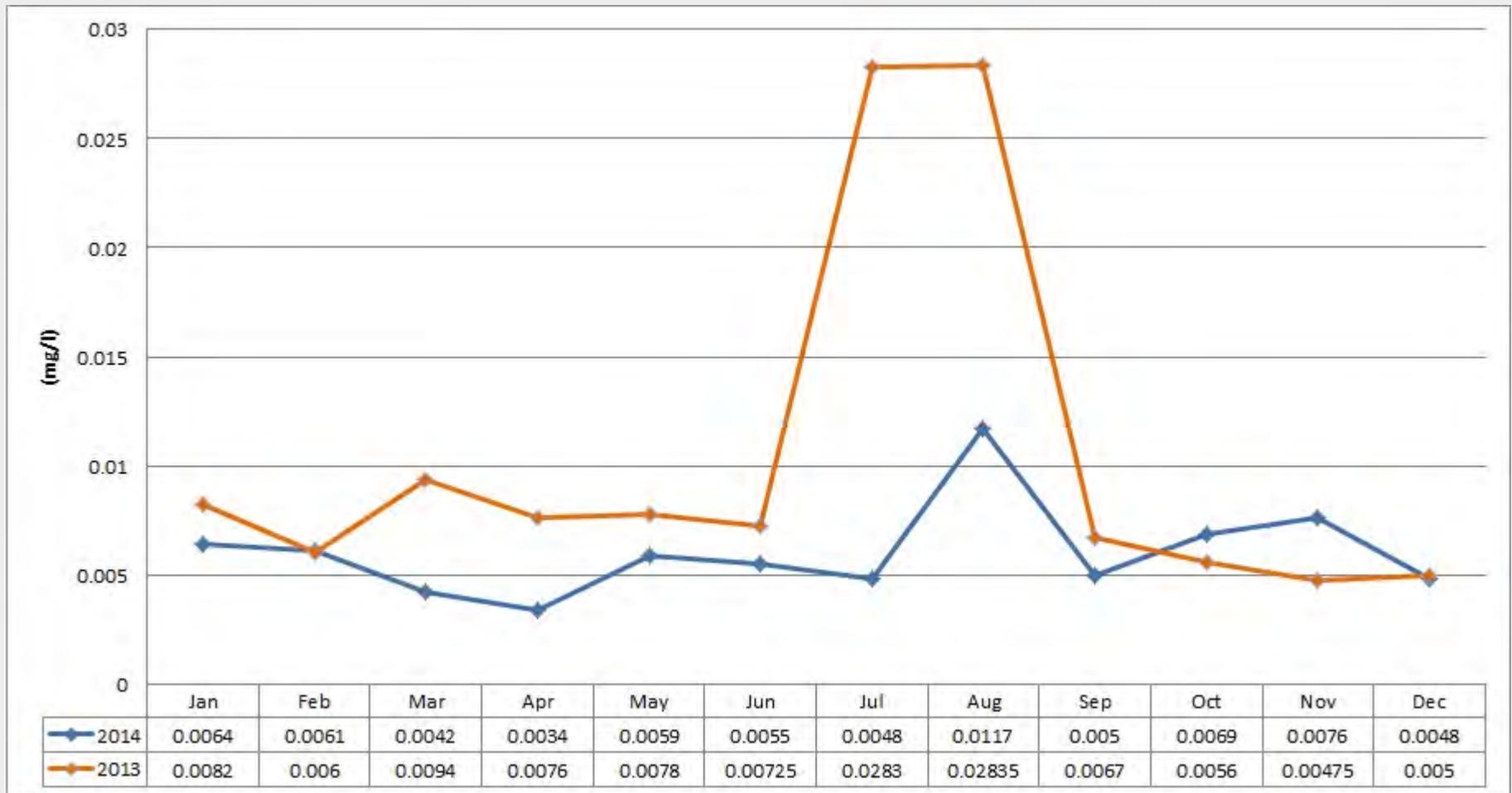
# TDS Concentration in Tailings Pond (2013 and 2014) (mg/L)



