



Wolverine Project

Surveillance Network Monitoring Report April to July 2006

Type B Water Licence QZ01-051
Conditions 41 to 45

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August 24, 2006

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1. INTRODUCTION

This report has been prepared to satisfy requirements contained within Type “B” Water Licence Approval QZ01-051 (Licence). The structure and content of this report is based upon details provided in the Environmental Assessment Act Screening Report (Application No. LQ00026), as authorized by Yukon Government Energy, Mines and Resources and the Yukon Water Board (YWB). It specifically provides information with respect to Licence Conditions 41-45.

This report is the third Surveillance Network Monitoring (SNM) report and covers the water quality results for required locations as outlined in the Licence from April to July 2006. It also provides a summary of onsite activities that occurred during this period.

This report contains the following information:

- Section 2 - Surveillance Network Monitoring Program requirements and site infrastructure update
- Section 3 - Water quality monitoring results for April to July 2006
- Section 4 – Status of underground activities
- Section 5 – Water treatment update
- Section 6 – Waste rock pad sump update

2. SURVEILLANCE NETWORK MONITORING PROGRAM AND SITE INFRASTRUCTURE UPDATE

The intent of the Surveillance Network Monitoring (SNM) Program is to monitor changes to the receiving environment compared to baseline conditions. A baseline characterization program commenced in October 1995 and the frequency has increased to monthly sampling since May 2005 and includes water sampling of three SNM creek sites (W9, W16 and W12). Water samples were analyzed for physical parameters, dissolved and total metals, total suspended solids, as well as dissolved organic carbon for creek sampling locations.

SNM station locations and water quality sampling frequency as required in the Licence are summarized in Table 2-1. Not all infrastructure-related stations have been monitored as onsite requirements changed at the onset of the program in May 2005. An aggregate wash plant was not constructed and therefore there is no station AWP-SP. Table 2-2 summarizes the sumps that currently exist onsite as well as their updated nomenclature.

Currently, the infrastructure near the portal consists of a dirty sump (PDS) and a clean sump (PCS). Both the PDS and the PCS have been reconstructed and re-lined and their new volumes are 320 m³ and 575 m³, respectively (Table 2-1). These two sumps were designed to be used in sequence to provide settling of solids in the water being discharged from the mine (note that to date, underground activities have been limited and therefore settling has not been required).

Three sumps have also been constructed at the water treatment plant area (located at the lower laydown area) and include an influent sump (WIS), a discharge sump (WDS) and a backwash sump (WBS).

The sumps are not sampled on a weekly basis but as required during treatment and prior to discharge. For the WIS and WDS treatment sumps, sampling has typically been conducted more frequently than once per week. All stream sites (W9, W12 and W16) are sampled monthly.

Table 2-1. Surveillance Network Monitoring Sampling Requirements

Station No.	Sampling Frequency
W9: Wolverine Creek	Quarterly
W12: Go Creek above Pup Creek	Quarterly
W16: Go Cr. 15 m upstream of Hawkowl Cr.	Monthly
AWP-SP – Aggregate wash plant settling pond (not required)	Monthly
UTMD – Underground test mine discharge	Weekly
WRSS – Waste rock stockpile seepage (WRS*)	Weekly
C-PS – Clean sump decant (PCS*)	Weekly
WTSP – Water treatment plant settling pond (WIS* & WDS*)	Weekly

Note: * see Table 2-2.

Table 2-2. Water Collection and Treatment Sump Volumes

Portal Location	Abbrev.	Capacity
Portal Dirty Sump	PDS	Design Volume: 320m ³ ; 0.45m Freeboard: 235m ³
Portal Clean Sump	PCS	Design Volume: 575m ³ ; 0.45m Freeboard: 472m ³
WTP Inlet Sump	WIS	Design Volume: 2123m ³ ; 0.45m Freeboard: 1773m ³
WTP Discharge Sump	WDS	Design Volume: 1300m ³ ; 0.45m Freeboard: 1081m ³
WTP Backwash Sump	WBS	Design Volume: 359m ³ ; 0.45m Freeboard: 292m ³
Waste Rock Pad Sump	WRS	Design Volume: 221 m ³

Discharge Concentration Requirements

Discharge limits set by Water Licence QZ01-051 are summarized in Table 2-3. Discharges must also pass a fish bioassay test as per Environment Canada Method EPS 1/RM/13 for a 96 hour LC₅₀. As the mine water chemistry has not changed since the onset of treatment, bioassays have not been submitted prior to each discharge. The test performed spring 2006 was achieved a limit >100% vol/vol indicating a very positive result. A sample will be tested in early August and the results will be reported in the next SNM Report.

