



Red Dog Mine Annual Meeting

Waste Management Permit No. 0132-BA002

Reclamation Plan Approval F20099958

2012

Agenda



- **Site Overview**
- **Production**
- **Waste Rock Management**
- **Tailings Management**
- **Water Management**
- **Permafrost Monitoring**
- **Biomonitoring**
- **Reclamation**
- **Inert Solid Waste Landfills**
- **Dust Monitoring**
- **MineActivities**

Site Overview



Aqqaluk Deposit 2012



Main Pit 2012



Aqqaluk Deposit and Main Pit 2011



Production



2012 Production



Mine Production

- Ore Hauled 3,746,526 tonnes
- Waste Rock Hauled 9,734,344 tonnes
- Total 13,480,870 tonnes
- Strip Ratio 2.6 : 1.0

Mill Production

- Ore Milled 3,575,584 tonnes
- Concentrate Production
 - Zinc 958,628 tonnes
 - Lead 175,790 tonnes

Waste Rock Management



Waste Rock Hauled 9,734,344 tonnes

Main Waste Stockpile
1,739,449 tonnes

Main Pit Dump
7,486,659 tonnes

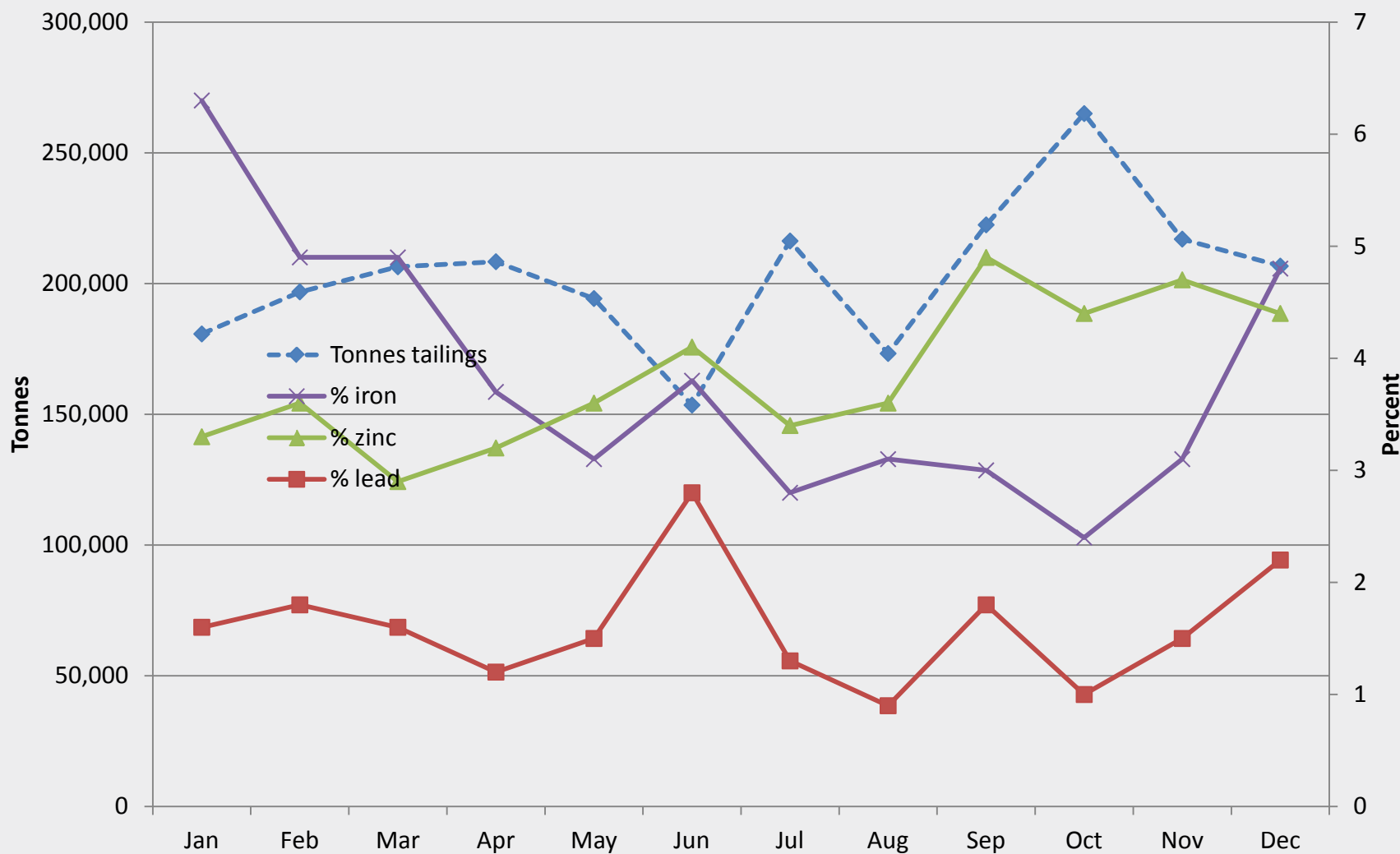
In pit use / disposal
224,352 tonnes

Construction use
283,884 tonnes

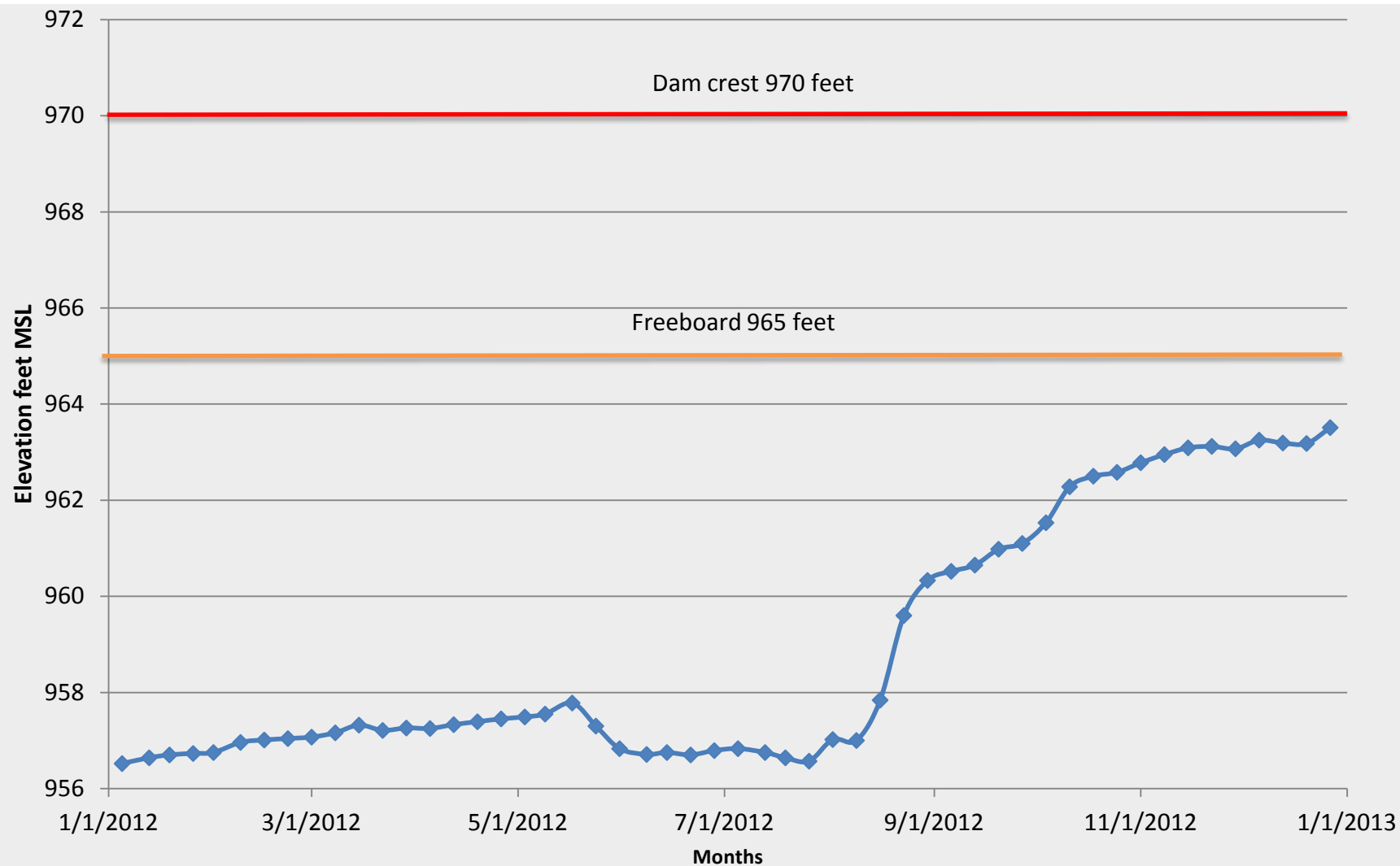
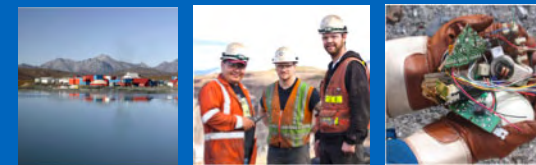
Most Reactive Waste
1,763,617 tonnes
2.5% Zn
1.2% Pb
5.6% Fe