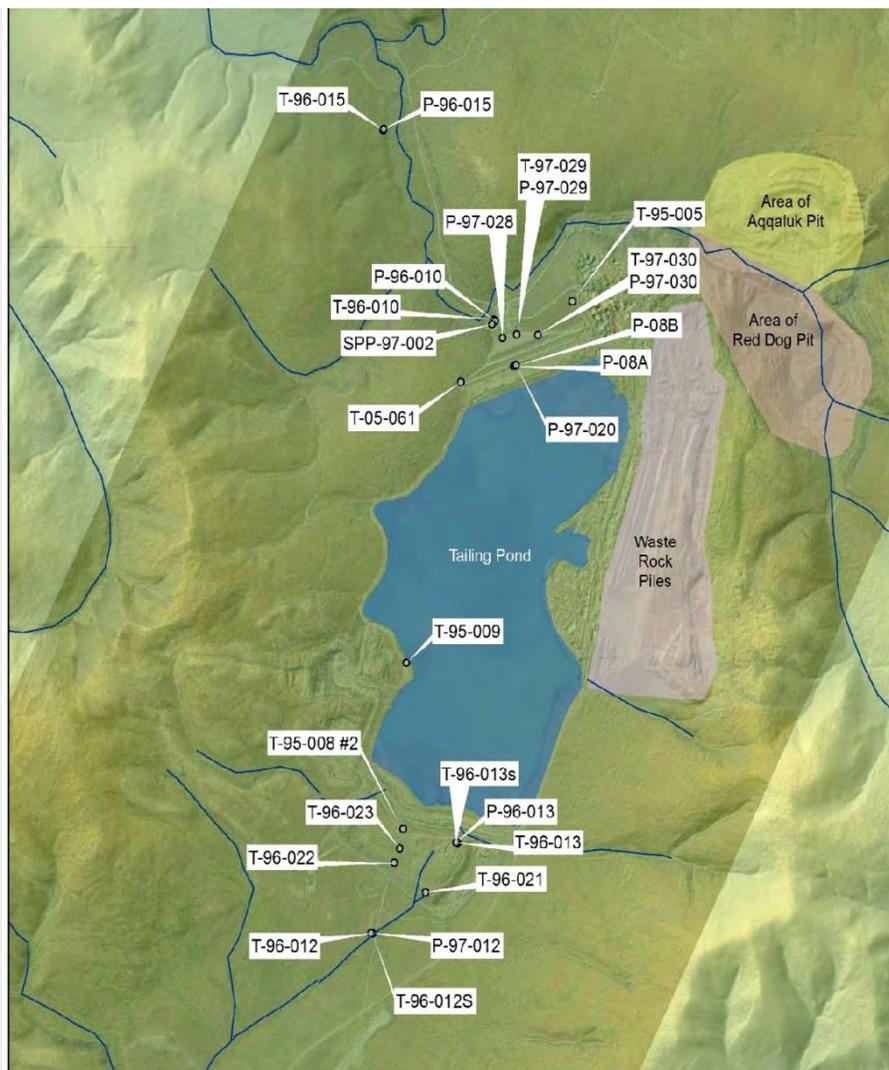
# High Density Sludge Treatment of ARD Water (Dissolved Se mg/L)



# Se in the Tailings Water (2013 and 2014) (mg/L)



# Thermistor & Piezometer Locations



# Permafrost Monitoring



## Monitoring Program

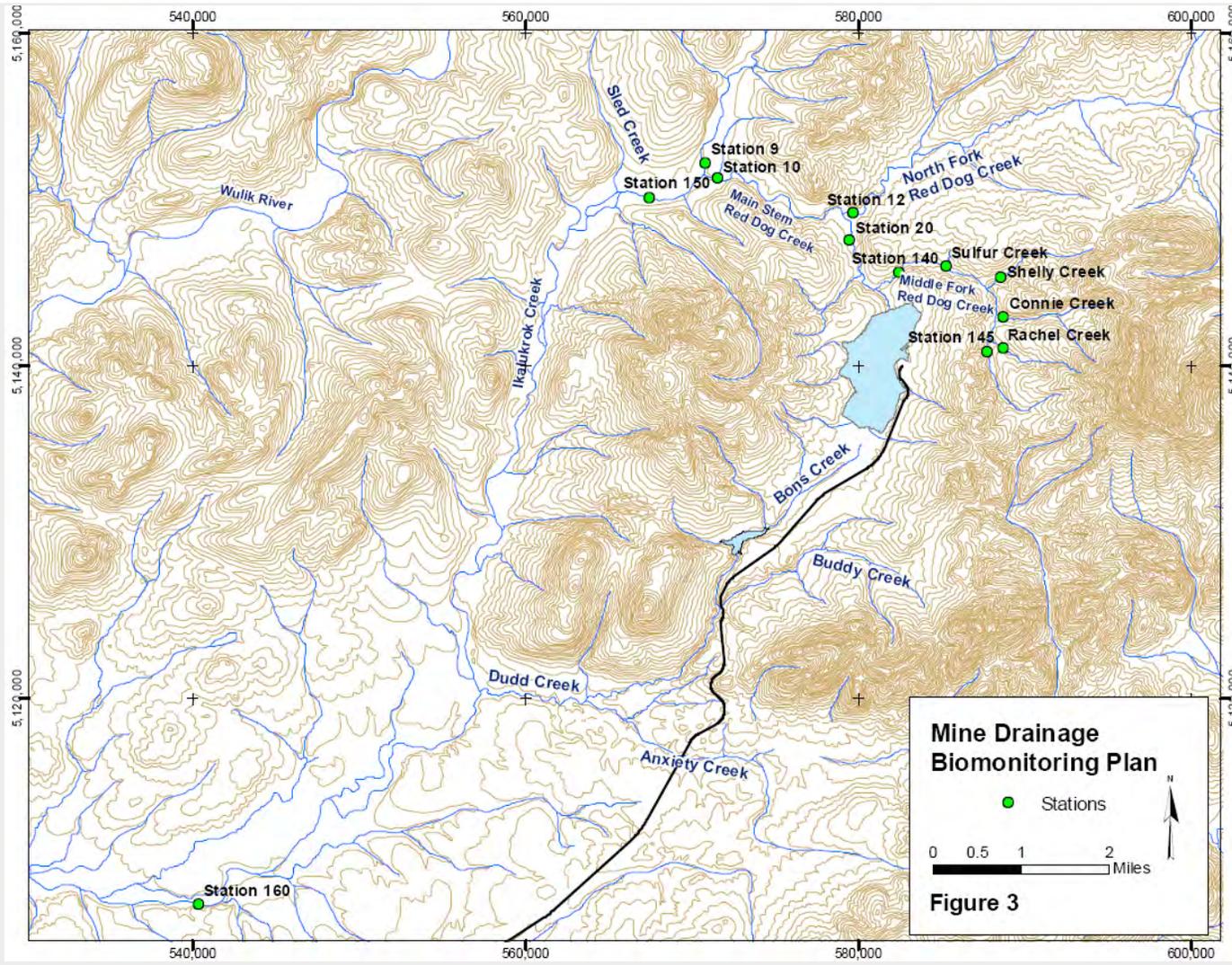
- Quarterly monitoring of 15 key background and dam area thermistors was conducted to assess currently observed trends in temperature changes in the permafrost;
- Quarterly monitoring of 8 key background and dam area piezometers was conducted to assess currently observed water levels and gradients.
- Annually produce an annual data monitoring report.
- Every five years review and analyze data to determine if changes in permafrost or sub-permafrost groundwater have occurred or can be expected to occur. Next review is in 2017.

