



**LORAX**  
ENVIRONMENTAL

## **TECHNICAL MEMORANDUM**

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**To: Bruce Graff, P.Eng., Linda Dandy, P.Geo.**

**Date: March 10, 2009**

**From: Andrew Rollo, P.Geo.**

**Project #: 489-2**

**Subject: 2009 Yellowjacket Water Quality and Waste Sampling Program**

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### ***1.0 Introduction***

Lorax Environmental Services Inc. (Lorax) has been requested to prepare a scope and budget associated with surface water quality and waste sampling programs in support of both the Effluent Discharge Permit and Small Mine Permit Applications for Prize Mining's Yellowjacket Property near Atlin, B.C. This document presents the proposed ARD/ML and water quality monitoring programs for review. These programs have been designed to ensure that all regulatory permitting requirements are met.

The Yellowjacket Project has a small footprint (25 ha), which is comprised of:

- Placer mining of surficial materials (145 m x 90 m);
- Open pit mining of mineralized zones (70 m x 40 m);
- Process plant – jaw crusher, SAG and grinding mills, Knelson concentrator (gravity flow);
- Material stockpiles and dumps;
- Process water sedimentation ponds with discharge to ground;
- Processing groundwater extraction, including pumps and pipelines;
- Access roads including internal roads within the pit;
- Diesel generator for electrical power including on-site transmission;
- A fuel storage and handling facility (double walled enviro tank system);
- Office and first aid trailers.

All of the mine components listed above are currently in place, and development during 2009 will involve the extraction and processing of approximately 30,000 tonnes of

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material from the open pit. Tailings generated from processing of this material will be deposited, along with process plant discharge supernatant solution, to the sedimentation pond(s). As well, the proposed development plans state that any waste rock generated as a result of resource extraction will be backfilled into the open pits.

The scope of the environmental programs proposed for 2009 will involve three components:

- 1) Surface water quality sampling and analysis;
- 2) Ore, waste rock, and tailings sampling and analysis; and,
- 3) Field leach bin construction and sampling.

## **2.0 Proposed Programs**

The following sections outline the scope of each of the components of the proposed 2009 monitoring programs.

### **2.1 Surface Water Quality**

The Yellowjacket Mine footprint currently contains all infrastructural components required for development of the resource at this deposit, including ore stockpiles, waste rock stockpiles, sedimentation ponds with tailings, and an open pit. As well, any future developments will not involve a significant increase in the mine footprint area or the volume of waste materials stored subaerially at site. Previous geochemical characterization of Yellowjacket Zone lithologies indicates that waste materials are non-acid generating (NAG), but neutral-drainage metal leaching may be an issue (Lorax 2006). As a result, mine site drainage is not expected to be significantly impacted as a result of the proposed 2009 development plans for this site. Further, the current discharges from site are largely indicative of what will be encountered from future development. Therefore, quantifying the current level of impact will provide robust information in support of the effects assessment required for the Yellowjacket Project Effluent Discharge Permit Application.

The proposed surface water quality monitoring program involves collection of surface water samples from the following locations:

- Pine Creek (4 stations: PC-1, PC-2, PC-6 located approximately 200 m downstream of mine site, and PC-5);
- Bulk Sample Pit; and,

- Sedimentation Pond.

In addition to the sampling stations listed above, field blanks, field duplicates, and filter blanks will be collected during each sampling event. Collection of water from these three locations will help to characterize site source water as well as determine the degree of impact (or lack thereof) associated with current drainages from the Yellowjacket Mine.

Sampling at each of these sites will be conducted monthly, except during freshet when samples will be collected weekly (Table 1). This will ensure that all possible flow conditions are captured to most effectively evaluate the impact of the Yellowjacket site on the receiving environment. For the purposes of budgeting, it is assumed that Prize Mining personnel or local contractors will conduct all monthly water quality sampling. The parameter list to be included in the Pine Creek Environmental Effects Monitoring Program is provided in Table 2.