Table 2-3. B Licence Maximum Authorized Concentration Grab Sample Discharge Quality Limits

Parameter	Limit (mg/L)
Arsenic	0.10
Cadmium	0.02
Copper	0.20
Lead	0.20
Nickel	0.50
Selenium	0.015
Zinc	0.50
TSS	15
Ammonia	2.5

Flow Monitoring

Flow monitoring is required quarterly for W9 and W12 and monthly for W16. In May, new Global Water Level Loggers (GWLL) dataloggers were installed at five locations, three of which cover the intent of the SNM flow monitoring. The logger at W9 (Wolverine Creek) is now approximately 5 m further upstream from the old station. A GWLL was also installed at W82 in the Wolverine Creek headwaters. An RST datalogger continues to log flows at W12 (Go Creek near Money Creek) while a new GWLL was installed at W80 on Go Creek (instead of at W16 so that flows are characterized further downstream for future surveillance purposes in Go Creek). Appendix D provides a map of all GWLL sites in a figure entitled, *Locations of Continuous Hydrology Monitoring Stations in the Immediate Vicinity of Wolverine Project and Regional Stations*. Flow measurements are currently set to record flows at one hour intervals and are downloaded using a Hewlett Packer personal digital assistant. These sites will be downloaded in August and hydrographs for the spring-summer period will be provided in the next SNM Report.

Sediment sampling is also required in triplicate at the creek stations annually, during summer low flows. This data will be provided in a subsequent SNM report.

3. WATER QUALITY MONITORING RESULTS

Water quality sampling has been conducted monthly since May 2005. The May through September 2005 baseline monitoring results (i.e. prior to water treatment and/or site discharge) for stations W9, W16 and W12 are summarized in Table 3-1.

There have been two previous SNM reports (dated February 7 and April 11, 2006) that have covered the monitoring periods from October through March. The April through July results for the nine parameters covered by the B Licence are summarized in Table 3-2. In April, only W16 was sampled as W9 was frozen and W12 was not accessible by snowmobile (a helicopter was not readily available during the sample period). From May to July, W9, W16 and W12 were sampled and the lab Maxxam Analytics Inc. (Maxxam), was used for analysis. The ALS Laboratory results (for W16, April) and the Maxxam results (for W9, W16 and W12 for May to July) are provided in Appendix A.

Table 3-1. W9, W16 and W12 2005 Baseline Water Quality Monitoring Results

Baseline Results Parameter (mg/L)	W9	W16 May-Dec 2005	W12
Arsenic (total)	<0.0005	<0.0005	<0.0005
Cadmium (total)	0.000024 to 0.00146	0.000025 to 0.00005	0.000017 to <0.00005
Copper (total)	<0.0010 to 0.0035	<0.001 to 0.0022	<0.001 to 0.0021
Lead (total)	<0.0005	<0.0005	<0.00050 to 0.00068
Nickel (total)	<0.001 to 0.0064	<0.001	<0.0010
Selenium (total)	0.00059 to 0.0031	<0.0005 to <0.001	<0.0010
Zinc (total)	<0.0050 to 0.175	<0.0050	<0.0050
TSS	<0.3	<0.3 to 5.8	<3.0 to 6.1
Ammonia	<0.005 to <0.02	0.0146 to 0.042	<0.02

Note: 2005 laboratory data reports available upon request

Table 3-2. W9, W12 and W16 2006 Water Quality Monitoring Results

Monitoring Results Parameter (mg/L)	W9			W16				W12		
	May '06	Jun '06	Jul '06	Apr '06	May '06	Jun '06	Jul '06	May '06	Jun '06	Jul '06
Arsenic (total)	0.0003	0.0003	0.0003	0.00024	0.0003	0.0002	0.0002	0.0004	0.0003	0.0003
Cadmium (total)	0.00102	0.00141	0.00125	0.000033	0.00004	0.00007	0.00006	0.00004	0.00004	0.00002
Copper (total)	0.001	0.0026	0.0015	0.00033	0.0006	0.002	0.001	0.0008	0.0017	0.0008
Lead (total)	0.00002	0.00006	0.00007	<0.00005	<0.00002	0.00008	<0.00002	0.0001	0.00015	0.00003
Nickel (total)	0.0023	0.0056	0.004	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	0.001	<0.0005
Selenium (total)	0.0034	0.0024	0.0034	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	0.0007
Zinc (total)	0.0716	0.135	0.129	0.0014	0.0018	0.0039	0.0017	0.0006	0.0032	<0.0005
TSS	<4	<4	<4	<3	<4	4	4	11	8	<4
Ammonia	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	<0.005

Note: Water collection was not possible at W9 or W12 in April 2006.
Data in Appendix A (lab QA/QC data available upon request)

Generally, the April to July data is comparable to the 2005 baseline characterization. TSS detection limits vary between the 2005 and 2006 data analyses, but all results are below 11 mg/L.