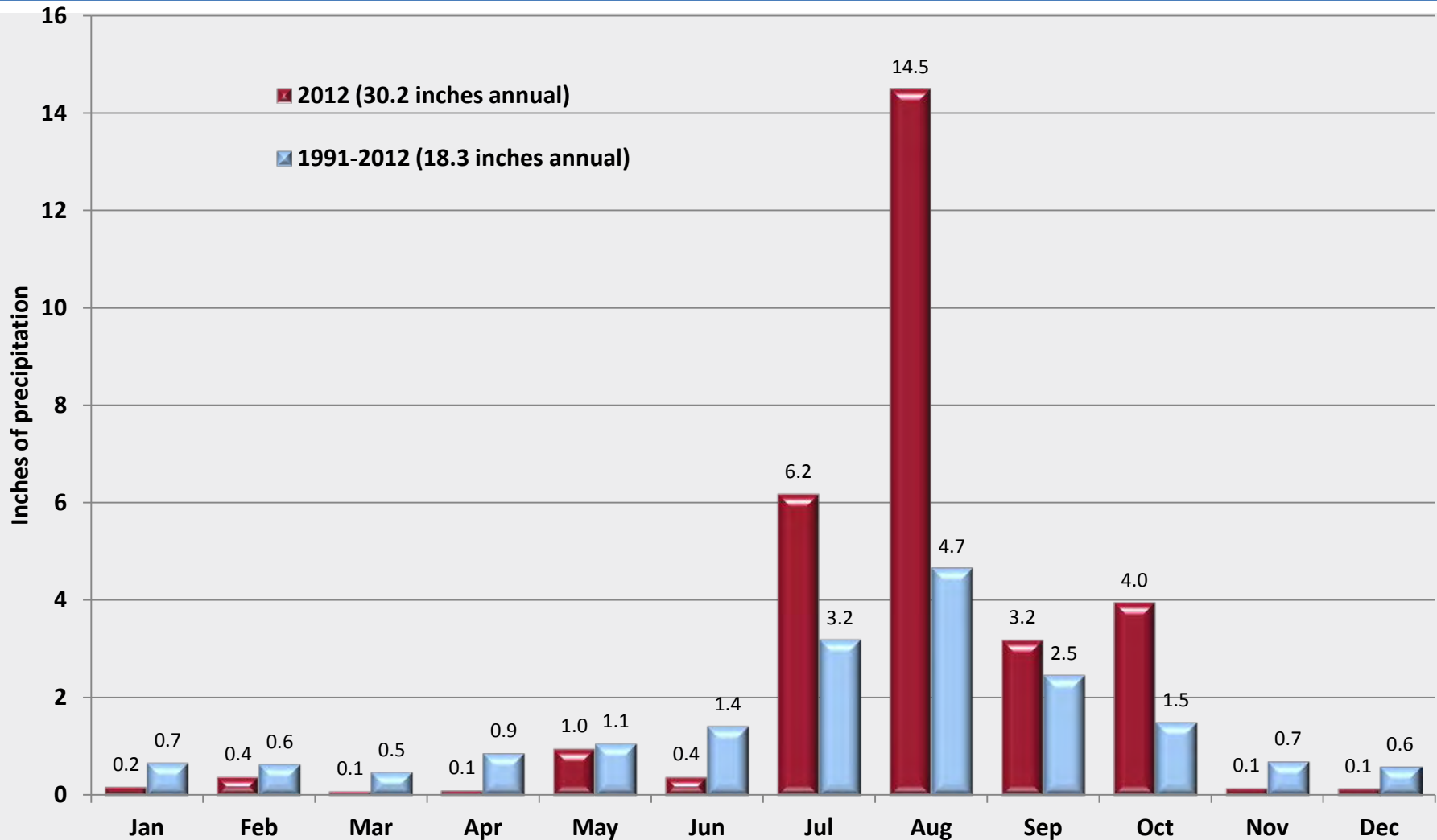
Tailings Management



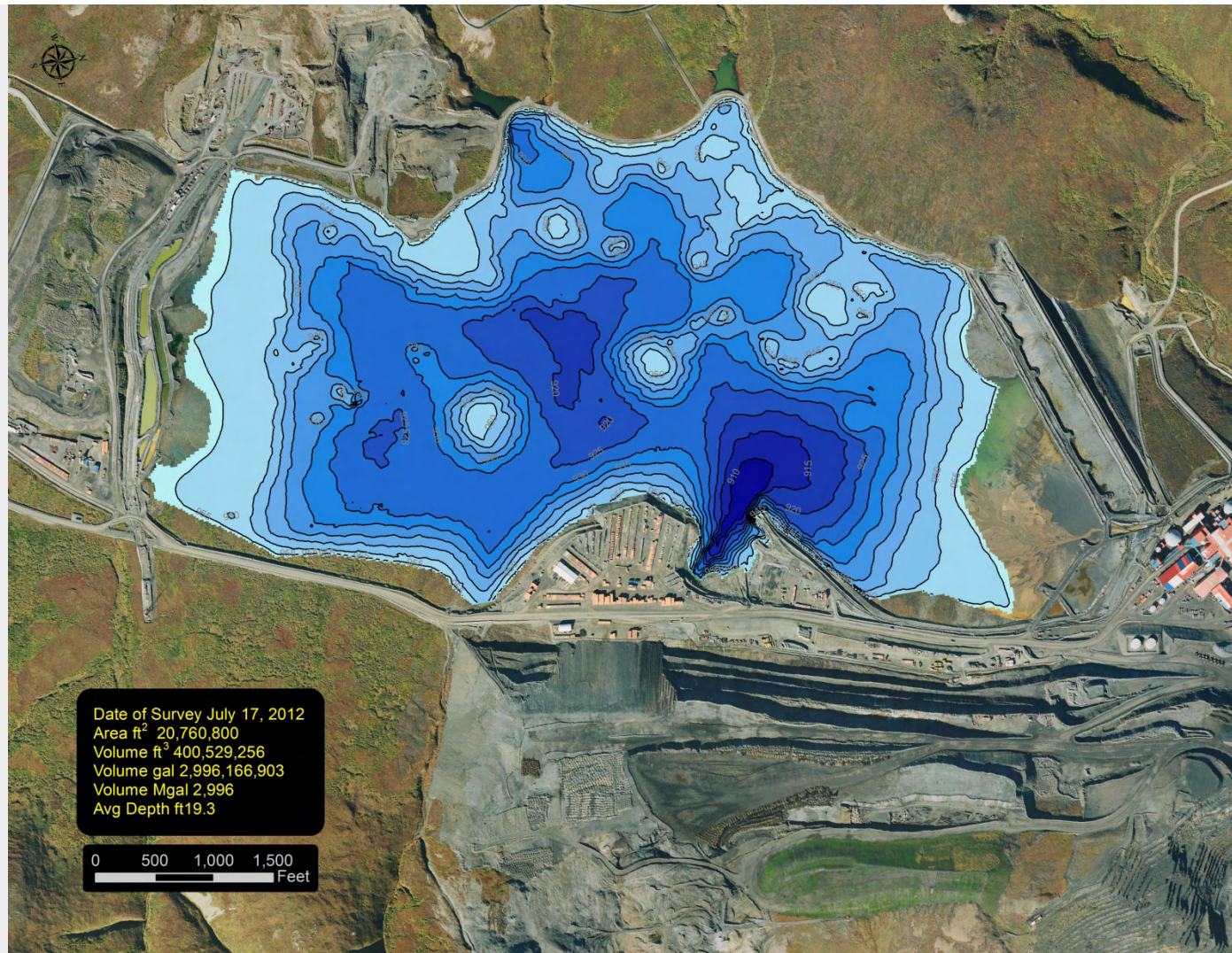
Tailings Pond Water Elevation



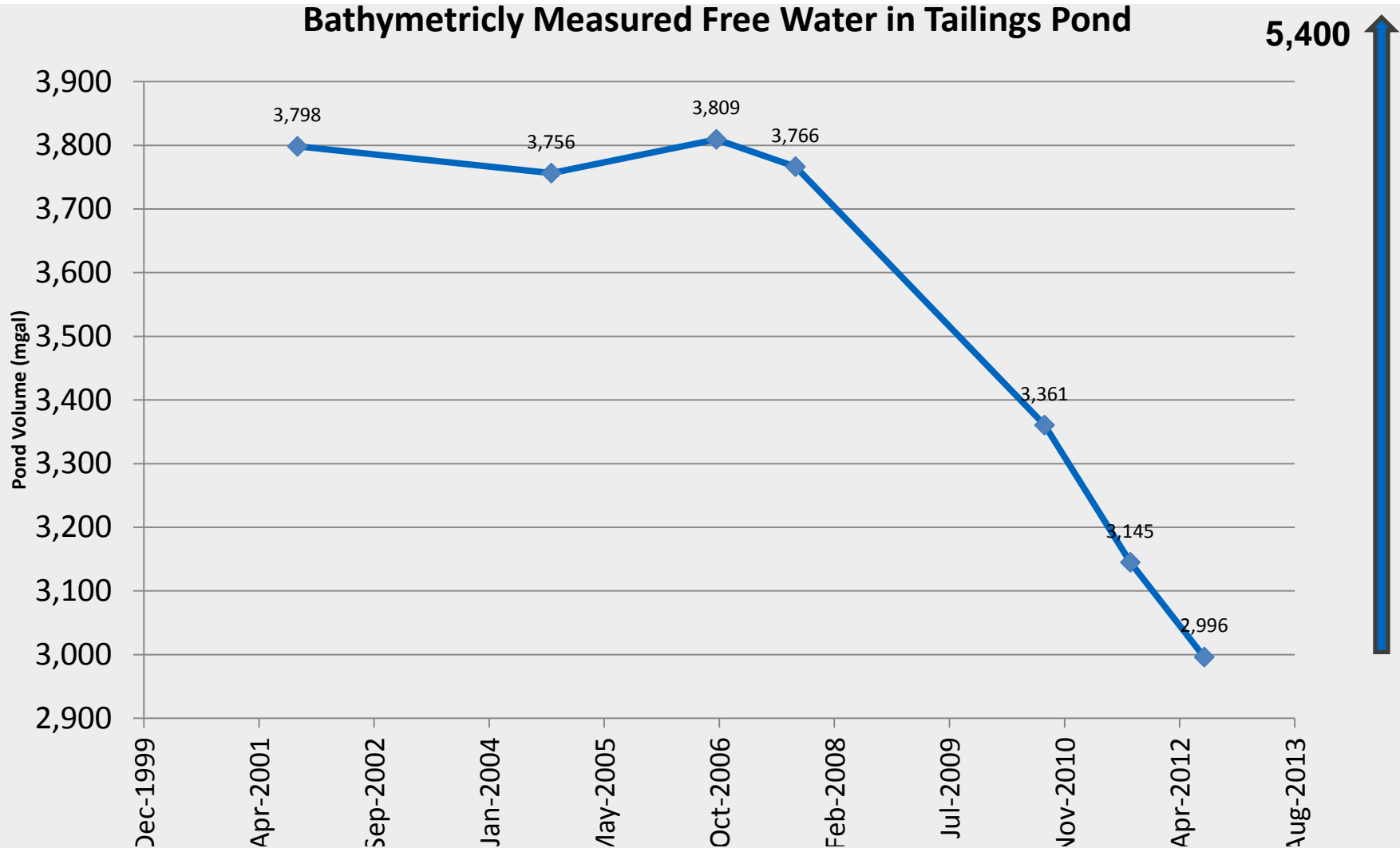
Red Dog Monthly Precipitation 2012 vs. 21 year average



