# Bonito Capital Corp.

A wholly owned subsidiary of Elgin Mining Inc.

# **Ulu Gold Project**

Nunavut, Canada

# Sewage Treatment Plant Operation and Maintenance Plan

March 2013

Bonito Capital Corp.
Elgin Mining Inc.
#201 - 750 West Pender Street
Vancouver, BC, V6C 2T7

# **Executive Summary English**

This Sewage Treatment Plant Operations and Maintenance Plan (Plan) has been prepared by Bonito Capital Corporation (BCC), a wholly owned subsidiary of Elgin Mining Inc. (Elgin) for the Ulu Exploration Project (Project) in accordance with its Water Licence 2BM-ULU0914 (Licence). The Project site is located in the Kitikmeot region of Nunavut approximately 12 km north of Hood River and 150 km north of Lupin Mine and has been in a state of care and maintenance since 2006.

Sewage and domestic wastewater from the camp facility is treated using a Rotating Biological Contactor (RBC) process. The treatment system is an aerobic, fixed-film biological treatment process designed to remove both Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) from the wastewater. Treated sewage effluent that meets the discharge criteria set out in the water license is discharged to East Lake via a 550 metre, insulated two-inch pipeline. Design conditions for the sewage treatment unit are based on 40 camp residents. During the camp start-up phase, the final effluent from the sewage treatment plant will be directed to the mine sump containment pond and held there until results from water quality monitoring are acceptable and approval is received from AANDC to discharge to East Lake. The effluent contained in the mine sump containment pond will then be directed to the STP primary clarifier for final treatment process.

Based on the design loadings of the treatment unit it is estimated that approximately 0.02 m<sup>3</sup>/day of sludge will accumulate in the RBC treatment unit. This volume of sludge production will require pump out twice per year and will be disposed of on-site in a shallow above-ground sump, covered with rock.

Routine operation and maintenance procedures include visual inspections and RBC effluent quality measurements. Non-routine operation and maintenance procedures will be carried out as needed to deal with sewage sludge, and system shut down and start-up. Treated effluent will be sampled on a monthly basis in accordance with the Licence and detailed records of maintenance activity, sampling and analytical results will be maintained.

This Plan summarizes potential operational problems, causes and corrective actions developed by the RBC manufacturer as well as a list of "Do's" and "Don'ts" to help ensure smooth operation of the unit. In the event of a failure of the system, emergency response procedures are also outlined in this Plan.

# **Executive Summary Inuktitut**

Awaiting translation – to be	e provided as soon as possik	ole



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#### 1. Introduction

The purpose of this plan is to guide the operations and maintenance activities associated with the sewage treatment facility located at BCC's Ulu project camp. The contents of this plan are based on "Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories" (NWT 1996) and address conditions included in Water License 2BM-ULU0914 issued by the Nunavut Water Board (Part H, Item 2).

#### 1.1.General Site Information

The Ulu project is located approximately 150 kilometres north of Lupin Mine (Figure 1) on Inuit Owned lands within the Hood River watershed in the Kitikmeot region of Nunavut at longitude 110°58'W and latitude 66°55'N. The site is located in the arctic tundra where rock and glacial features dominate the landscape. It is accessible year-round by aircraft only. Historically, bulk items were brought on site via winter road. During current exploration activity, day to day supplies are flown to the site. The area is characterized by severe climate with typical temperatures ranging throughout the year between —50°C in winter to +30°C in summer. Permafrost in this area generally extends to several hundred metres.