A comparison of the three SNM stations over the January to July 2006 SNM monitoring period is provided for As, Cd, Cu, Pb, Ni, Se and Zn in Figures 3-1 to 3-7, respectively. Bars that are striped represent values below the concentration graphed (i.e. less than this detection limit). W9 (Wolverine Creek) Cd, Cu, Ni, Se and Zn concentrations are higher in all periods compared to the Go Creek sites (W12 and W16), reflecting the

natural highly mineralized area within the Wolverine watershed. Cu, Ni and Zn concentrations also appear to increase with increased flows in the spring.

The sites that were not able to be sampled appear as spaces on the figures. As outlined in a previous SNM Report, W16 was not sampled in February and W9 was not sampled in March or April due to frozen conditions.

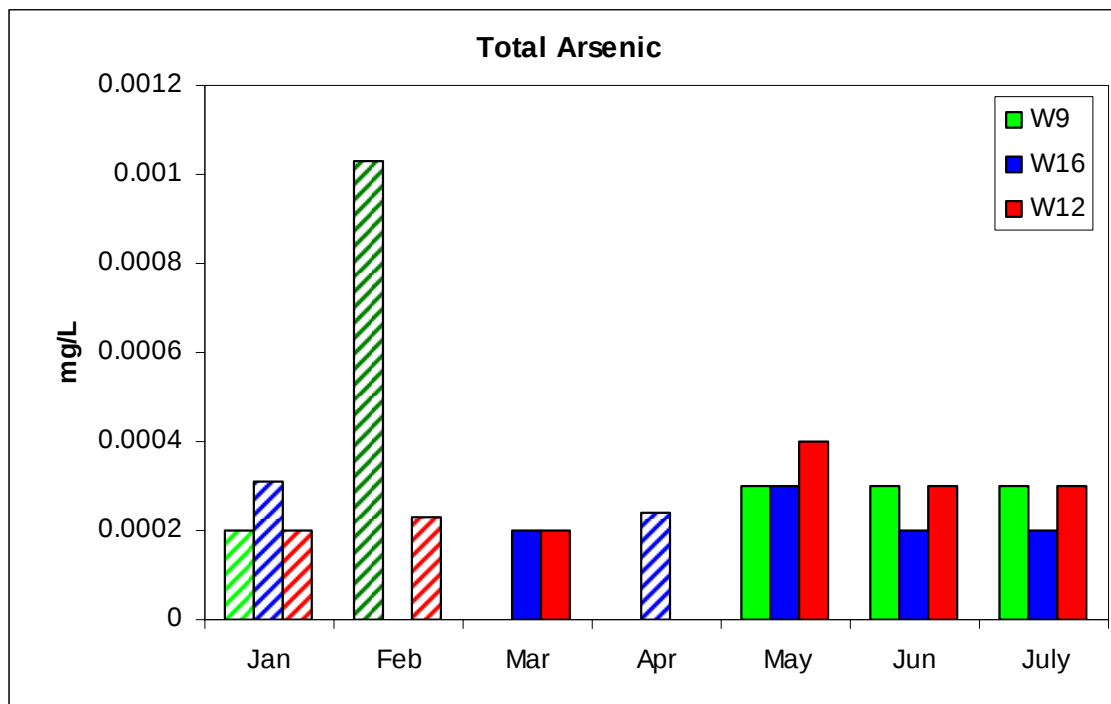


Figure 3-1. 2006 Arsenic Concentrations (mg/L) for W9, W12, and W16.