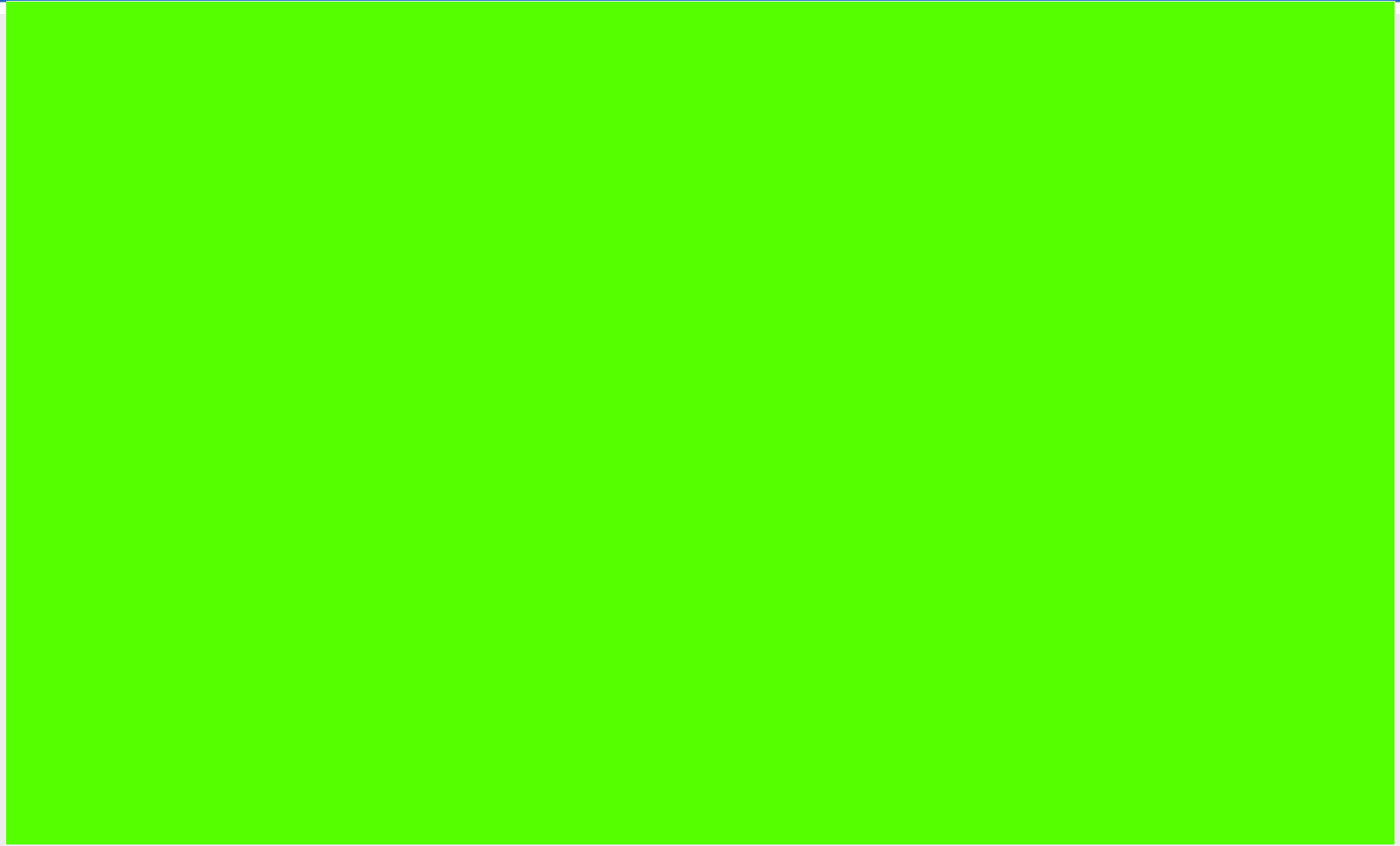
Tailings Pond Bathymetry



Water in Storage as of 17-Jul-2012



Mine Water Quality



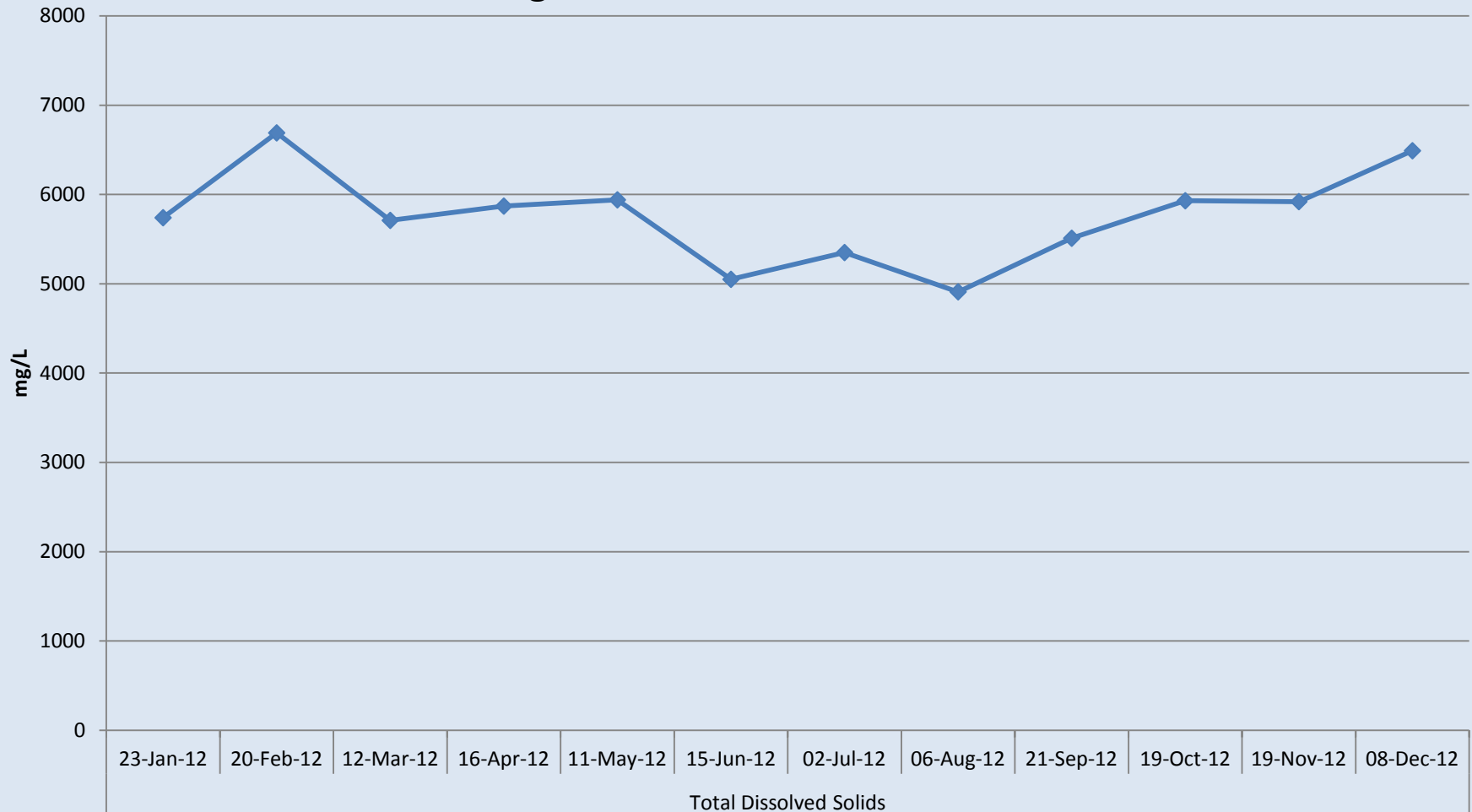
Water Treatment



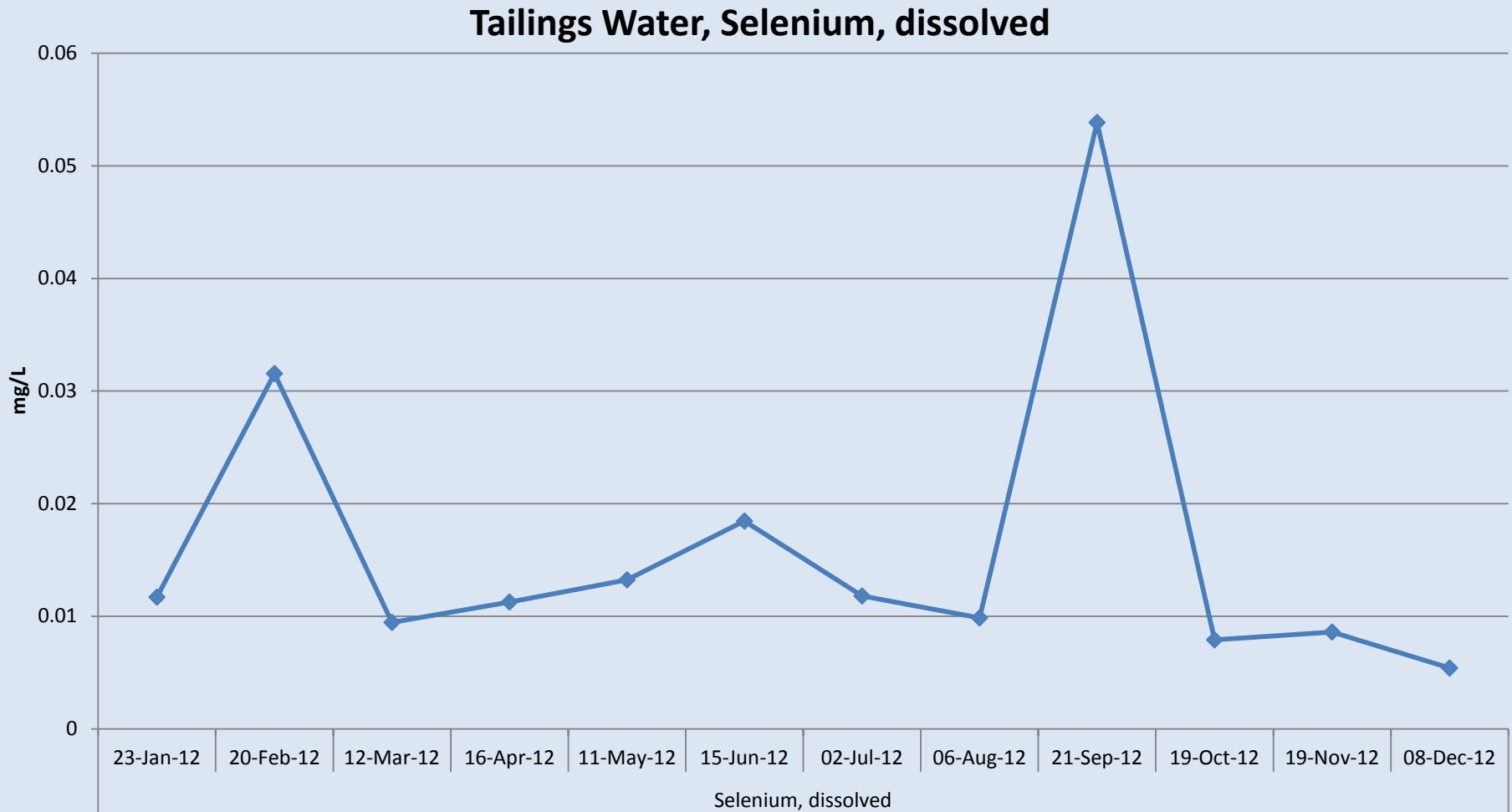
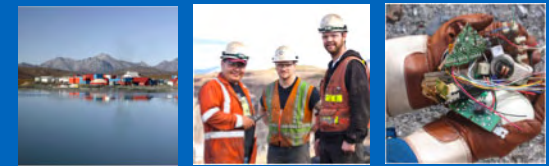
TDS in the Tailings Pond