# Biomonitoring

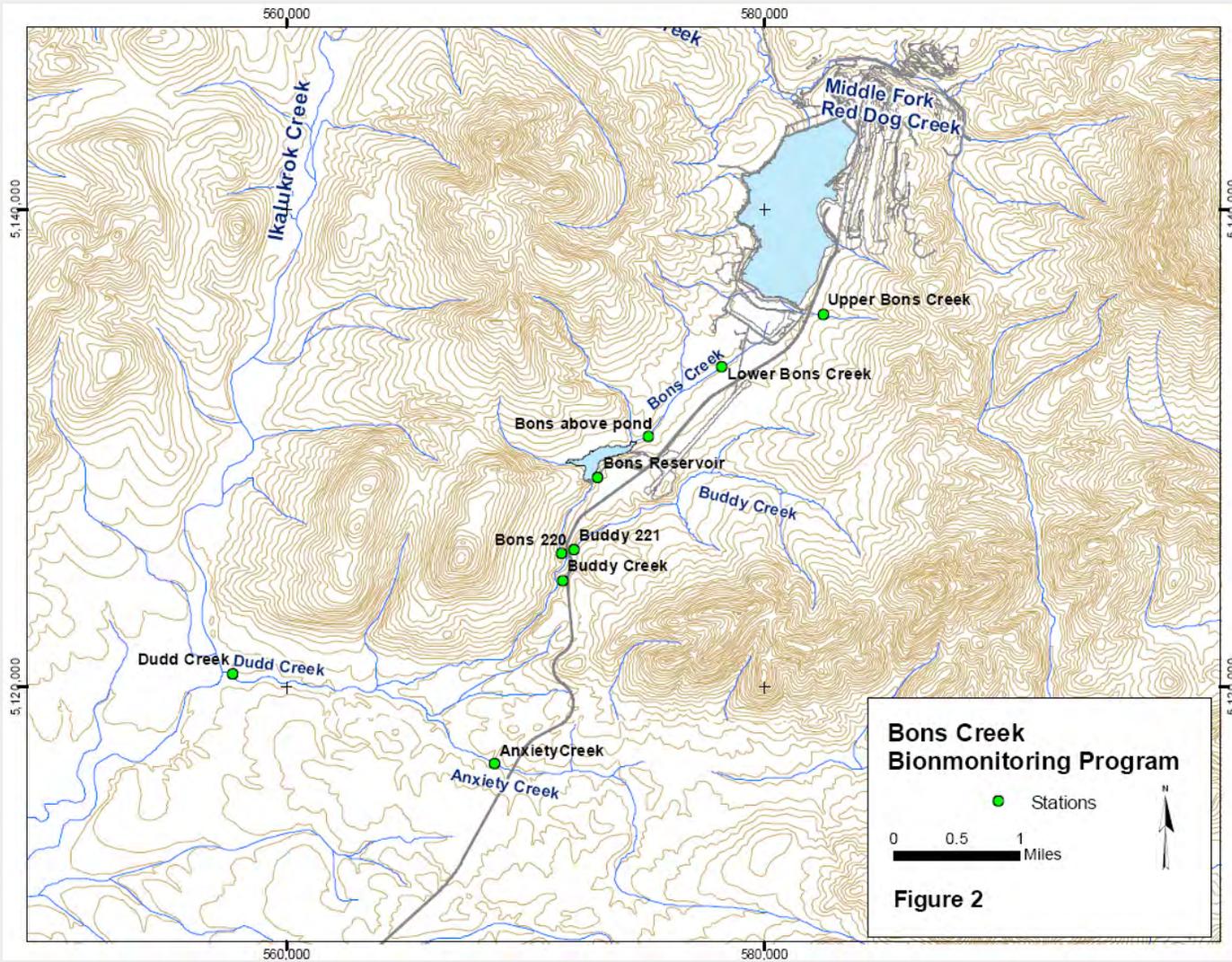


**Figure 46. North Fork Red Dog Creek fyke net site in early June (left photo 2012, right photo 2013).