The Ulu Project site is completely self-contained with the exception of the transportation requirements for materials/supplies and workforce mobilization. There are three (3) main location areas as shown in Figure 2:

- <u>Ulu Camp</u>, which houses the residential complex consisting of Weatherhaven accommodations, vehicle repair shop, vehicle parking, power house, emergency generators, office and change rooms, fuel storage tank farm, freshwater system, sewage treatment plant and sewage line, incinerator, ore storage area, waste pad, mine portal, mine sump, and access roads as shown in Figure 3;
- 2. <u>Camp 3</u>, which is comprised of fuel tank farm, explosives magazine, detonator magazine, quarry and borrow pit eskers; and
- 3. Airstrip

Figure 1: Ulu Project Location Map



Figure 2: Main Areas Ulu Site

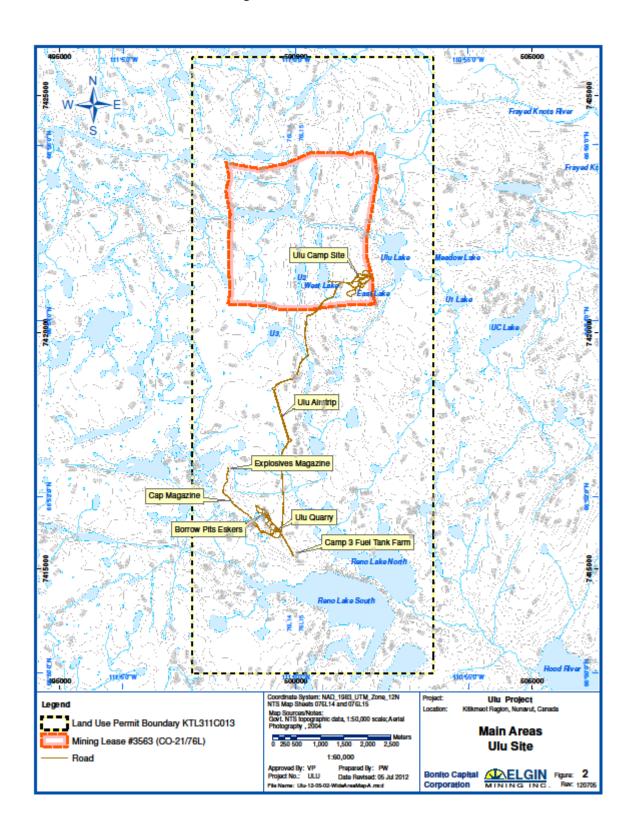
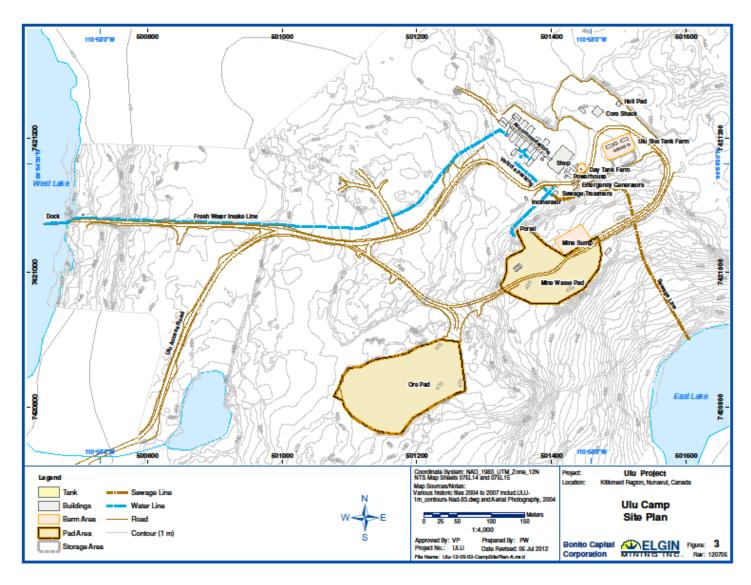


Figure 3: Ulu Mine Site Plan



# 2. Background

Echo Bay Mines Ltd. purchased the Ulu site lease from BHP in 1995 with the intent to develop the property into a satellite mine for additional feed to the Lupin mill. An underground development, diamond drilling, and bulk sample program was initiated in 1996 to provide infill geological information. Echo Bay temporarily shut down the Ulu Project site in September 1997. Wolfden Resources purchased the Ulu Project in February 2004. Elgin Mining purchased the property in July 2011.