Tailings Water, Total Dissolved Solids



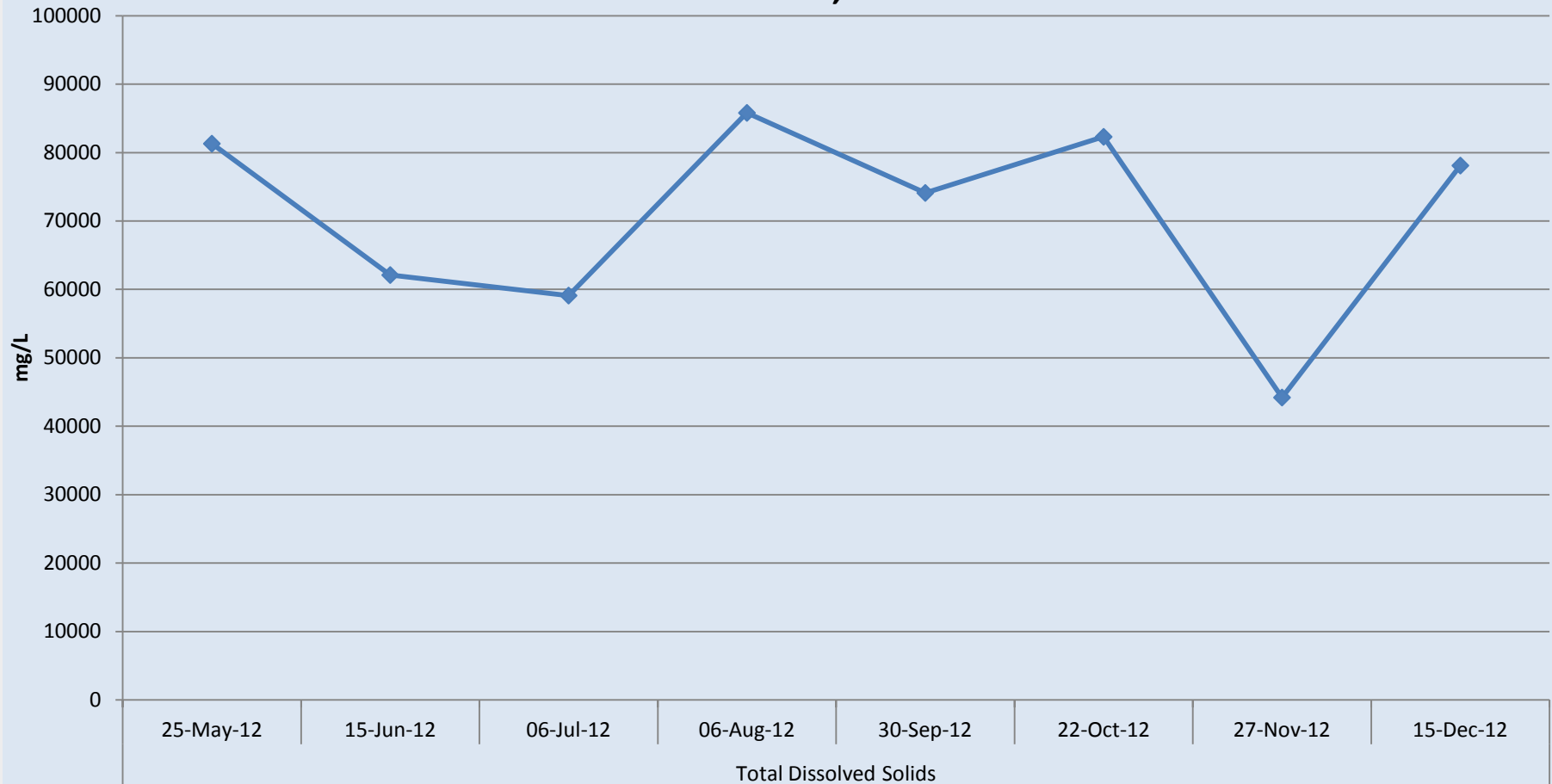
Se in the Tailings Pond



TDS Influent WTP 1 and WTP 3



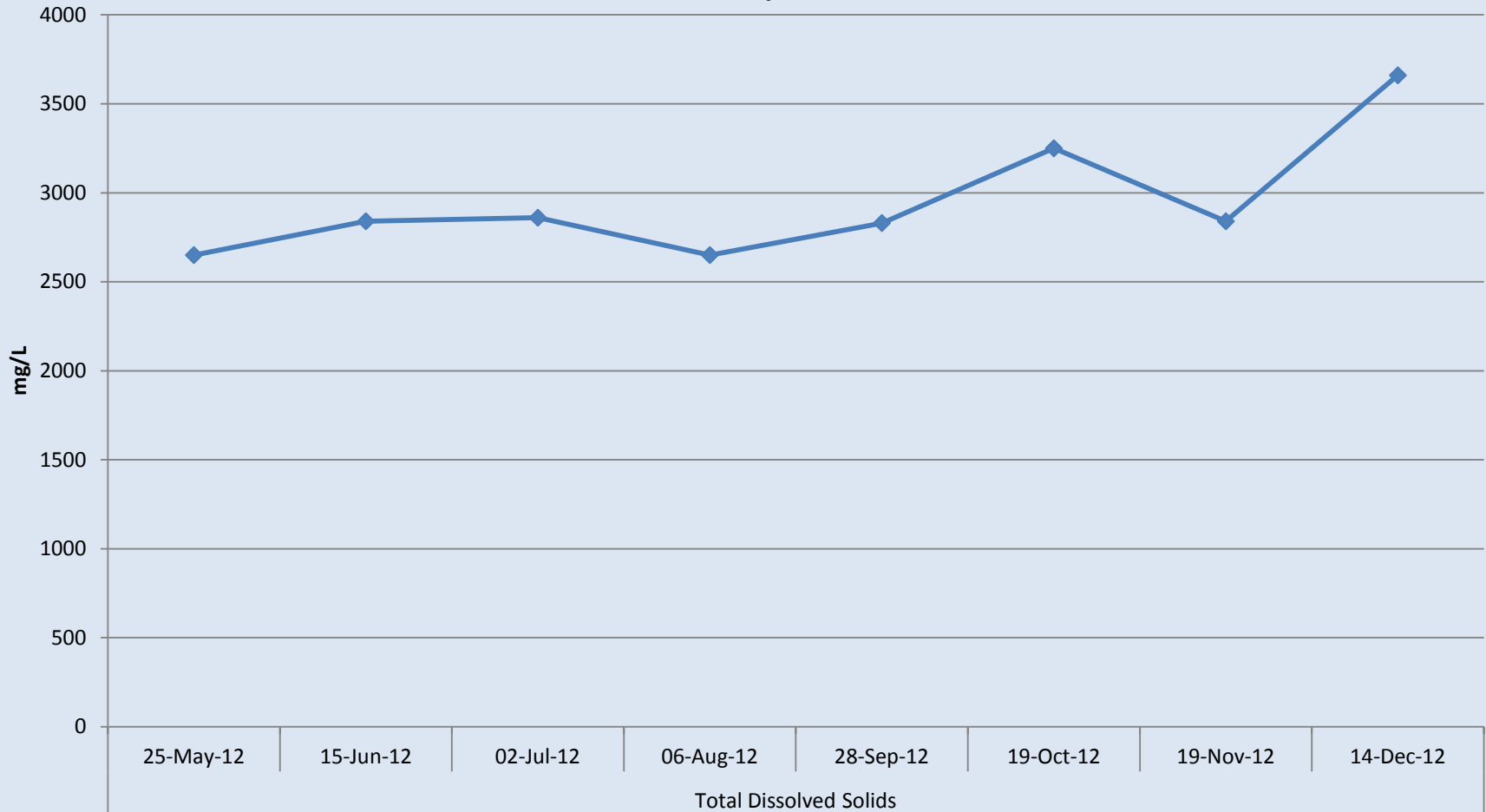
WTP 1 and WTP 3 Influent, Total Dissolved Solids



TDS Effluent WTP 1 and WTP 3



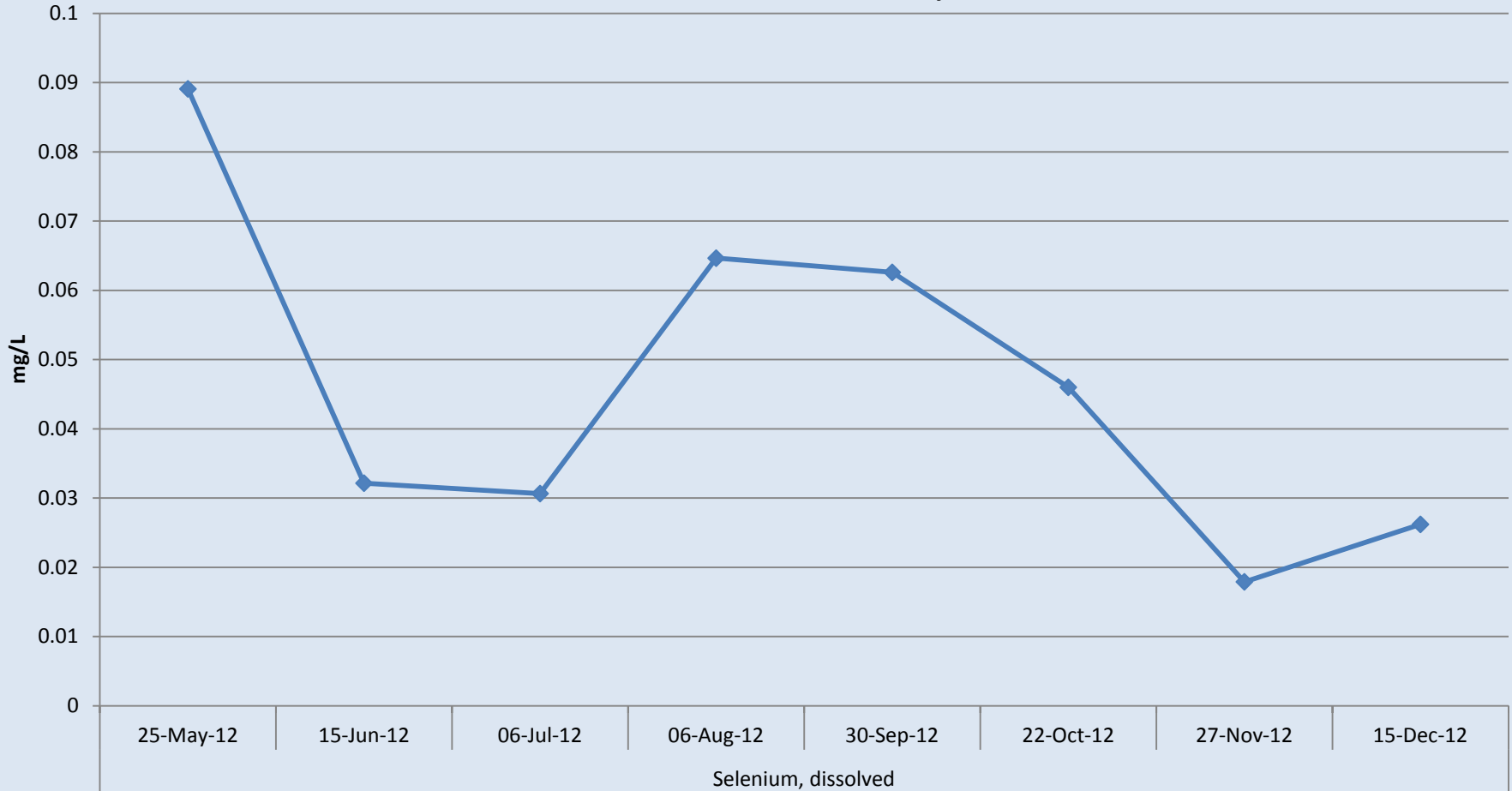
WTP 1 & WTP 3 Effluent, Total Dissolved Solids