**

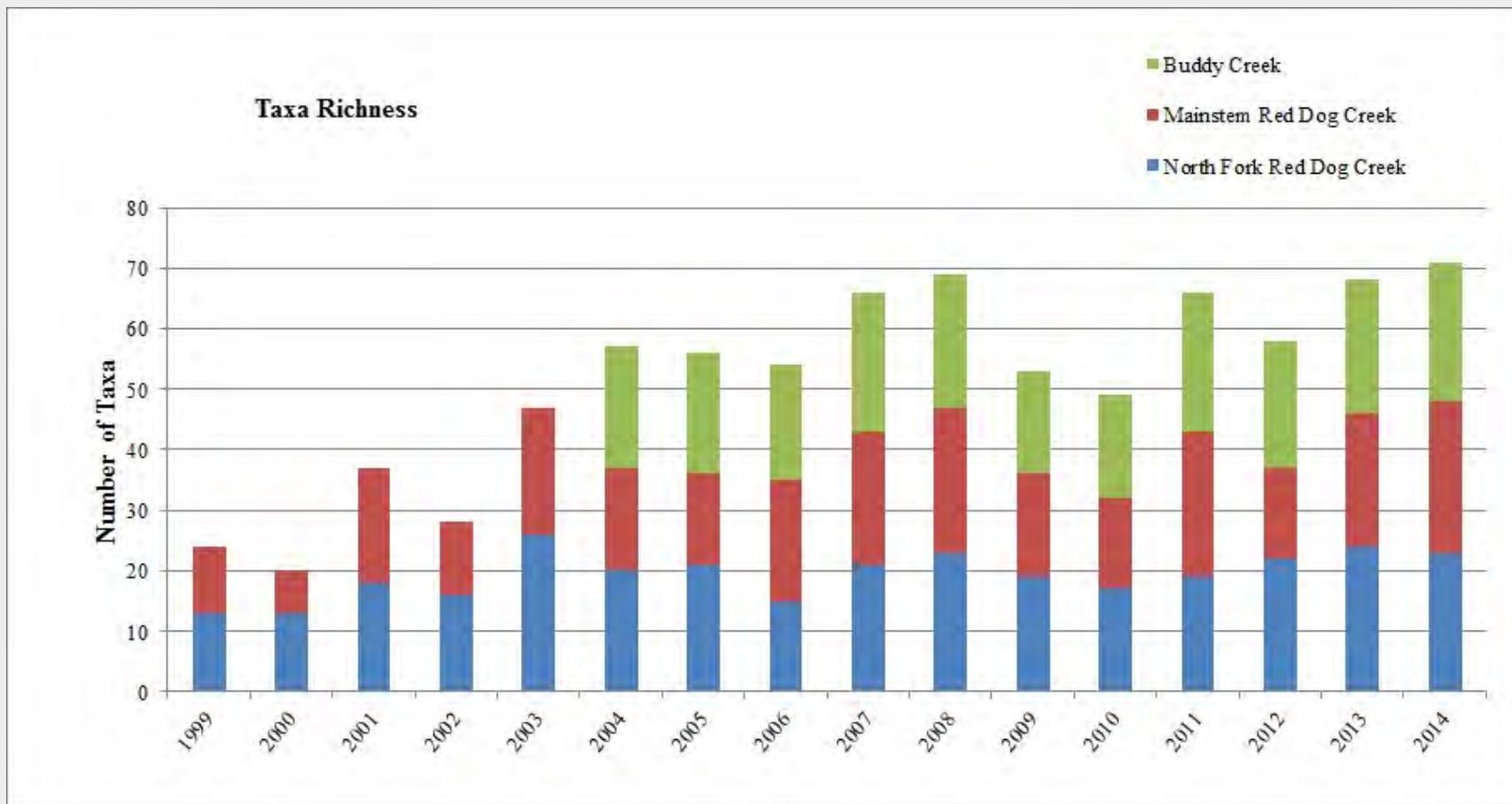
# Mine Drainage Monitoring Stations



# Bons Creek Monitoring Sites

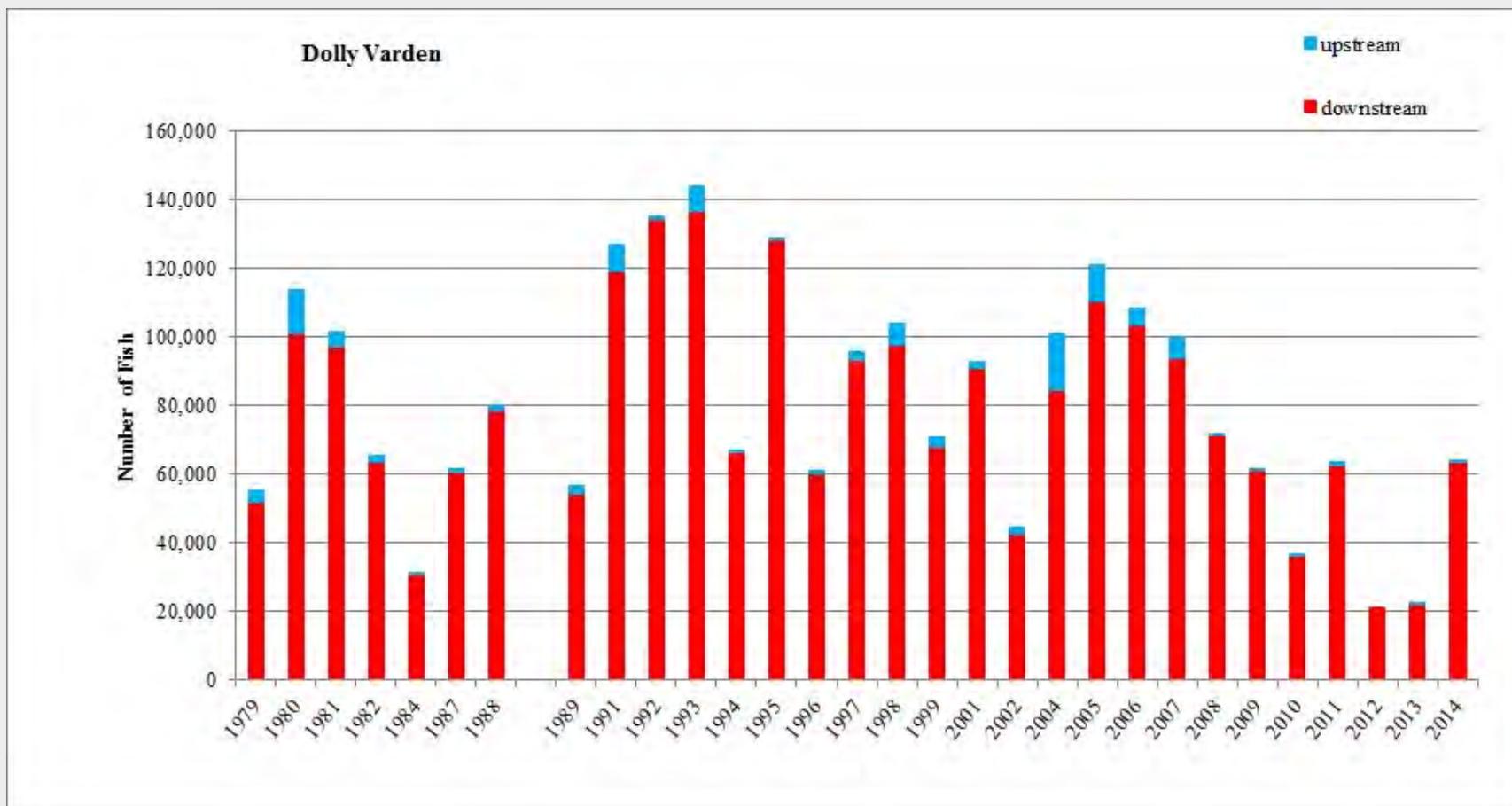