**Table 1:**

**Proposed 2009 Yellowjacket Project surface water quality program sampling schedule.**

Month	PC-1	PC-6 <sup>1</sup>	PC-2	PC-5	Open pit	Sed Pond
March 2009	X	X	X	X	X	X
April 2009	X	X	X	X		X
May 2009	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>		X
June 2009	X	X	X	X	X	X
July 2009	X	X	X	X		X
August 2009	X	X	X	X		X
September 2009	X	X	X	X	X	X
October 2009	X	X	X	X		X
November 2009	X	X	X	X		X
December 2009	X	X	X	X	X	X
January 2010	X	X	X	X		X
February 2010	X	X	X	X		X

<sup>1</sup> PC-6 is located approximately 200 m downstream of the Yellowjacket Mine site

<sup>2</sup> Sampling frequency is weekly during freshet

**Table 2:**  
**Proposed surface water sample parameters and detection limits, Yellowjacket Project Environmental Effects Monitoring Program.**

Parameter	Symbol	Detection Limit	Units
<i>Physical Parameters</i>			
Conductivity		1	µS/cm
Hardness		0.5	mg/L
pH	pH	0.1	pH
Total Suspended Solids	TSS	1	mg/L
Turbidity	NTU	0.1	NTU
<i>Major Anions and nutrients</i>			
Alkalinity-Total	CaCO <sub>3</sub>	0.5	mg/L
Chloride	Cl	0.5	mg/L
Sulphate	SO <sub>4</sub>	0.5	mg/L
Fluoride	F	0.01	mg/L
<sup>4</sup> Ammonia Nitrogen	N	0.005	mg/L
Nitrate Nitrogen	N	0.005	mg/L
<sup>5</sup> Nitrite Nitrogen	N	0.002	mg/L
Dissolved ortho-Phosphate	P	0.002	mg/L
Total Dissolved Phosphate	P	0.002	mg/L
<i>Dissolved and Total Metals</i>			
Aluminum	Al	0.2	µg/L
Antimony	Sb	0.02	µg/L
Arsenic	As	0.02	µg/L
Barium	Ba	0.02	µg/L
Beryllium	Be	0.01	µg/L
Bismuth	Bi	0.005	µg/L
Boron	B	50	µg/L
Cadmium	Cd	0.005	µg/L
Calcium	Ca	0.05	µg/L
Chromium	Cr	0.1	µg/L
Cobalt	Co	0.005	µg/L
Copper	Cu	0.05	µg/L
Iron	Fe	1	µg/L
Lead	Pb	0.005	µg/L
Lithium	Li	0.5	µg/L
Magnesium	Mg	0.05	µg/L
Manganese	Mn	0.05	µg/L
Mercury	Hg	0.01	µg/L
Molybdenum	Mo	0.05	µg/L
Nickel	Ni	0.02	µg/L
Phosphorus	P	2	µg/L
Potassium	K	0.05	µg/L
Selenium	Se	0.04	µg/L
Silicon	Si	100	µg/L
Silver	Ag	0.005	µg/L
Sodium	Na	0.05	µg/L
Strontium	Sr	0.05	µg/L
Thallium	Tl	0.002	µg/L
Tin	Sn	0.01	µg/L
Titanium	Ti	0.5	µg/L
Uranium	U	0.002	µg/L
Vanadium	V	0.2	µg/L
Zinc	Zn	0.1	µg/L

## 2.2 Waste Material Sampling Program

During the 2007 bulk sampling program, approximately 10,000 tonnes of material was extracted, of which only 4,200 tonnes has been processed to date. Therefore, ore, waste and tailings materials are currently available for collection and analysis. Examination of existing waste materials that have been generated using the same techniques to be used for the 2009 mining program is advantageous because it provides site specific information on the actual materials that will be generated during operations. The waste material sampling program will comprise:

- 15 samples representative of existing materials produced during the 2007 bulk sample program, including both ore and waste rock (~5 kg each);
- 30 samples from exploration drill holes representative of material to be extracted during future development at the Yellowjacket Project (2 – 4 kg each); and
- 3 samples of tailings generated from the processing plant (2 – 4 kg each).

Existing ore and waste rock samples will be sieved at the lab, with the < 2 mm fraction being analyzed separately from the remainder of the sample. This will provide important information on the ARD and metal leaching characteristics of the most reactive fraction of materials that were produced as part of the bulk sampling program. These data, together with the drill hole samples from future development areas and field leach bin drainage chemistry (discussed below), will permit robust predictions of the potential impact of future waste materials generated at the Yellowjacket Mine site.