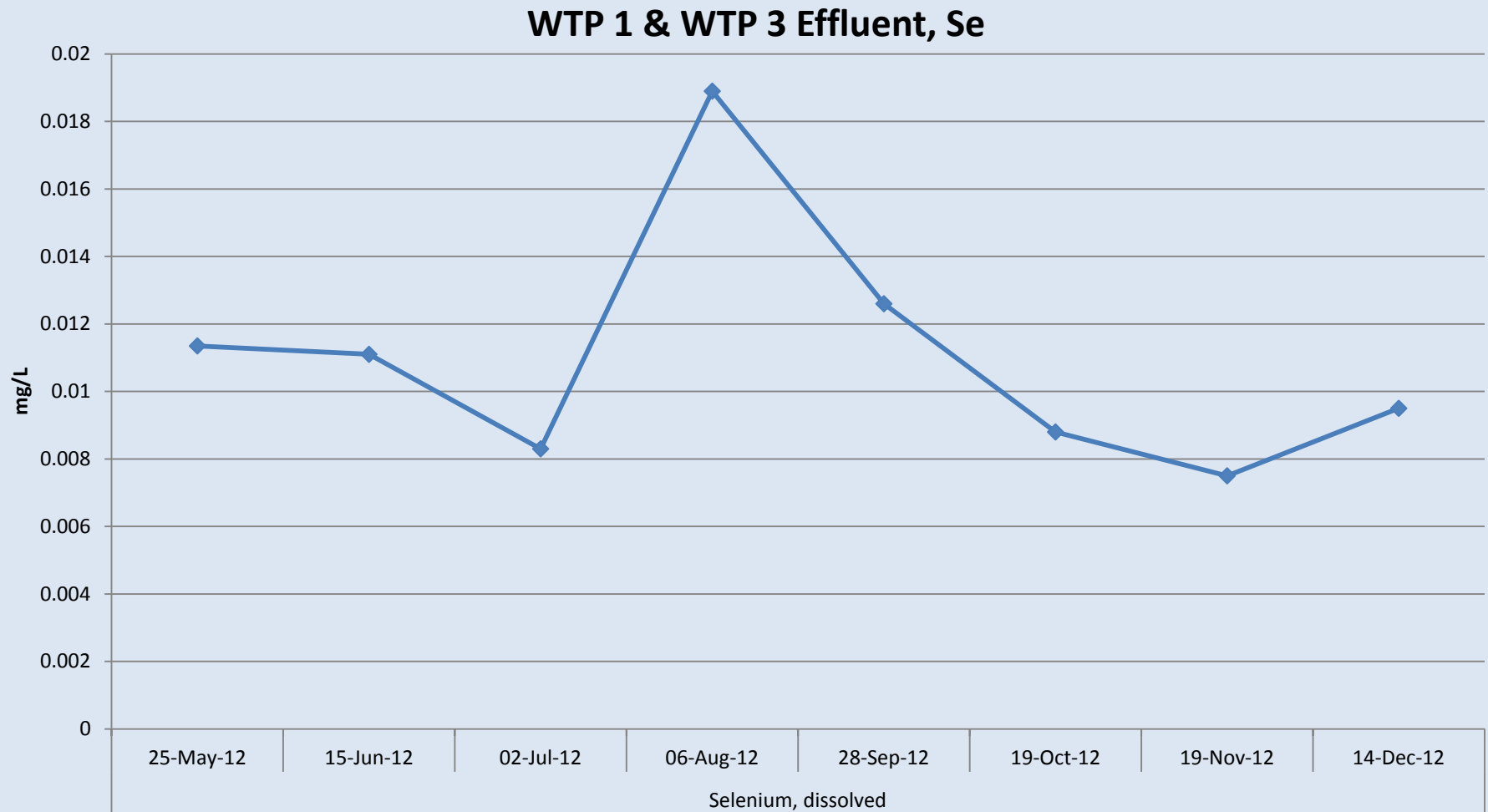
Se Influent WTP 1 and WTP 3



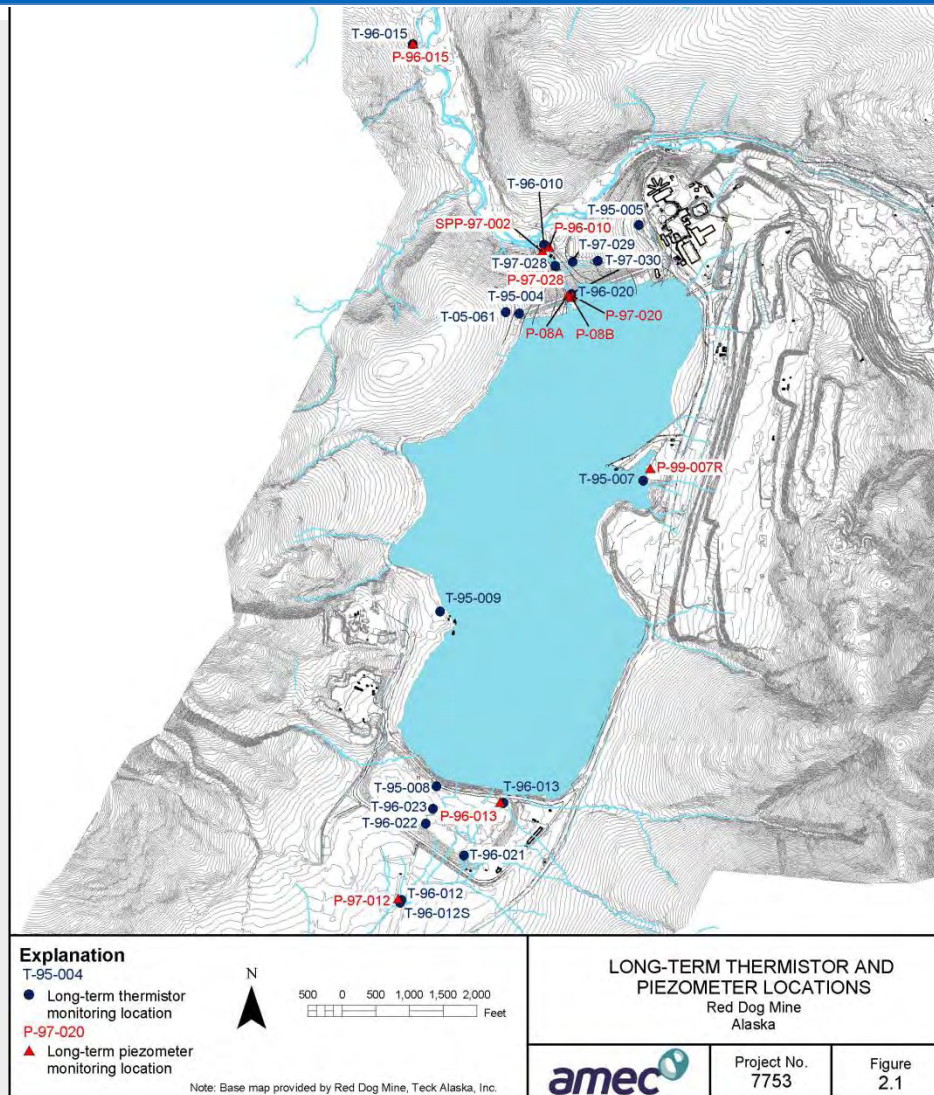
WTP 1 & WTP 3 Influent, Se



Se Influent WTP 1 and WTP 3



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.

2012 Conclusions:

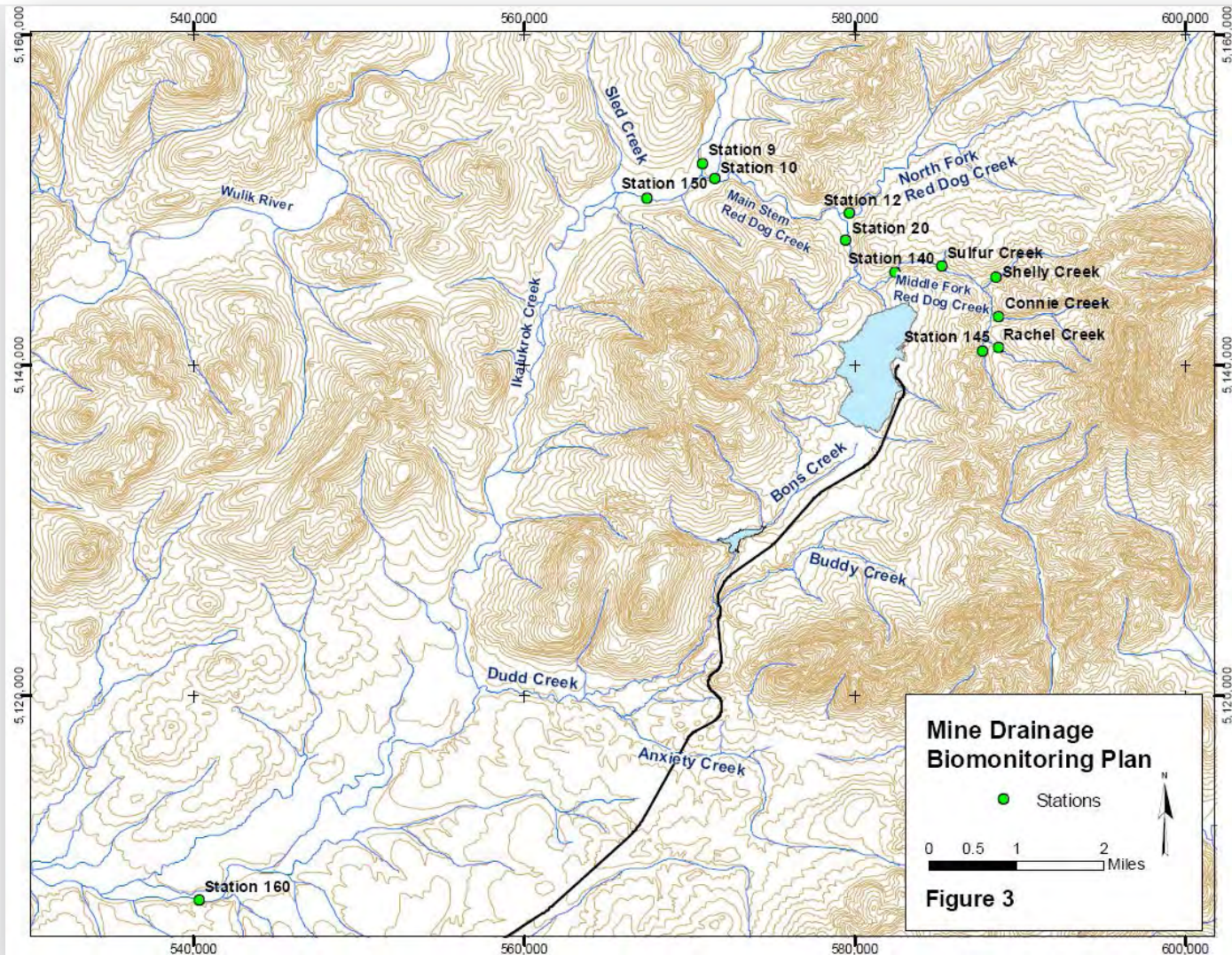
- Subpermafrost groundwater conditions beneath the dam are the same as those noted for background conditions in 1997.
- No vertical flow is occurring from the impoundment into deep groundwater, even though there is a zone where permafrost is absent beneath the impoundment.