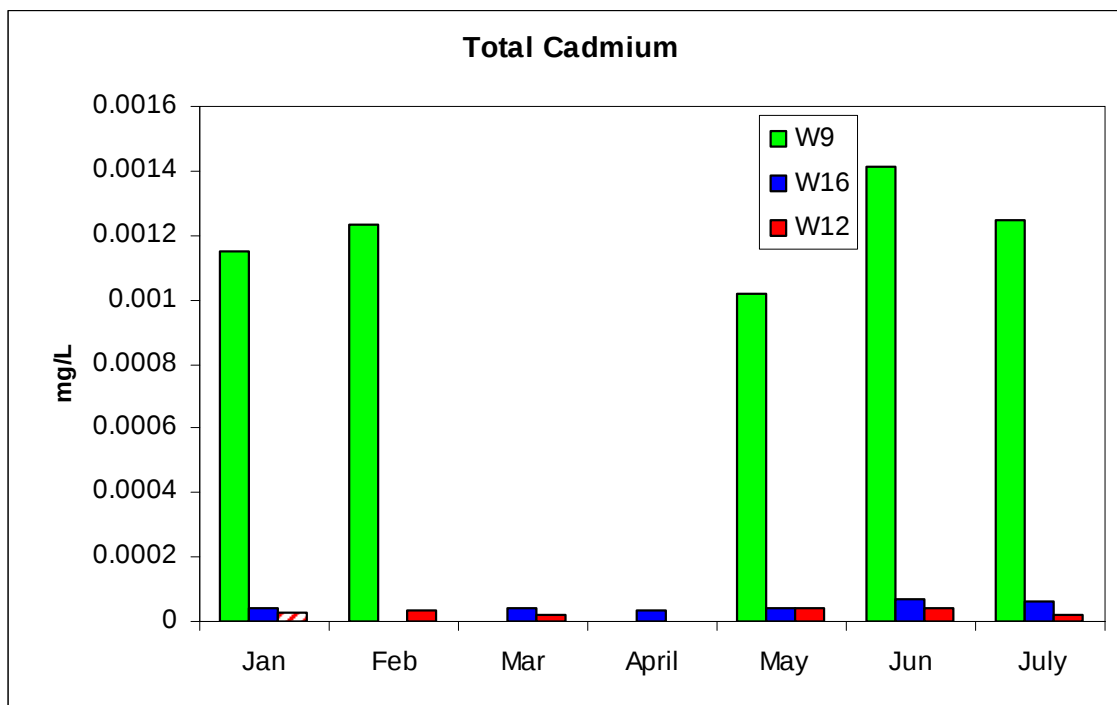


Figure 3-2. 2006 Cadmium Concentrations (mg/L) for W9, W12, and W16.

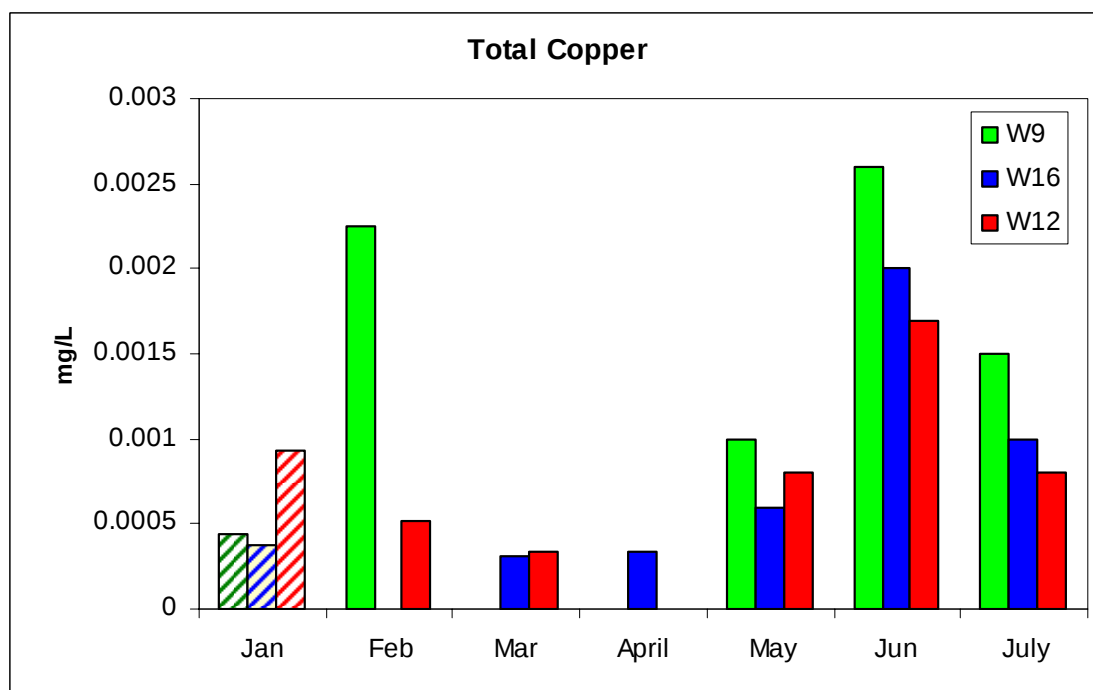


Figure 3-3. 2006 Copper Concentrations (mg/L) for W9, W12, and W16.