For budgeting purposes, it is assumed that Prize Mining personnel will collect the 30 drill hole samples selected by Lorax. Samples of existing materials will be collected during the field bin construction site visit by Lorax personnel. All samples will be submitted for static characterization, including acid-base accounting (ABA; paste pH, total sulphur, sulphate sulphur, sulphide sulphur, total carbon, total inorganic carbon, siderite corrected Sobek neutralization potential (NP) and multi-element geochemistry (aqua-regia leach). As well, a suite of samples will be submitted for mineralogical investigation in order to more clearly determine the source and abundance of NP mineralization in Yellowjacket Zone materials.

## 2.3 Field Leach Bin Program

Due to the fact that the mine footprint is located on highly porous and permeable placer gravels, the collection of drainage from these materials is not possible. Therefore, field-

based kinetic tests will be conducted in order to collect and monitor the quality of contact water draining from the waste stockpiles at the Yellowjacket site. The proposed field-based kinetic tests will utilize plastic bins, constructed of barrels approximately 0.6 m in diameter by 0.8 m high, to mimic natural weathering reactions (Figure 1). Field leach bin experiments are advantageous because they more closely resemble the actual conditions present with natural waste piles, including site-specific climatic conditions, scale, grain size, and water-rock ratios. As well, field leach bins are an inexpensive way to provide long-term monitoring of water quality from geologic materials.



**Figure 1: Example of field leach bin experiment set-up.**

Based on review of the Yellowjacket Property Bulk Sample Waste Characterization Program (Lorax 2006), approximately four to eight field weathering bins will be constructed at site and will include the main waste lithologies determined from review of mine plans and geologic information along strike of the Yellowjacket Fault Zone. As well, depending on the finalized mine plan, experiments using ore and/or tailings materials may be constructed in order to obtain drainage chemistry data from these materials. However, details of these experiments will be finalized after discussion with Prize Mining and review of all available geologic and site information. It should be noted that the budget developed for this project assumes that only one Lorax scientist will be conducting the site visit, and any field assistance required will be provided by local contractors or Prize Mining personnel. As well, construction of the cribs (wooden structures holding the field leach bins in Figure 1) prior to the arrival of Lorax at site will

ensure that project costs are kept down by helping to limit the amount of time needed for the site visit. Detailed plans, including building materials and measurements, will be provided.

### **3.0 Reporting**

The results from each phase of the three components will be compiled into a separate report. However, due to the long term nature of the field-based kinetic testing, an annual report will be produced that summarizes all previous data together with recommendations for the following years monitoring. The number of report copies requested will be bound and distributed to the site; in addition, an electronic copy of the report will be included with the submission. Any comments, suggestions or additions requested by the client will be incorporated and final hard copies will be compiled, bound and submitted accompanied by the associated digital files.

### **4.0 Budget**

The total proposed budget for professional fees and disbursements for the 2009 Yellowjacket Water Quality and Waste Sampling Program is \$72,660 (Table 3), of which \$65,660 is for professional fees and \$7,000 is for disbursements. In the interest of saving costs, analytical expenses, estimated at \$48,240, will be billed directly from the laboratories to the client; therefore, the total provided in Table 3 does not include analytical costs. Also note that the total provided does not include applicable taxes.