Biomonitoring

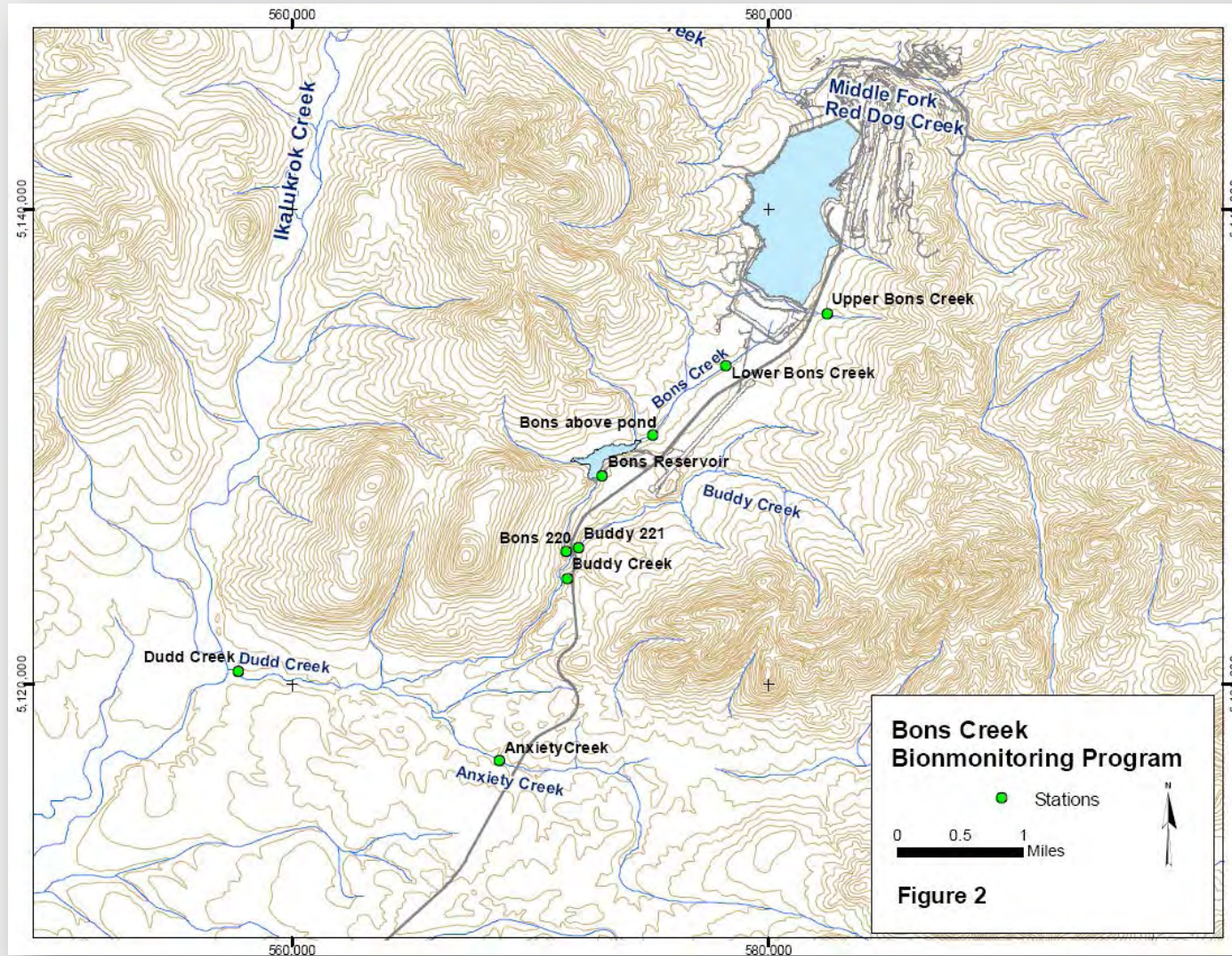


Figure 48. Fyke net site in North Fork Red Dog Creek in spring 2012 at Station 12.

Mine Drainage Monitoring Stations



Bons Creek Monitoring Sites



Aquatic Invertebrates

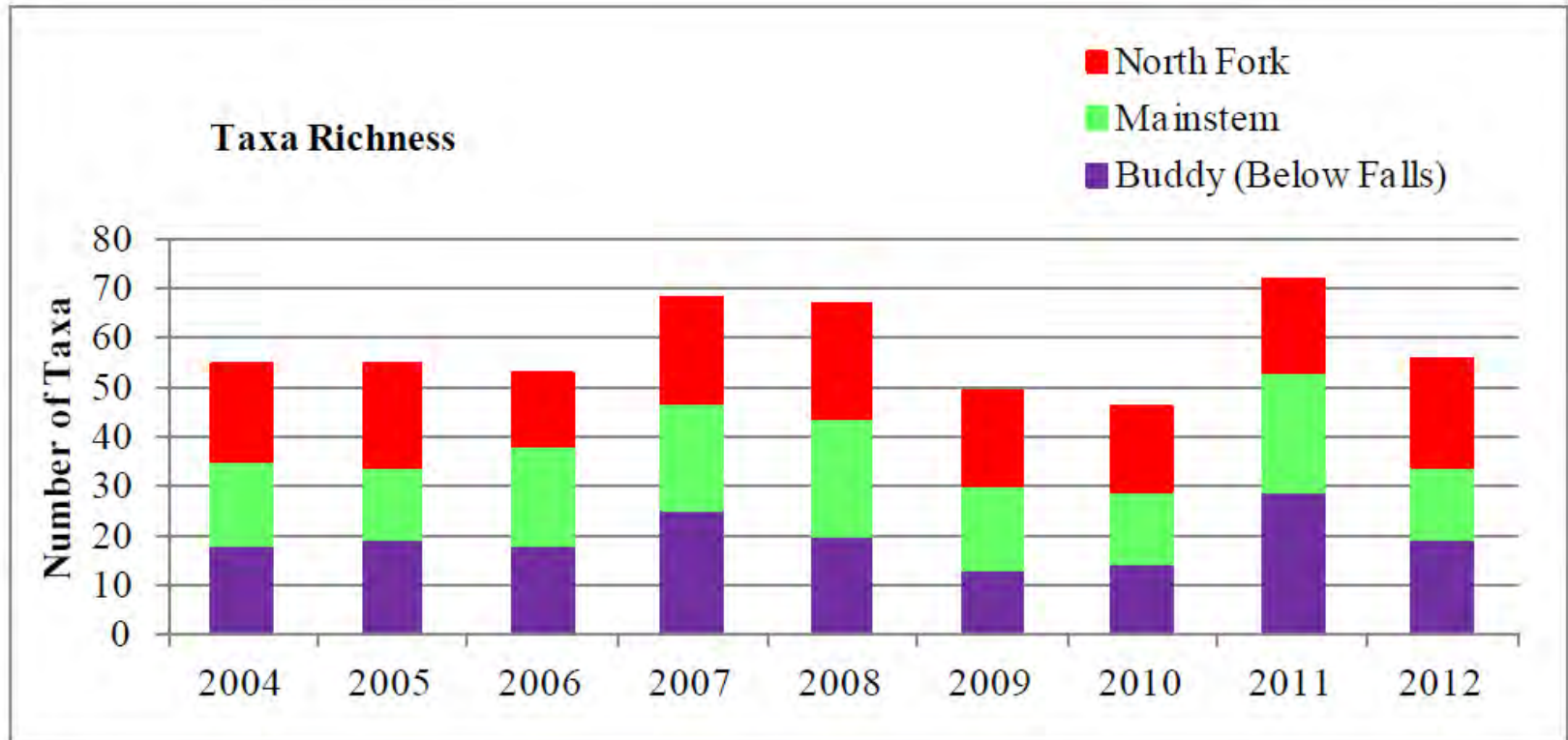


Figure 32. Aquatic invertebrate taxa richness in North Fork Red Dog, Mainstem Red Dog, and Buddy creeks.

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Arctic Grayling in Red Dog Creek

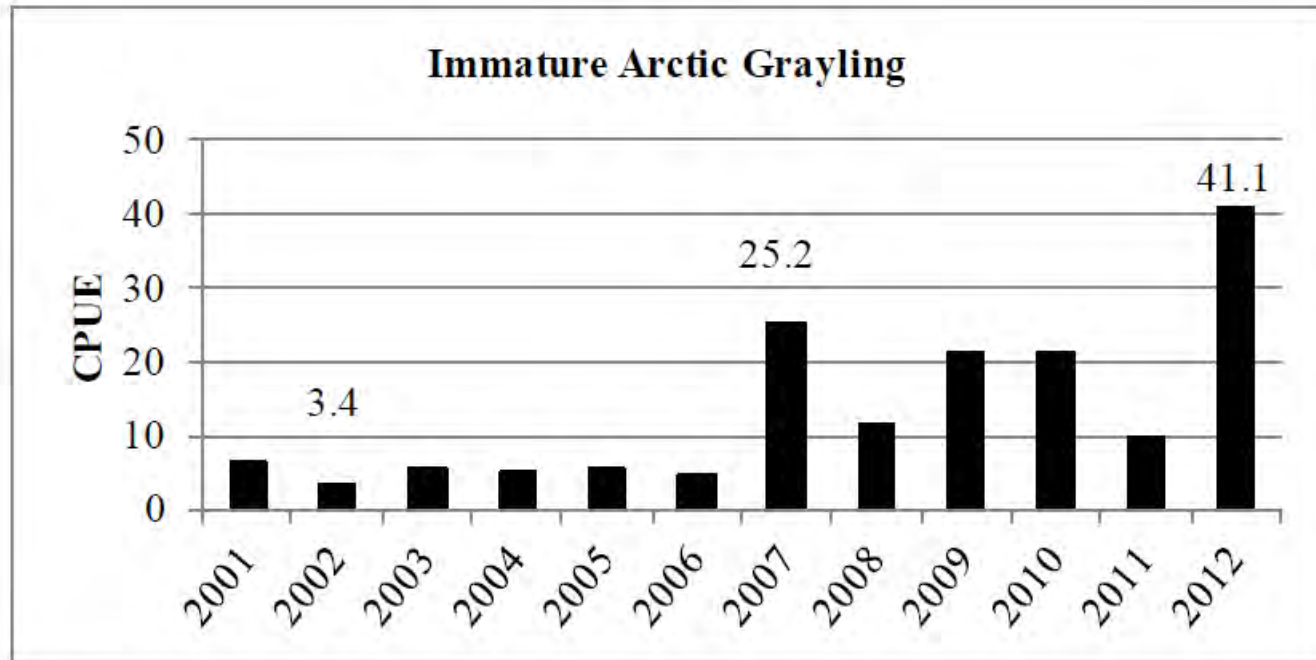


Figure 54. Catch per unit of effort (fish per day) of immature Arctic grayling in North Fork Red Dog Creek in spring 2001 to 2012.