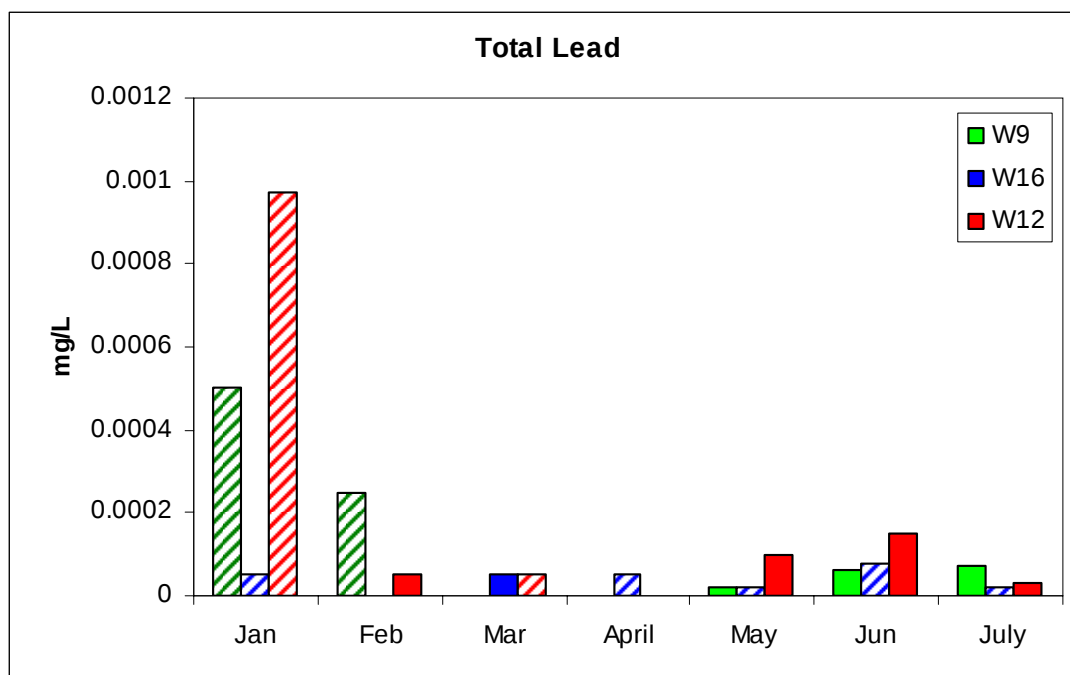


Figure 3-4. 2006 Lead Concentrations (mg/L) for W9, W12, and W16.

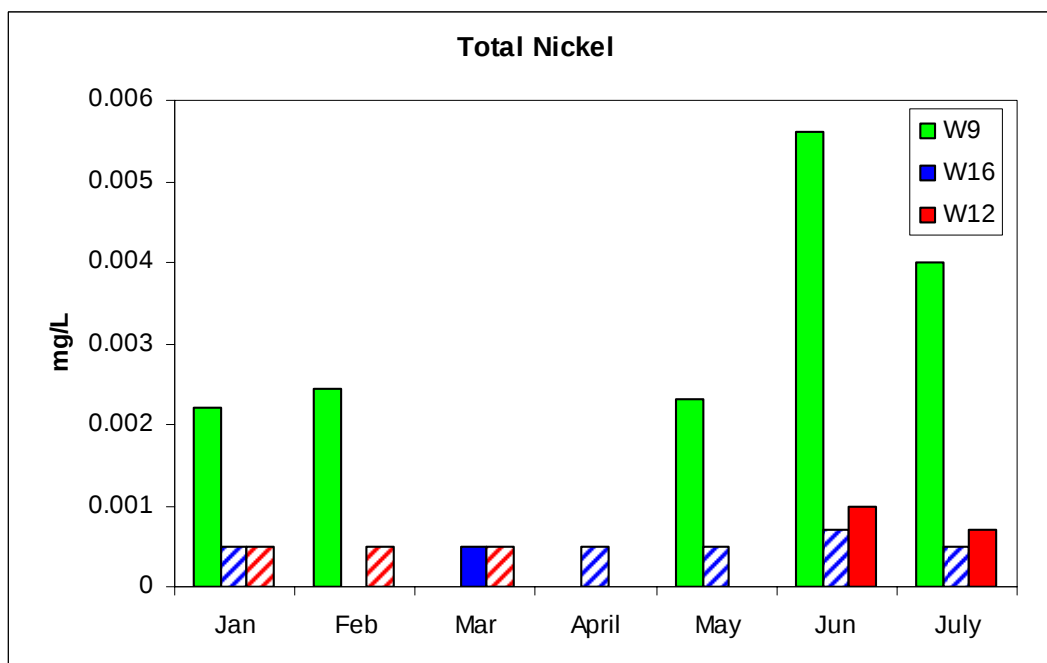


Figure 3-5. 2006 Nickel Concentrations (mg/L) for W9, W12, and W16.