Drinking water for the camp site is obtained from West Lake via an insulated two-inch pipeline approximately 680 metres in length (Figure 3). Water is pumped from the lake using a 7 hp submersible electric pump installed on a floating dock. Two water storage tanks are present at the site; a 27,000 litre tank for general water use and a 63,000 litre tank for fire water storage. Water consumption for camp and exploration purposes is expected to be less than 100 m<sup>3</sup> per day.

Sewage and domestic wastewater from the camp facility is treated on-site using a Rotating Biological Contactor (RBC) process. The treatment system, described in more detail in Section 3, is an aerobic, fixed-film biological treatment process designed to remove both Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) from the wastewater. During the start-up phase, the final effluent from the sewage treatment plant will be directed to the mine sump containment pond until the results of the water quality monitoring data shows that it meets discharge criteria and approval is obtained from AANDC to re-direct the flow to East Lake via a 550 metre, insulated two-inch pipeline (Figure 2). Design conditions for the sewage treatment unit are based on 40 camp residents and include the following design parameters:

Peak day hydraulic capacity: 11.4 m3 /day

Peak hour hydraulic capacity: 1.9 m3 /hour

BOD influent concentration: 250 mg/L

TSS influent concentration: 250 mg/L

BOD effluent concentration: 25 mg/L

TSS effluent concentration: 25 mg/L

Upon re-direction of the flow from the sewage treatment plant, the effluent contained in the mine sump containment pond will be decanted to the STP primary clarifier for processing.

# 3. Sewage Treatment Facility Operation and Maintenance

#### 3.1. Site Drainage and Hydrology

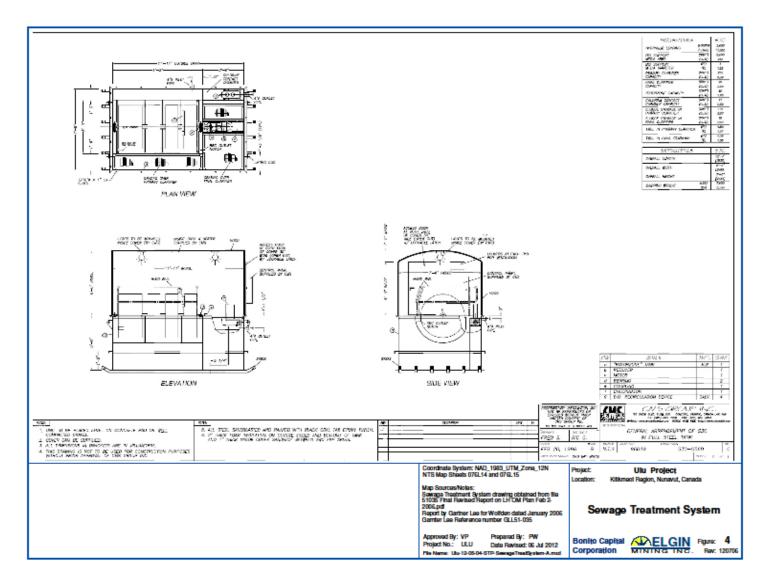
Treated sewage effluent is discharged to East Lake, as illustrated in Figure 3. The 1.8 ha lake also receives surface water runoff from the camp site area. There are no defined inlet or outlet streams associated with the lake. However, some subsurface drainage from East Lake to Ulu Lake is expected to occur. The lake has a maximum water capacity of 40,900 m³, corresponding to a maximum water depth of 6.2 metres. The small size and isolated position of the waterbody, and barriers to fish passage are assumed to preclude the existence of fish in East Lake. In 2005, gill nets were installed in East Lake to determine whether the lake contained fish but none were encountered.

#### 3.2. Treatment System Description

The sewage treatment plant employed at this facility is a skid-mounted Rotordisk<sup>TM</sup> system (Model S30) supplied by Seprotech Systems Incorporated (Figure 4). The fully-contained system is comprised of a primary settlement tank, a Rotating Biological Contact (RBC) tank, and a secondary settling tank.