# Aquatic Invertebrates



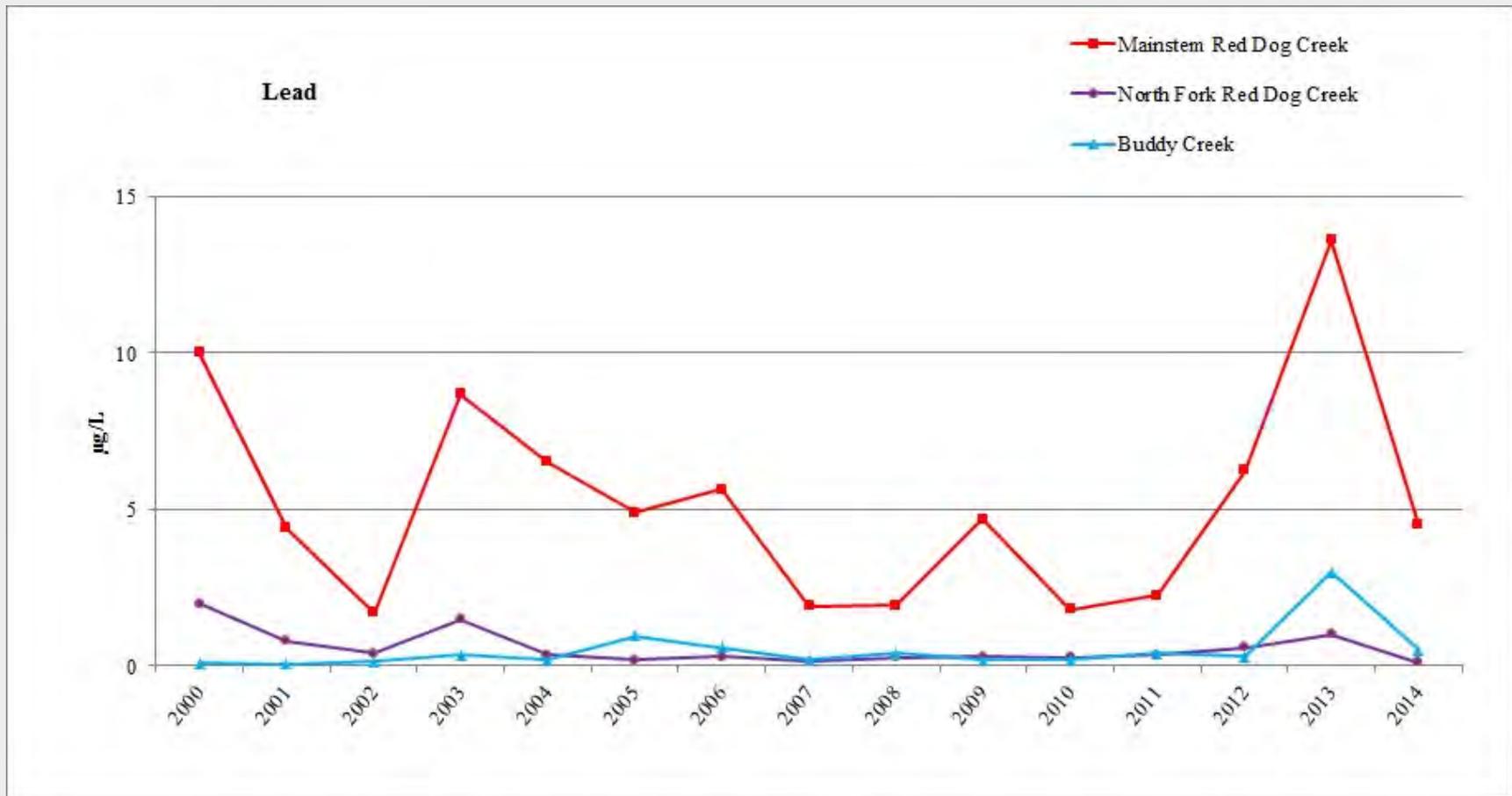
From [Aquatic Biomonitoring at Red Dog Mine, 2014](#) by Alvin G. Ott and William A. Morris