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Dolly Varden

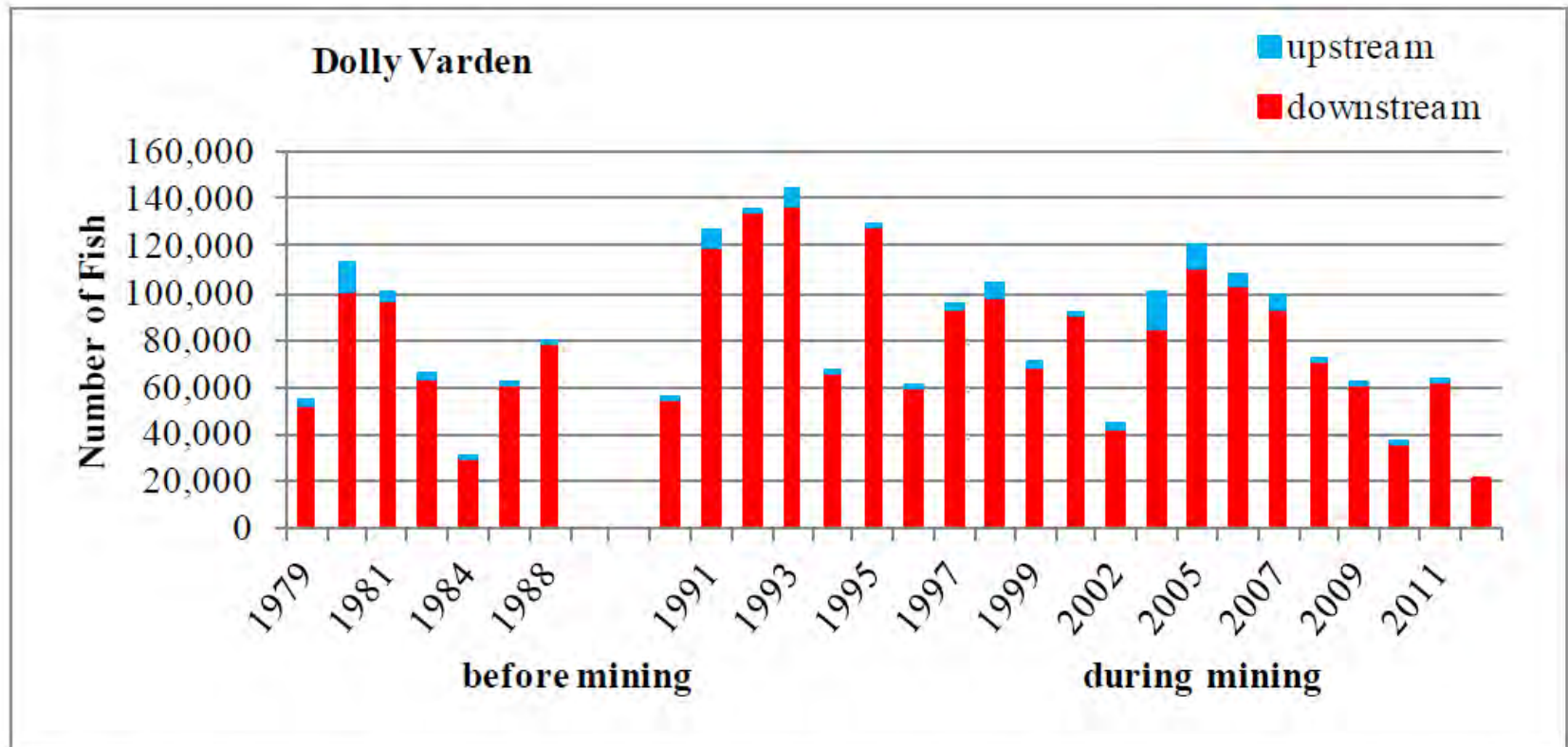


Figure 46. Estimated Dolly Varden in the Wulik River just prior to freezeup.

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Lead Concentrations in Creeks near Red Dog Mine

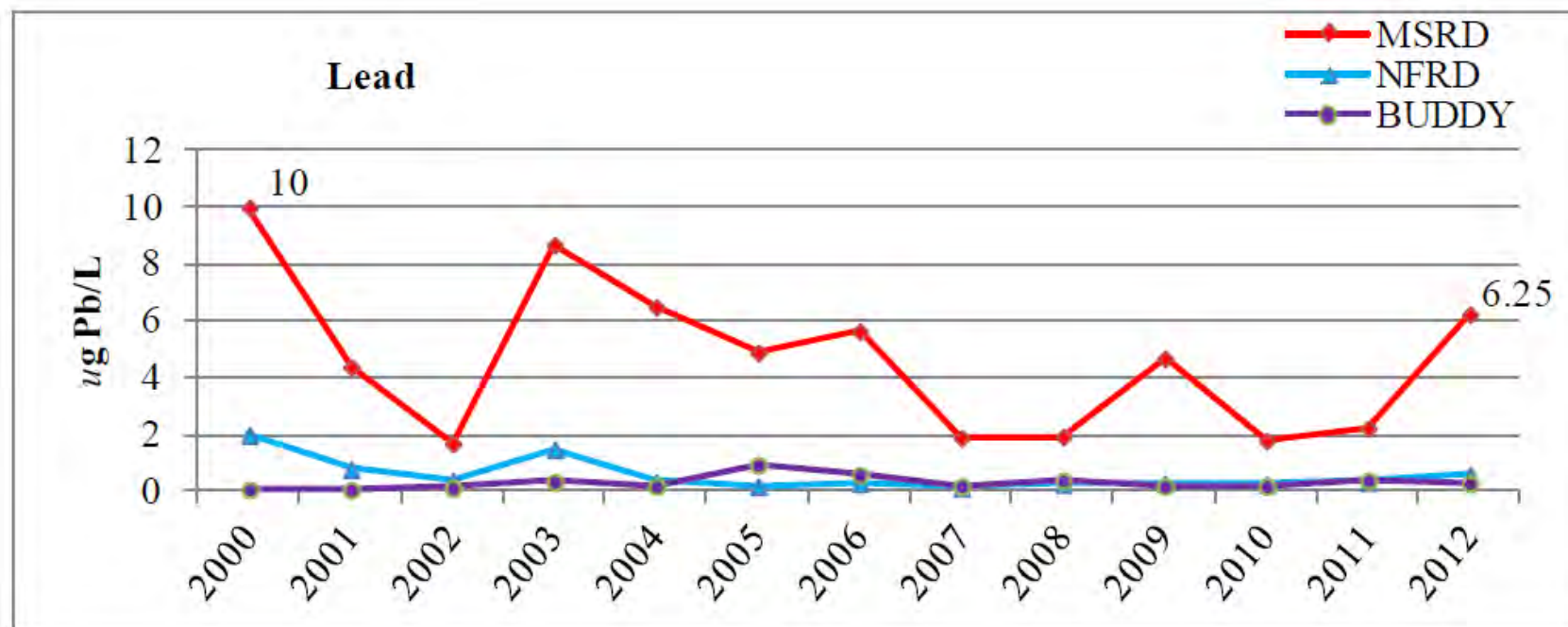


Figure 13. Median Pb concentrations in Mainstem Red Dog, North Fork Red Dog, and Buddy Creeks (2000 to 2012).

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Zinc Concentrations in Creeks near Red Dog Mine

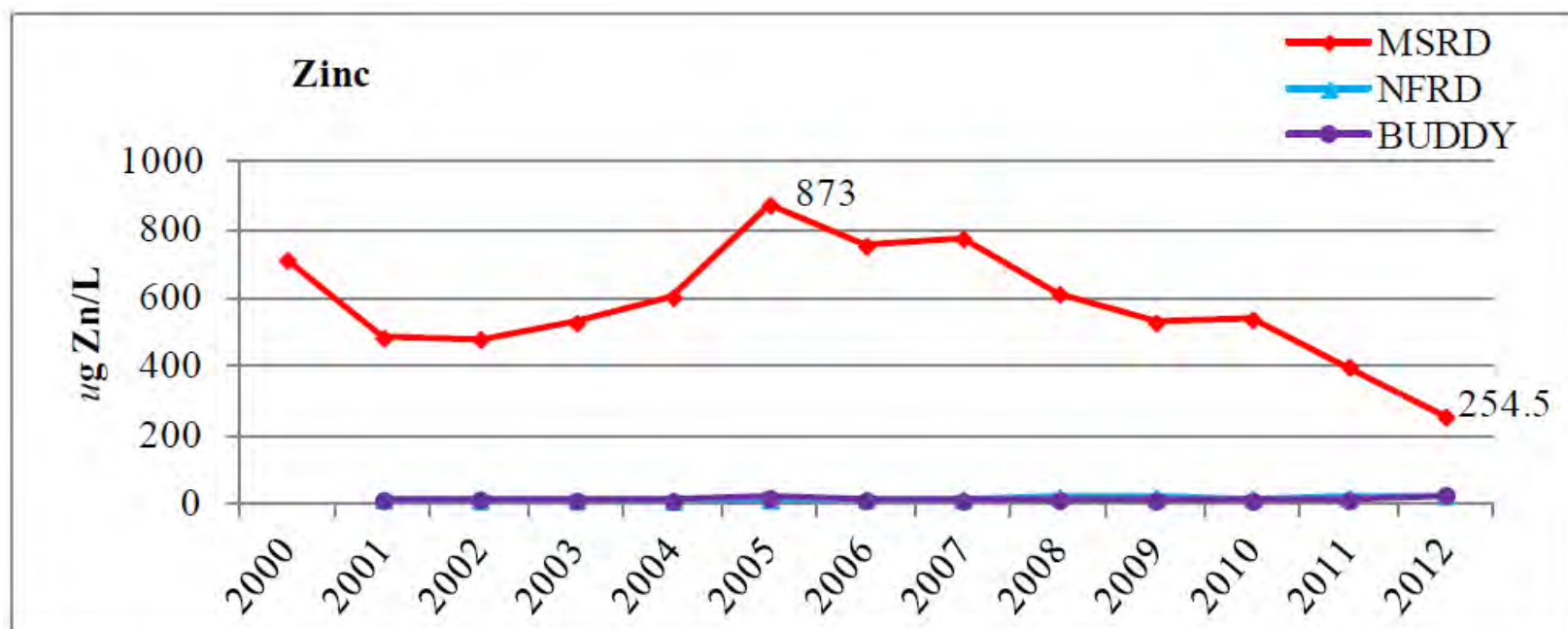


Figure 14. Median Zn concentrations in Mainstem Red Dog, North Fork Red Dog, and Buddy Creeks (2000 to 2012).

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Selenium Concentrations in Creeks near Red Dog Mine

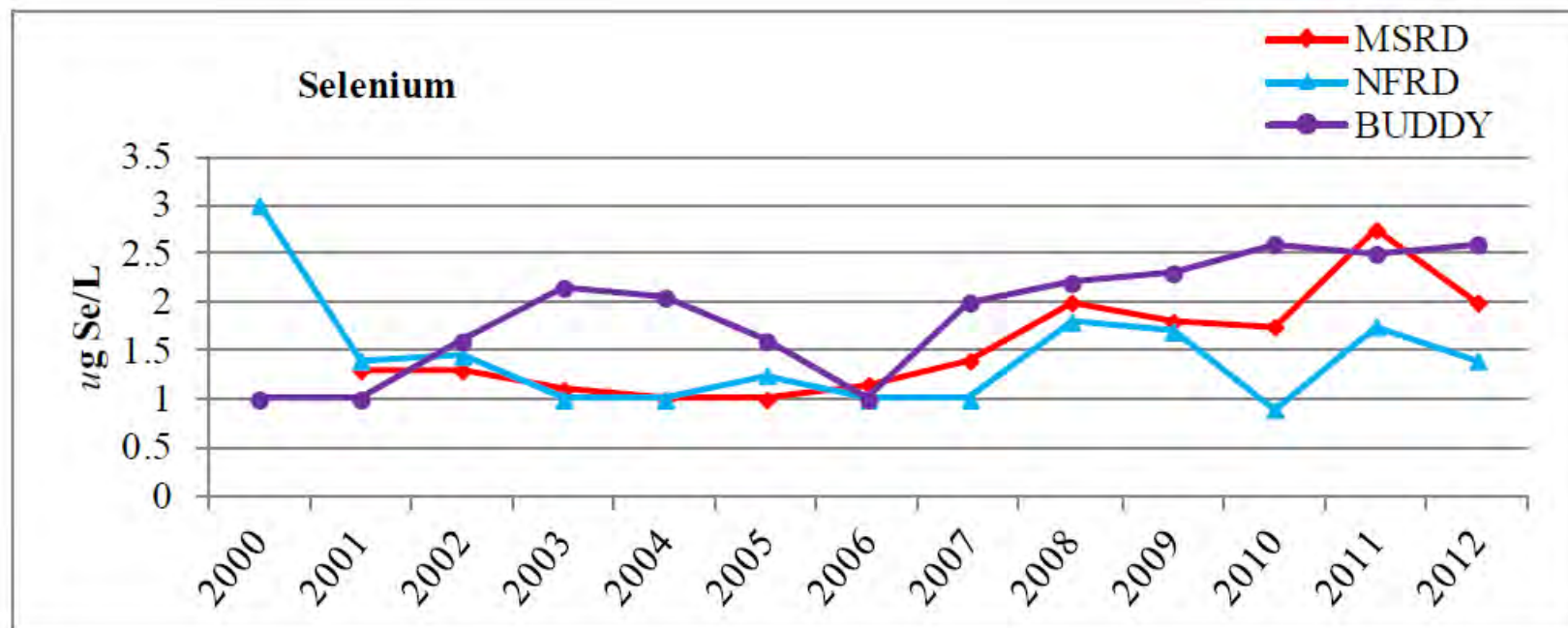


Figure 15. Median Se concentrations in Mainstem Red Dog, North Fork Red Dog, and Buddy Creeks (2000 to 2012).