Raw sewage is pumped into the primary settlement tank (6.09 m³ capacity), whereby heavy solids are retained through gravity settling and thickening. Supernatant from the primary settlement tank enters the RBC tank (1.70 m³ capacity) through an inlet slot located at the front section of the RBC tank. The RBC tank is made up of four stages, or disk banks. The four separate disk banks are mounted on a common rotating shaft. As the disk banks are only partially submerged, the rotation serves to provide continual aeration for the fixed film biological growth and filtering process (which occurs on the disk banks). The first disk bank represents 40% of the total RBC surface area and is responsible for the most significant reduction in BOD. Subsequently, the accumulation of biological growth will be the greatest on the first disk bank and gradually decrease through subsequent sections. The growth will be generally thick and often filamentous on the first disk bank, becoming thinner and more compact on stages 2 through 4. Under certain operating conditions, nitrifying bacteria may become dominant in the third and fourth disk banks. The fourth disk bank has a recirculation device that allows well-aerated liquid to be recycled to the primary settlement tank. Treated water from the RBC enters the secondary settlement tank (2.69 m³ capacity), whereby biomass sloughed from the disks and other suspended solids settle through gravity. Clarified effluent is discharged from the treatment unit through a 4-inch outlet pipe.

**Figure 4: Sewage Treatment System** 



# 3.3. Operation and Maintenance Responsibilities

The Site Manager, under the supervision of the Project Manager, will conduct all operation and maintenance activities associated with this facility (described in Section 3.4). Contact information is provided below:

Project Manager (Wayne Osborne)

867-446-9860

#### 3.4. Operation and Maintenance Procedures

Both routine and non-routine operating and maintenance (O&M) procedures are described in the subsections below.

#### 3.4.1. Routine **0&M**

The following procedures associated with operation and maintenance of the sewerage facilities will be performed on a daily basis while the camp is in operation:

- visual inspection of RBC unit;
- visual inspection of camp kitchen grease trap;
- visual inspection of effluent pipeline and heat trace checks along the pipeline;
- visual inspection of the pump station at the main camp; and
- field measurements of RBC effluent (pH, temperature, dissolved oxygen).

Prior to inspecting the RBC unit the operator will ensure the unit is well ventilated and appropriate personal protective gear, including disposable gloves, is worn. During daily visual inspections of the RBC unit, attention will be paid to the nature of the biological growth on the disk media. The colour of the growth will typically be dark brown to black on the first disk stage. The growth on disks 2-4 will typically range between medium brown to tan on the final section. Unusual discolouration/texture of the disk media growth or strong sour odours could be indicative of process malfunction. A troubleshooting guide is provided in Section 3.7.

Mechanical maintenance of the RBC unit, including lubrication of the shaft bearings, will be conducted on a monthly basis.

#### 3.4.2. Non Routine O&M

Non-routine O&M procedures will be performed associated with the following system needs:

- sewage sludge management;
- unit startup; and
- unit shutdown.

It is expected that sewage sludge will be removed from the primary and secondary settlement chambers of the RBC unit on a twice per year basis. The total sludge capacity of the treatment unit (both settlement chambers) is 3.47 m<sup>3</sup>. The accumulation of sludge can be indirectly monitored by visually observing the thickness of the scum blanket on the surface of the primary settlement tank. When the scum blanket has grown to a height of approximately 25 cm, it is a good indication that sludge accumulation is near the capacity of the treatment unit, and sludge withdrawals are required.

Special start-up procedures must be followed if the RBC unit has been out of operation. These procedures are briefly summarized below:

- support bearings on shaft and coupling re-lubricated;
- primary settling tank should be filled with fresh water;
- while the RBC is rotating, introduce wastewater at design or less than design loading rates; and
- unit start-up normally requires 2½ to 3 weeks, with 50% BOD removal often occurring after one week.

Shutdown procedures are necessary if the treatment unit is to be taken out of operation for any significant period of time. These procedures are briefly summarized below:

- remove all accumulated sewage sludge from settlement chambers;
- clean disk media and flush unit clean; and
- drain tanks and pipes and disconnect pipes.