# Dolly Varden



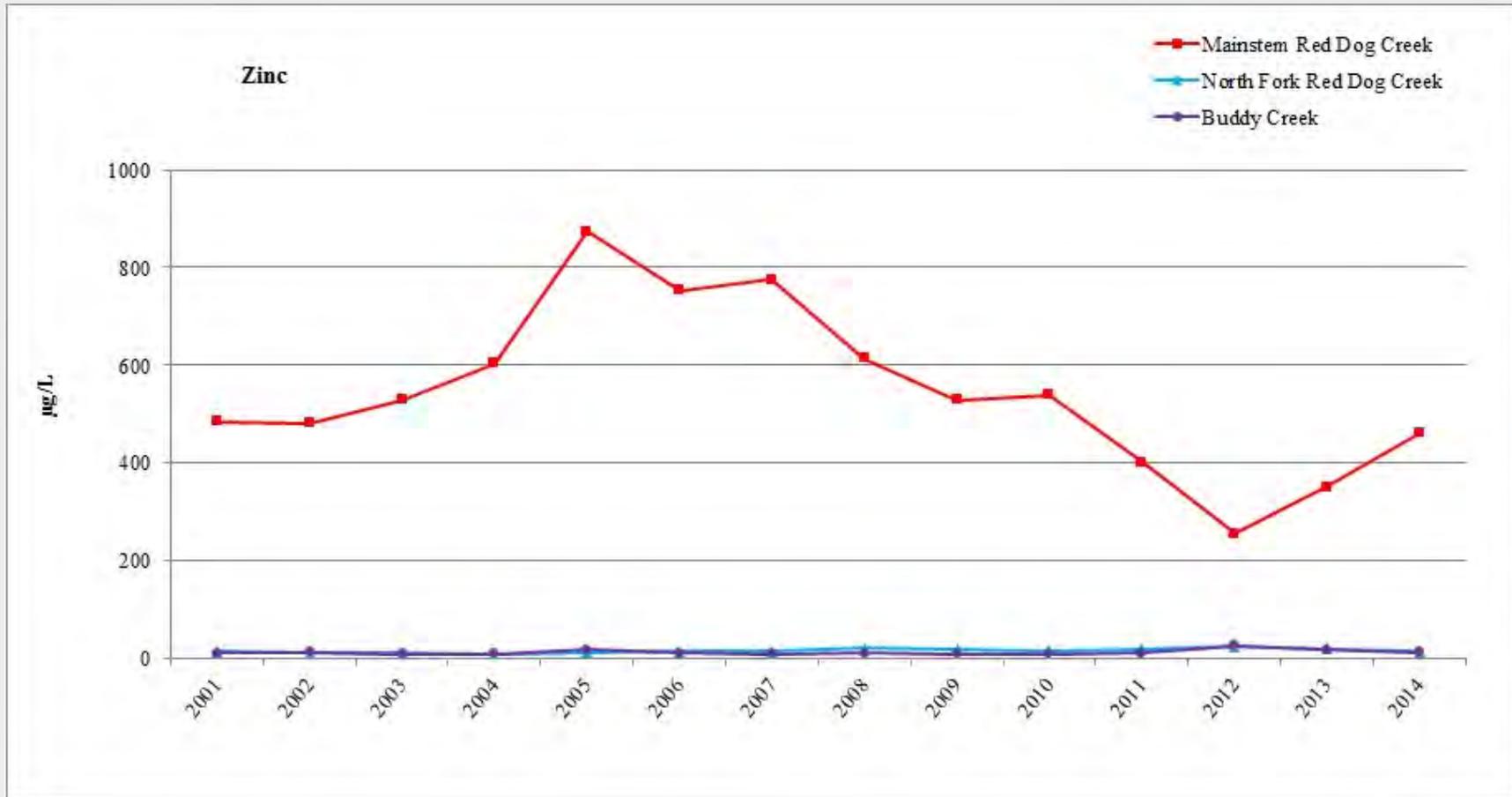
From [Aquatic Biomonitoring at Red Dog Mine, 2014](#) by Alvin G. Ott and William A. Morris