From [Aquatic Biomonitoring at Red Dog Mine, 2012](#) by Alvin G. Ott and William A. Morris

Oxide Pile Cover Study



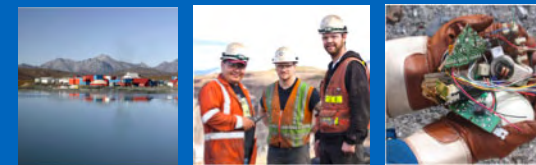
Four Year Results Oxide Pile Cover Study



Table 3.2
Net percolation summary.

Station	Airport Precipitation				Station Precipitation
	Year 1 2008-2009	Year 2 2009-2010	Year 3 2010-2011	Year 4 2011-2012	2011-2012
Plateau	16%	11%	16%	36%	32%
West	17%	10%	24%	38%	24%

Other Oxide Pile Tests



Analyte	Barrel Test		Oxide Stockpile Runoff			
	Okpikruok	Kivilina	Site 01	Site 02	Site 03	Site 04
Calcium	93.7	174	183	197	348	333
Lead	0.0041	0.011	0.026	0.034	0.012	0.013
Selenium	0.0128	0.1259	0.0632	0.0407	0.0507	0.0251
Cadmium	0.893	0.033	0.952	0.0045	0.961	0.66
Zinc	36.5	0.0873	0.0053	1.71	0.0046	0.005
Acidity as CaCO ₃	110	< 20	< 20	< 20	< 20	< 20
Total Dissolved Solids	700	670	760	800	1330	1240

Inert Solid Waste Landfills



Wildlife



Caribou on Port Road



Water Treatment



Water Use and Treatment



Location	Total 2012 Flow Gallons
Bon's Creek Total Flow	175,378,000
Reclaim Flow to Mill	1,287,100,000
WTP #1 Influent from Reclaim	183,800,000
WTP #1 Influent from MWD	9,900
WTP #1 Clarifier Underflow Sludge To Tails	26,498,000
WTP #1 Effluent to Sandfilter/Discharge	4,201,000
WTP #2 Influent from Reclaim	1,104,100,000
WTP #2 Sludge Discharge To Tails	38,331,000
SandFilter Effluent Discharged to Red Dog Ck	311,020,000
WTP #3 Influent from MWD	46,484,000
WTP #3 Influent from Mine Water Collection	0
WTP #3 Total Effluent	46,484,000
Total Treated Water Discharged to Red Dog Creek	311,020,000

Fugitive Dust



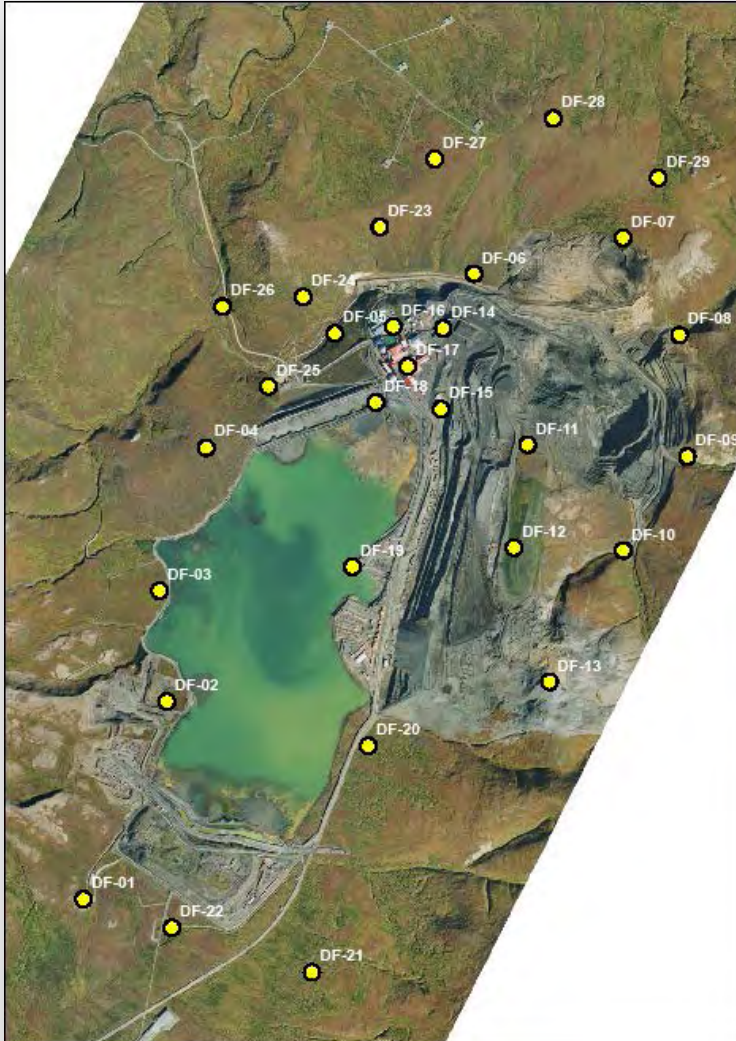
Dust Monitoring



Several monitoring programs are in place to monitor dust levels and deposition

- TEOMs* – real-time dust concentration measurements at PAC and Tailings Dam
- * Tapered Element Oscillating Microbalance; determines concentration in air by weight and airflow measurements
- Vegetation monitoring – effects of dust deposition on plant communities over time
- Moss studies – quantities of dust deposition over time
- Dustfall jars – rates and quantities of dust deposition over time
- Road surface sampling – deposition and tracking on roadways

Dust Monitoring



- Results of dust monitoring are analyzed to assist with mine air quality evaluations.
- This map shows dustfall jar locations for 2012.

Dust Monitoring



	2006	2007	2008	2009	2010	2011	2012
Days with TSP > 150	20	19	4	18	24	23	41
Average TSP	45	47	38	50	54	41	95
Average MAX TSP	179	180	117	180	218	332	366
Average Min TSP	8	7	6	10	8	4	5
Average Std Dev	43	39	29	43	46	58	104
Days Sampled	278	354	289	294	349	334	279

- Air monitoring programs allow for tracking and analysis of dust concentrations and effectiveness of dust control measures; and
- Provide information to help with decisions on where dust control improvement efforts should be focused

Activities



Continuing

- Interim Cover on Main Waste Dump
- Improved ARD collection at the base of the Main Waste Stockpile.
- Year-Round Treatment of ARD from Main Waste Stockpile

2013 Activities

- Sulfur Creek stormwater diversion
- Re-skin the Mine Concentrate Storage Building
- Begin performance monitoring of interim cover
- Paalaaq Development Drilling
- Six foot lifts on Main Tailings Dam and Back dam to 976' ASL

Main Waste Stockpile ARD Collection system



ARD Collection System



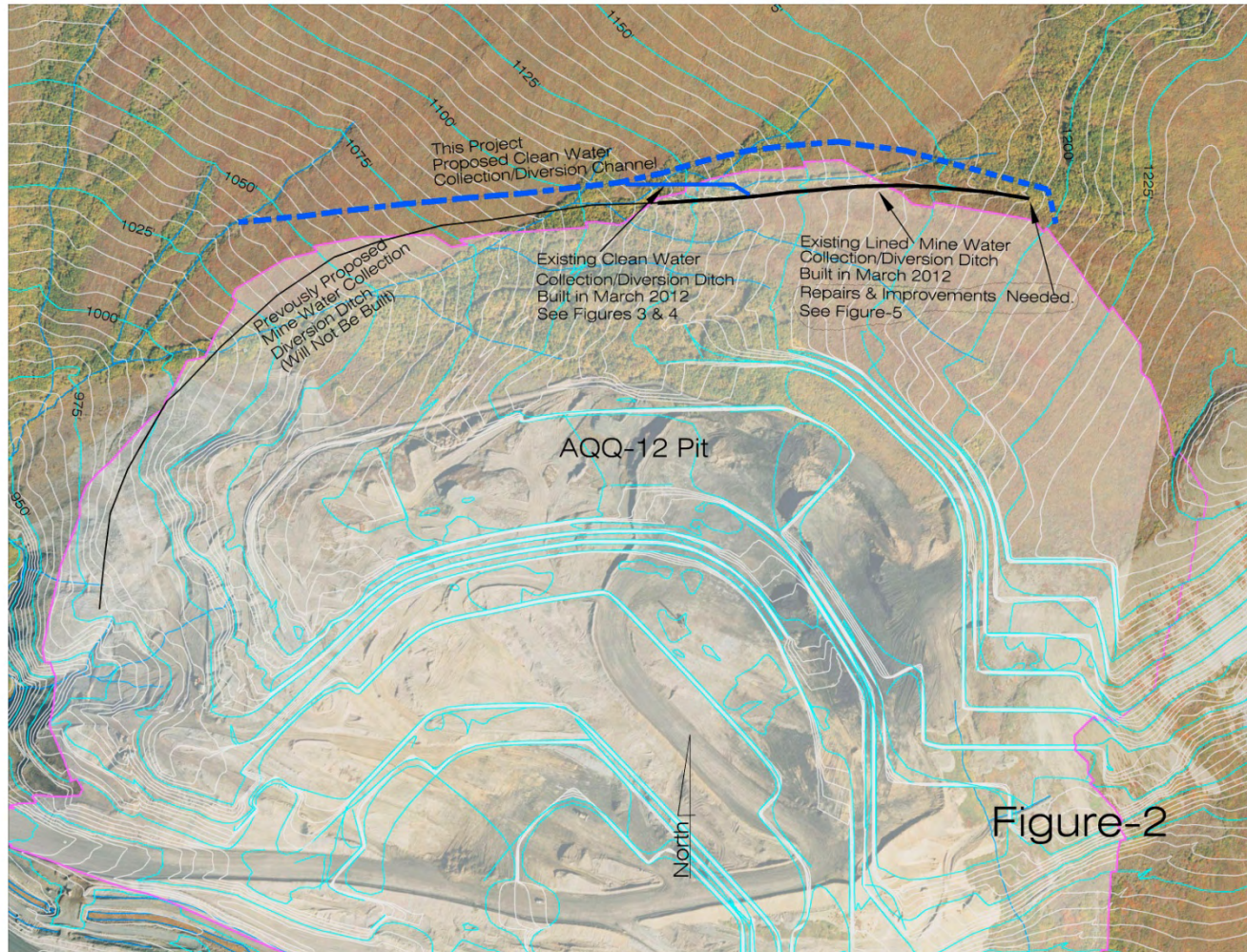
Smart Ditch



Interim Cover and Compaction



Sulfur Creek Stormwater Diversion



Sulfur Creek Storm Water Completed





Thank You