# 3.5. Sampling Procedures

Treated wastewater effluent will be sampled on a monthly basis at the Monitoring Program Station location ULU-2 (discharge point at East Lake) as defined in the water license. Collected samples will be analyzed for the following parameters:

- Fecal coliforms
- BOD<sub>5</sub>
- Total suspended solids
- pH (measured at time of sampling)
- Temperature (measured at time of sampling)
- Conductivity (measured at time of sampling)
- Total Nitrogen
- Total Kjedahl Nitrogen
- Nitrate
- Nitrite
- Total phosphorus
- Total dissolved phosphorus
- Total Nitrogen

All analyses will be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation will be current and in good standing. All sampling, sample preservation and analysis will be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater".

# 3.6.Record Keeping

On-site records will be maintained incorporating the following information:

- maintenance record:
  - daily;
  - o monthly;
  - o non-routine (including start-up, shutdown, upsets, sludge withdrawals);
- date and volume of sewage sludge removed from treatment unit;
- · sampling dates and times; and
- analytical results of effluent sampling (location ULU-2).

### 3.7.Troubleshooting

The RBC manufacturer has developed a list of potential operational problems, causes and corrective actions. This information is summarized in Table 1.

Table 1: Rotordisk® Process - Rotordisk® Troubleshooting Guide

Problem	Cause	Corrective Action
Slime on media appears     shaggy with a brown     colour	PROPER OPERATION	NO PROBLEM NORMAL CONDITION
2. Black slime growing on disks	Solids and/or BOD overloading	<ul> <li>a. Pre-aerate RBC influent</li> <li>b. For severe organic overloads, increase recycle rate</li> <li>c. De-sludge unit</li> <li>d. Place another RBC unit in parallel</li> </ul>
3. Rotten egg or other obnoxious odors	Solids or BOD overloading	See Problem 2, solutions a, b, c and d, above
4. Development of odors and white biomass over most of the media surface	Septic influent wastewater or high hydrogen sulfide or sulfate concentration	a. Determine the cause of the problem and correct it at source. For example, aerate equalization tank b. Pre-aerate influent wastewater c. Determine the cause of the problem, possibly with the addition of chlorine or hydrogen peroxide: potassium permanganate has also been used

Problem	Cause	Corrective Action
	2. Overload first stage	a. Check dissolved oxygen levels to confirm overload problem b. Provide a larger amount of surface area for the first stage treatment by removing baffle c. Increase number of recycle buckets
5. White slime	Bacteria that feed on sulfur compounds. Also, industrial discharges containing sulfur compounds may cause an overload	See Problem 2, solutions a, b. and c above
	2. Grease on the disks	a. Remove grease at source b. Install grease traps
6. Sloughing or loss of slime (biomass)	Toxic or inhibitory substances in influent, including abrupt pH changes	a. Eliminate source of toxic or inhibitory substances b. Reduce peaks of toxic or inhibitory substances by carefully regulating inflow to plant c. Dilute influent using plant effluent or any other source of water d. See Problem 7.4
	Variation in flow or organic loading	a. During low flow or loading periods, pump from secondary clarifier or 4th stage RBC unit effluent to recycle water with food and dissolved oxygen through the RBC unit  b. During high flow or loading conditions. attempt to throttle plant inflow during peak periods  c. For severe organic overloads, remove bulkhead or baffle between stages 1 and 2
7. Decrease in process efficiency	1. Reduced wastewater temperature  2. Unusual variations in flow or organic loading  3. Sustained flows or loads above design levels  4. High or low pH values  5. Improper rotation of media	<ul> <li>a. Decrease air opening in RBC building</li> <li>b. Heat air inside RBC unit cover or building</li> <li>See Problem 6, cause 2. solutions a. b, and c above</li> <li>Install additional treatment units</li> <li>Adjust pH to near neutral</li> <li>Inspect chain tension and adjust</li> </ul>