# Lead Concentrations in Creeks near Red Dog Mine



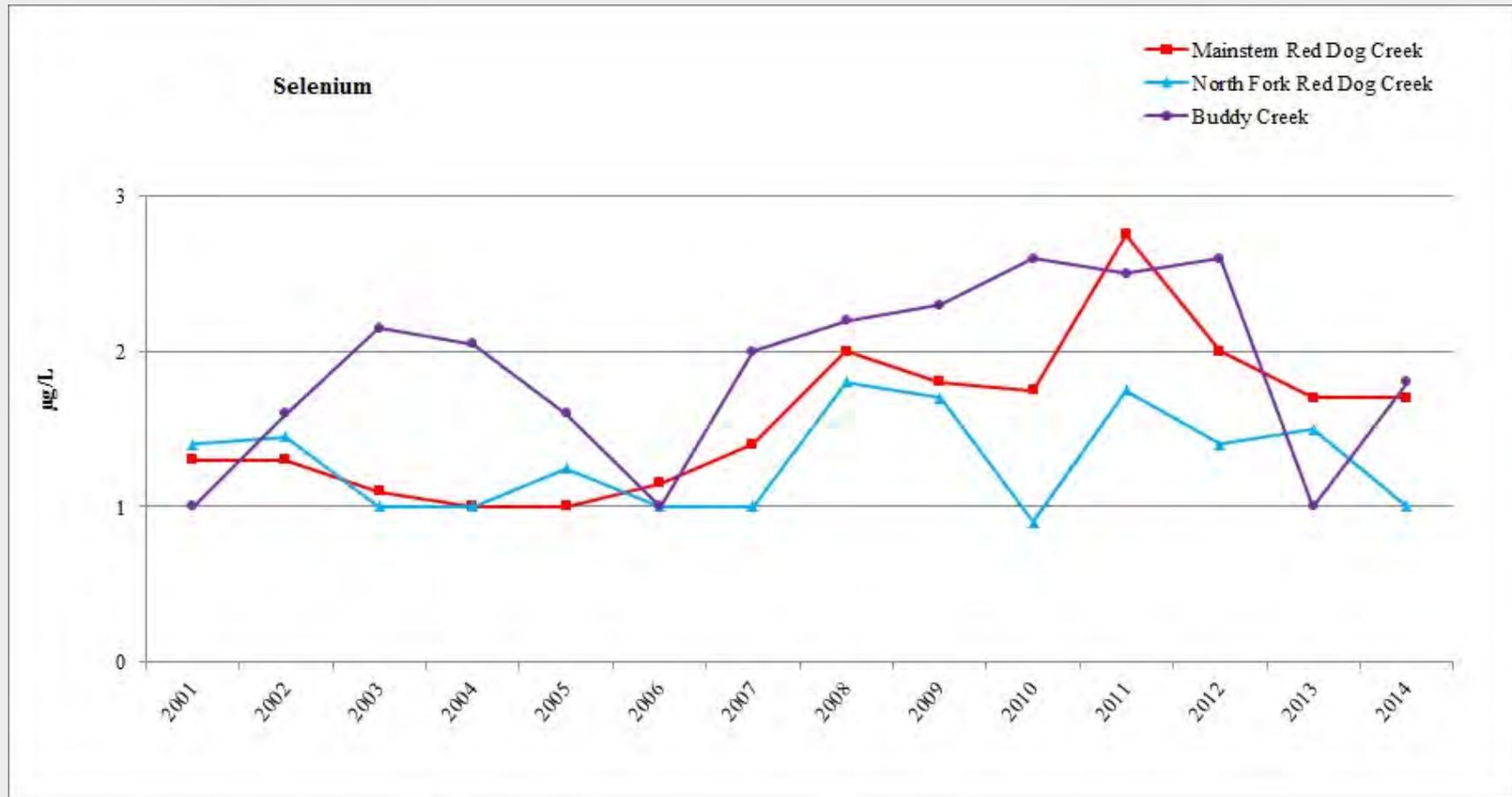
From [Aquatic Biomonitoring at Red Dog Mine, 2014](#) by Alvin G. Ott and William A. Morris

# Zinc Concentrations in Creeks near Red Dog Mine



From [Aquatic Biomonitoring at Red Dog Mine, 2014](#) by Alvin G. Ott and William A. Morris