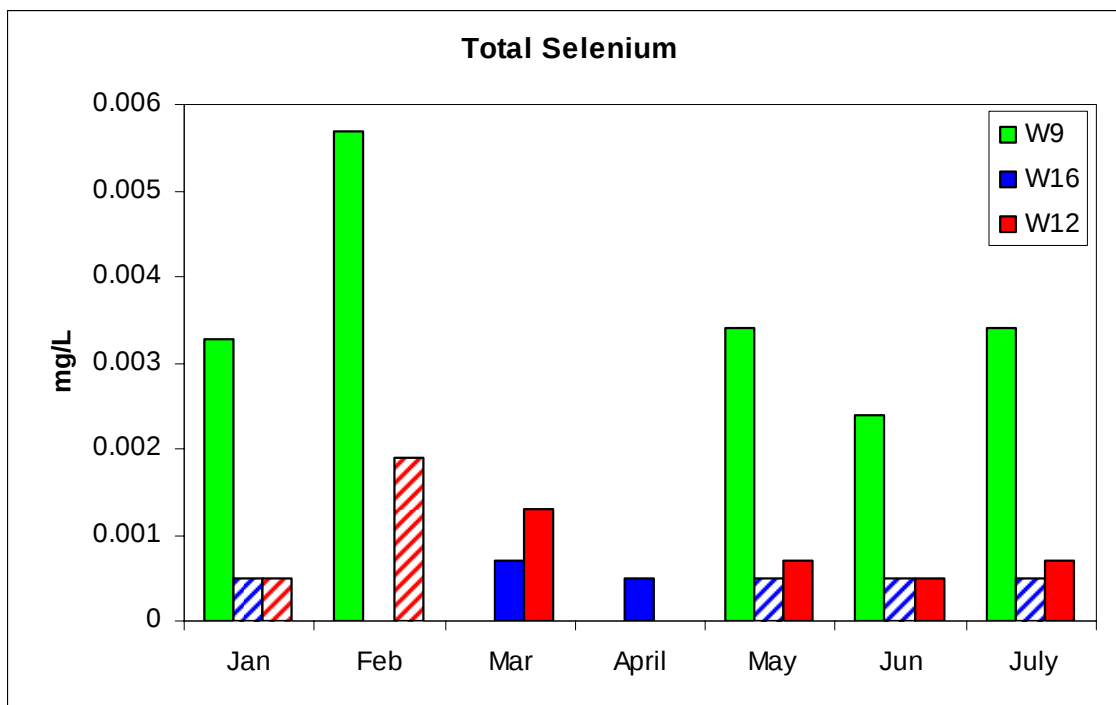


Figure 3-6. 2006 Selenium Concentrations (mg/L) for W9, W12, and W16.