**Table 3:  
Budget for the 2009 Yellowjacket Water Quality and Waste Sampling Program.**

Phase	Description	unit	# units	unit rate	total	Item Total
1	<b>Surface Water Quality Monitoring Program</b>					
	• <i>Professional Fees</i>					
	Development of WQ monitoring program	hours	16	\$ 150	\$ 2,400	
	Liaison/meetings with regulators	hours	8	\$ 150	\$ 1,200	
	Laboratory Liaison and sample logistics	hours	16	\$ 135	\$ 2,160	
	Data Review and Management	hours	24	\$ 100	\$ 2,400	
	Interim TAR report preparation	hours	32	\$ 135	\$ 4,320	
	Final Report production	hours	32	\$ 135	\$ 4,320	
	Senior Review	hours	16	\$ 150	\$ 2,400	
	Drafting	hours	8	\$ 75	\$ 600	
	Support, report formatting and compilation	hours	8	\$ 50	\$ 400	
	Project Management	hours	8	\$ 150	\$ 1,200	
	Subtotal				\$ 21,400	\$ 21,400
	• <i>Disbursements</i>					
	phone/fax, report preparation				\$ 500	\$ 500
Subtotal				\$ 500	\$ 500	
• <i>Analytical Fees*</i>						
water sample analysis (see proposed sampling schedule in text)	sample	89	\$ 280	\$ 24,920	\$ 24,920	
Subtotal				\$ 24,920	\$ 24,920	
2	<b>Geologic Materials - static testing</b>					
	• <i>Professional Fees</i>					
	Review of geology and mine plans	hours	8	\$ 135	\$ 1,080	
	Selection of drill hole samples and preparation of sampling memo	hours	8	\$ 135	\$ 1,080	
	Lab liaison/data management	hours	8	\$ 135	\$ 1,080	
	Liaison/meetings with regulators	hours	8	\$ 150	\$ 1,200	
	Data Review and Analysis	hours	24	\$ 100	\$ 2,400	
	Report production	hours	40	\$ 135	\$ 5,400	
	Senior Review	hours	8	\$ 150	\$ 1,200	
	Drafting	hours	8	\$ 75	\$ 600	
	Support, report formatting and compilation	hours	8	\$ 50	\$ 400	
	Project Management	hours	8	\$ 150	\$ 1,200	
	Subtotal				\$ 15,640	\$ 15,640
	• <i>Disbursements</i>					
	phone/fax, report preparation				\$ 500	\$ 500
Subtotal				\$ 500	\$ 500	
• <i>Analytical Fees*</i>						
sample prep	sample	63	\$ 10	\$ 630		
Acid-base Accounting	sample	63	\$ 120	\$ 7,560		
Multi-element geochemistry	sample	63	\$ 20	\$ 1,260		
Grain Size Analysis	sample	15	\$ 50	\$ 750		
Mineralogy	sample	15	\$ 300	\$ 4,500		
Subtotal				\$ 14,700	\$ 14,700	
3	<b>Field Leach Bin Program</b>					
	• <i>Professional Fees</i>					
	Design and Prep	hours	16	\$ 135	\$ 2,160	
	Site visit (sample collection + bin construction)	hours	60	\$ 135	\$ 8,100	
	lab liaison/data management	hours	16	\$ 100	\$ 1,600	
	Data Review and Analysis	hours	16	\$ 100	\$ 1,600	
	Interim TAR report preparation	hours	32	\$ 135	\$ 4,320	
	Annual Report production	hours	24	\$ 135	\$ 3,240	
	Senior Review	hours	16	\$ 150	\$ 2,400	
	Client/regulator Liaison	hours	16	\$ 150	\$ 2,400	
	Project Management	hours	8	\$ 150	\$ 1,200	
	Drafting	hours	16	\$ 75	\$ 1,200	
	Support, report formatting and compilation	hours	8	\$ 50	\$ 400	
	Subtotal				\$ 28,620	\$ 28,620
	• <i>Disbursements</i>					
Air, transport, accomodation, food				\$ 4,000		
Shipping				\$ 1,000		
Field Supplies				\$ 1,000		
Subtotal				\$ 6,000	\$ 6,000	
• <i>Analytical Fees*</i>						
sample prep	sample	8	\$ 10	\$ 80		
Acid Base-Accounting	sample	8	\$ 120	\$ 960		
Multi-element	sample	8	\$ 20	\$ 160		
particle size analysis	sample	8	\$ 50	\$ 400		
Field bin leachate analysis (8 bins x 6 samples)	sample	48	\$ 150	\$ 7,200		
Subtotal				\$ 8,800	\$ 8,800	
	<b>Total</b>					<b>\$ 72,660</b>

\* Analytical fees are not included in the total

## **References**

Lorax (2006). Yellowjacket Property Bulk Sample Waste Characterization Program.  
Prepared for Prize Mining Corp by Lorax Environmental Services, Inc., June  
2006.