# Selenium Concentrations in Creeks near Red Dog Mine

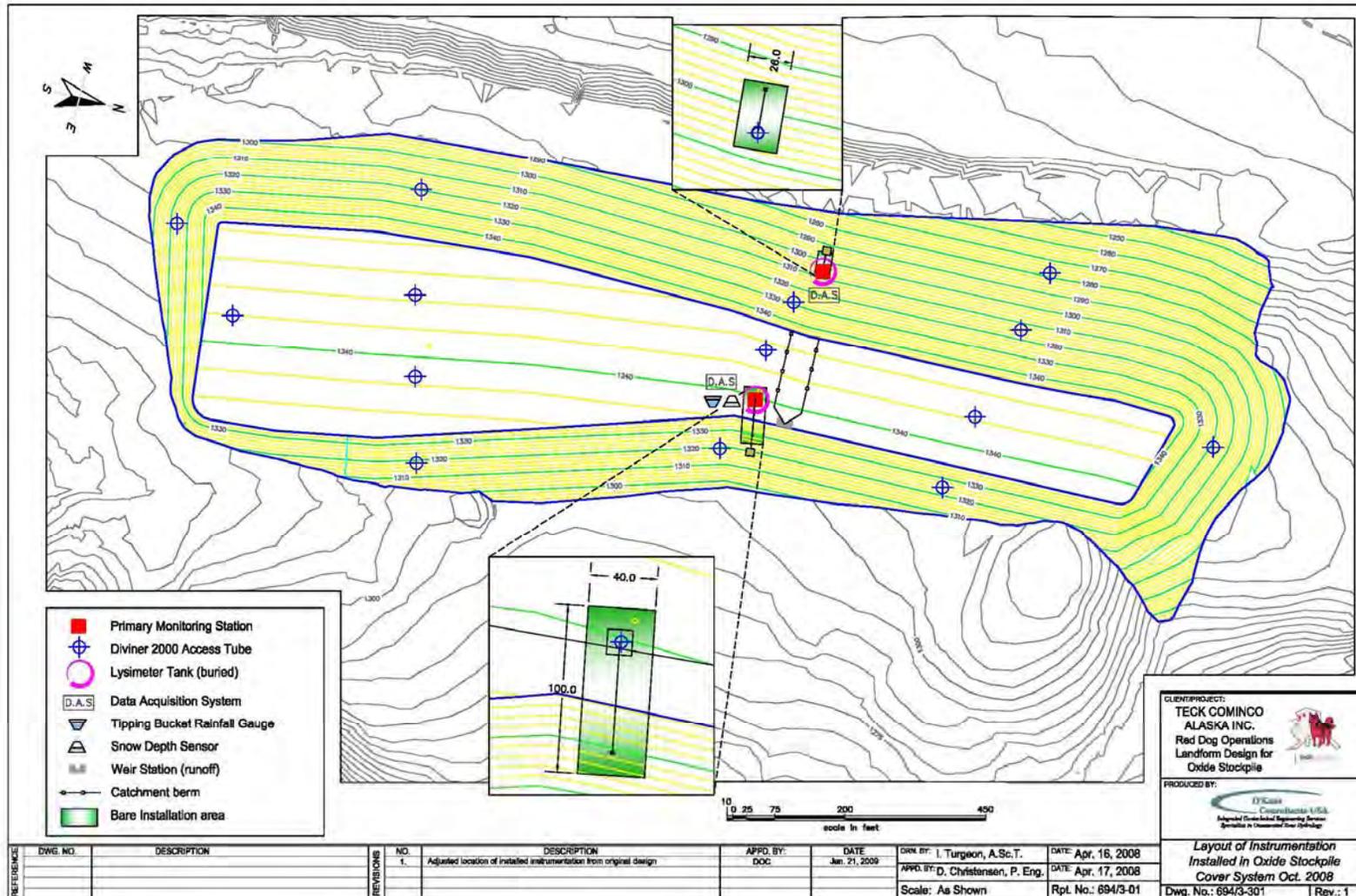


From [Aquatic Biomonitoring at Red Dog Mine, 2014](#) by Alvin G. Ott and William A. Morris

# Oxide Pile Cover



# Oxide Pile Cover Study



# Five Year Results Oxide Pile Cover Study



Net Percolation as Percentage of Annual Precipitation						
	2009	2010	2011	2012	2013	Average
<b>Plateau</b>						
Field	16%	11%	16%	30%	38%	22%
Model	17%	21%	19%	36%	46%	23%
<b>West Slope</b>						
Field	12%	7%	11%	24%	30%	17%
Model	5%	16%	20%	23%	31%	19%
<b>Both Stations</b>						
Field						20%
Model						21%

# Selenium Piloting – Bio-Reactors



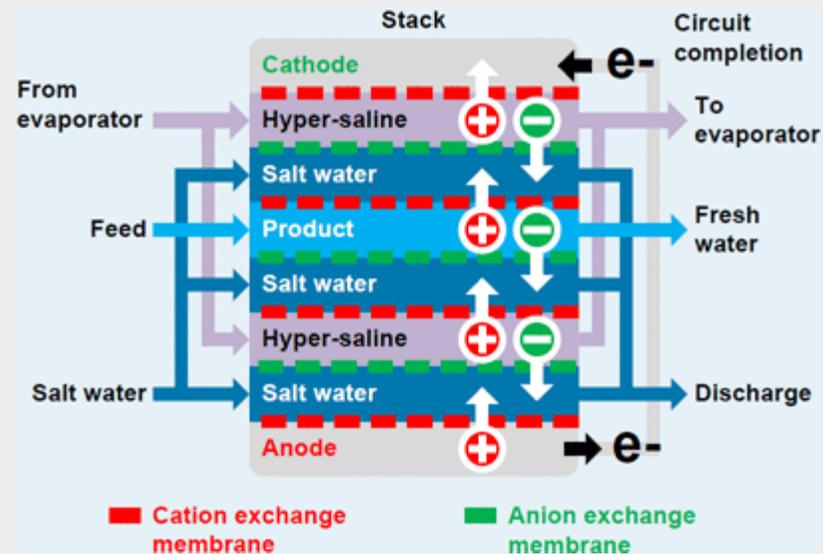
- GE: Advanced Biological Metals Removal Process (ABMet)
- Currently evaluating the results of the pilot test



# Selenium Piloting – Saltworks ElectroChem



- Saltworks ElectroChem process – ion exchange membrane with electrical currents to attract ions
- Currently evaluating the results of the pilot test



# Selenium Piloting – Reverse Osmosis Membrane Filtration



- 25 gpm pilot plant onsite
- Currently commissioning
- Piloting scheduled to be completed in 2015



# Construction Projects



## 2015 Projects

- Main Tailings Dam Widening
- Tailings Back Dam Raise to 986 ft.
- Lime Slacking Building



# Questions

# Thank You