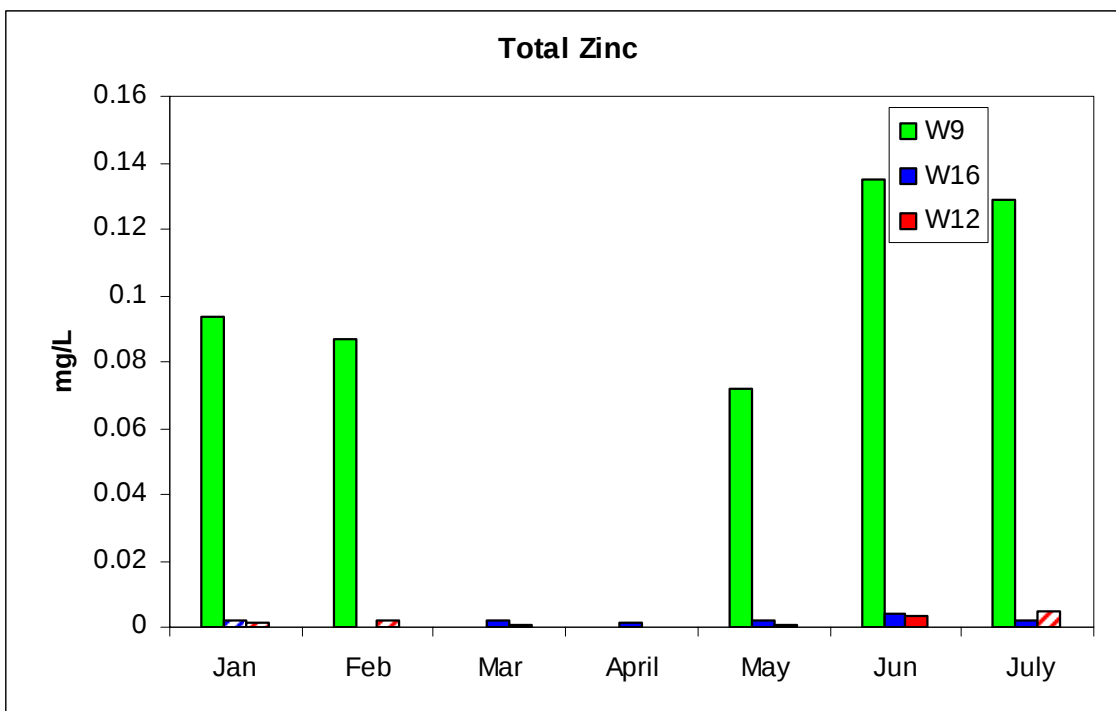


Figure 3-7. 2006 Zinc Concentrations (mg/L) for W9, W12, and W16.

4. STATUS OF UNDERGROUND ACTIVITIES

As stated in the SNM February to March report, groundwater had flooded the mine adit to the portal during the temporary seasonal shutdown. Initially, water was pumped to the portal sumps and trucked to the upper lined area of the waste rock pad until the water treatment plant area infrastructure and sumps were operational. Between March 9 and April 2, 2006, a total of approximately 443 m³ was transferred to the waste rock pad for temporary storage. The recharge rate was calculated to be 1 L/s and this rate has been consistent during the April to July period.

Since the re-construction of the PCS and PDS and the construction of the WIS, WDS and WBS, the underground workings are being dewatered with pumps. Mining contractor Procon arrived on-site in early July is currently rehabilitating the underground workings and assisting with dewatering. Details on water treatment and discharge are described in following section.

5. WATER TREATMENT UPDATE

To date, untreated mine water has consistently met the discharge limits except for selenium (Table 2-3), which has been above the limit of 0.015 mg/L. The concentration ranges between 0.018 to 0.045 mg/L (as summarized in Table 5-1).

Table 5-1. Total Metals Water Quality Results for Mine Water, May to June 2006

Water Sample ID		TX	PortalSump	B01	B01	TO
Lab Report No.		A620637	A621010	A622291	A622807	A623668
Sampling Date		18/05/06	20/05/06	28/05/06	31/05/06	03/06/06
Parameter (mg/L)	ADL					
Total Arsenic (As)	0.1	0.002	<0.001	<0.001	0.002	0.001
Total Cadmium (Cd)	0.02	<0.002	<0.002	<0.002	<0.002	<0.002
Total Copper (Cu)	0.2	<0.005	<0.005	<0.005	<0.005	<0.005
Total Lead (Pb)	0.2	<0.03	<0.03	<0.03	<0.03	<0.03
Total Nickel (Ni)	0.5	0.013	0.014	0.02	0.012	0.015
Total Selenium (Se)	0.015	0.045	0.032	0.018	0.019	0.021
Total Zinc (Zn)	0.5	0.07	0.014	0.039	0.072	0.05

Note: ADL = Allowable Discharge limit

Data in Appendix B (lab QA/QC data available upon request)

There are two methods of treating selenium currently onsite: the addition of a coagulant and flocculent (Ferrifloc and Ipafluc 16, respectively) to the sumps or the activated carbon water treatment plant. The methods of application of both of these treatments are

provided in the previously submitted *Water Management Plan*, and a revision to this plan is currently in preparation.

During this spring-summer period, the use of Ferrifloc/Ipafloc 16 has proven to be the most efficient method for selenium removal. The water is treated either continuously in-line as the water is pumped from the underground workings, or else as a batch treatment if the water is stored in the sumps. The treatment methodology, whether continuous or batch, has been to add Ferrifloc until the pH of the water in the treatment ponds is between 6.7 and 7.1. At this point, treatment stops and the water is left to settle for a minimum of 8 hours. After initial settling, a small amount of Ipafloc 16 is added and mixed into the water. Finally the water is allowed to settle for a minimum of 8 hours and samples are taken and sent into the lab for analysis to verify compliance for discharge.

This treatment method has been consistently successful in lowering the concentration of selenium to well below discharge limits (Table 5-2).

Table 5-2. Treated Mine Water Discharges for June and July 2006

Sump Name		PCS	WDS	WIS	WDS	WIS*	WIS*
Lab Report No.		A625299	A625784	A629169	A630191	A631055	A631788
Sample Date		9/06/06	16/06/06	03/07/06	07/07/06	14/07/06	19/07/06
Discharge Date		16/06/06	22/06/06	07/07/06	13/07/06	N/A	20/07/06
Discharge Volume m ³		472	1081	1773	1081	0	1773
Parameters (mg/L)	ADL						
Total Arsenic (As)	0.1	0.0002	0.0006	0.0002	0.0004	0.0002	0.0004
Total Cadmium (Cd)	0.02	0.00015	0.00008	<0.00001	0.00026	0.00018	0.00017
Total Copper (Cu)	0.2	0.0007	0.0006	0.0002	0.0013	0.0018	0.0016
Total Lead (Pb)	0.2	0.00032	0.00024	0.00004	0.00029	0.00076	0.00096
Total Nickel (Ni)	0.5	0.0234	0.0121	0.0056	0.0237	0.0172	0.0165
Total Selenium (Se)	0.015	0.0032	0.0065	0.0022	0.0046	0.0183	0.0045
Total Zinc (Zn)	0.5	0.031	0.0107	0.0014	0.0318	0.0214	0.0163
TSS	15	<4	6	<4	10	6	
Ammonia	2.5	0.413	0.054	<0.005	0.388	0.242	

Note: * WIS (report no. 6431055) did not meet discharge criteria for total selenium due to insufficient exposure time with the flocculent. With additional settling time, all total metals were within discharge limits (as per report no. A631788)
 Data in Appendix B (lab QA/QC data available upon request)

Once lab results indicate that the treated water has met all of the required discharge limits, the treated water is discharged to the headwaters of the Go Creek watershed. All treated mine water discharges to date, including discharge volumes, are provided in Table 5-2. The WIS sampled on July 14/06 met all discharge parameters except for selenium. It was concluded that the sump had not settled for a long enough period prior to sampling. It was left to settle, sampled again on July 19 and subsequent analyses met all discharge requirements.

6. WASTE ROCK SUMP UPDATE

The Waste Rock Sump (WRS), located at the temporary waste rock pad is used to collect water from the waste rock stored in the pad. Table 6.1 summarizes the water chemistry for this SNM period.

The May 1/06 sample met all discharge limits except for selenium and TSS. The May 10/06 sample met all discharge limits, as summarized in Table 6-1. Lab results were provided to Environmental Programs Branch Water Inspection Officer Brad Finnson on May 18, 2006 and approval was given to YZC to pump the WRS to the vegetated area down slope, provided that the TSS levels be monitored and lowered if they increased above the discharge limit of 15 mg/L.

On May 19/06, the TSS was 39 mg/L as measured onsite with a Hach meter. On May 21/06, after a TSS measurement of 28 mg/L, coagulant and flocculent (Ipafluc 16 and Powerfloc) were mixed with the sump water, then allowed to settle for 24 hours. On May 22/06, the TSS was measured at 0 and 8 mg/L in two different locations in the sump. Approximately 177m³ was discharged.

Samples of WRS were taken again on June 5/06 and July 6/06 (only total metals were analyzed for this sample). Selenium levels are above discharge limits for both samples and zinc is above discharge limits for the July 6/06 sample. This sump has been monitored for water level, and has not been discharged.

Table 6-1. Summary of Water Chemical Analyses of WRS

Sampling Date	5/1/2006	5/10/2006	5/19/06	5/21/06	5/22/06	6/5/2006	7/6/2006
Lab Report No.	A617651	A619028	Field Measurement (Hach Meter)			A623969	A630191
Parameters (mg/L)	ADL	WRS	WRS	WRS	WRS	WRS	WRS
Total Arsenic (As)	0.1	0.002	0.0007			0.004	0.007
Total Cadmium (Cd)	0.02	<0.002	0.00055			0.003	0.009
Total Copper (Cu)	0.2	0.015	0.0036			0.026	0.01
Total Lead (Pb)	0.2	0.03	0.0064			0.04	<0.03
Total Nickel (Ni)	0.5	0.009	0.0072			<0.008	0.208
Total Selenium (Se)	0.015	0.015	0.0115			0.105	0.286
Total Zinc (Zn)	0.5	0.121	0.0422			0.116	1.09
TSS	15	36	14	39	28	0-8	20
Ammonia (N)	2.5	0.41	0.39				

SUMMARY

In total, YZC has treated and discharged 6,357 m³ of water during the period of May to July from the water treatment and waste rock sumps. The water quality in the mine has been comparable over this period as there has been minimal underground. There were no observable changes in the creek monitoring sites (W9, W12, and W16) when compared to the 2005 baseline data. The next SNM report will summarize the late summer and fall period (August to November) and will be submitted in early December.