Problem	Cause	Corrective Action
8. Accumulation of	Solids removal in pre-	a. Improve pre-treatment efficiencies
solids and	treatment steps is not	<b>b.</b> Provide supplemental aeration to
clogging in the	adequate	help prevent solids from settling
RBC system		c. Move baffles to change flow patterns
,		to reduce settling (if the problem is
		serious, the RBC wastewater tank may
		have to be pumped or cleaned out)
		d. De-sludge primary tank
9. Floating or rising	Removal of sludge from	a. Improve pre-treatment efficiencies
sludge in the	the clarifier is	<b>b.</b> Remove sludge from the clarifier
secondary	inadequate	more often
clarifier		
ciarine		
10. Excess shaft	1. Organic loading too	Decrease organic loading
weight or	high	a. Remove baffles between units to
biomass thickness	2. Stage loading too high	increase size of treatment stages
	3. Shaft speed too low	<b>b.</b> Increase number of recycle buckets
	4. Inorganic solids	Increase shaft rotational speed by
	accumulation because	adjusting drive ratio
	of inadequate	Check primary treatment and grit
	pretreatment	removal
	5. Accumulation of	Equipment for proper operation
	minerals	Use chemical pre-treatment to eliminate
	6. Digester supernatant	minerals
	adding excessive BOD	
	or sulfides	Modify supernatant pumping
	or surrides	frequency
11. Shaft rotation	1. Normal variations in	Time rotation by quarters. A
non-uniform or	balance	difference of less than 3 seconds in
"jerky"		quarter rotation time is normal
Jenny	2. Uneven biomass weight	a. If severe, shut unit down and wash
	due to power outage	down disks
	auc to power outage	b. Turn off the unit temporarily and
		rotate manually to uniformly wet
		biomass growth before restarting
		c. Decrease or stop flow of wastewater
		to affected units
		d. Contact manufacturer for assistance

Problem	Cause	Corrective Action
12. Effluent quality	1. Organic loading too	a. Add additional operating RBCs
apparently below	high	<b>b.</b> Identify cause of additional loading
requirements		and eliminate at source
	2. Sampling or testing	c. Add supplemental air to RBC trough
	procedures inaccurate	a. If nitrification is occurring, analyze for
	2 1 - 1 1 1 1	carbon BOD only by using nitrification
	3. Inadequate secondary	inhibitor
	clarifier operation	<b>b.</b> Check for contaminated dilution water, sampler lines, or improper
	4. Anaerobic solids in the	sampling storage
	RBC tanks producing	a. Clean and de-sludge clarifier
	BOD kickback	<b>b.</b> Modify sludge removal procedures to
		eliminate BOD kickback
		c. Install BUGS filter after clarifier
		Flush or drain tanks
42 Coolle on other	Ni. Anizi a na la na sina na na na	Addition of controlled decrees of
13. Snails or other	Nutritional environment conducive for	a. Addition of controlled dosages of
nuisance		chlorine. Physical removal may be
organisms in RBC tanks	reproduction of hard-	required with taking units out of
tanks	bodied shell snails (1/8"	service temporarily
	- 1/2 " in size)	<b>b.</b> Contact manufacturer

#### 3.8.Good Practices Checklist

The following list of "Dos" and "Don'ts" are supplied by the RBC manufacturer to help ensure smooth operation of the treatment unit. This list will be posted in areas of the camp where the possibility of inappropriate deposit of materials exists.

#### DOs

- 1. Do use biodegradable soap if at all possible. The system will however handle a certain amount of normal soap. When laundering clothes, please follow manufacturer's instructions regarding quantity of detergent. Excessive use of detergent can cause odour in the system.
- 2. Do put large amounts of grease in a container and dump in garbage. The system will handle a certain amount of fat and grease. Never put large amounts of grease (i.e. old grease from deep fryer) into the sewer lines.

#### DON'Ts

- Do not put non-biodegradable materials down the drain, put them in the garbage; these include any plastics, rubber, disposable diapers, sanitary napkins, rubber goods, cigarettes, cellophane, etc.
- 2. Do not put harsh chemicals down the drain. They will kill the bacteria necessary for efficient treatment. These include acid or caustic cleaners, gasoline, oil, turpentine, photographic chemicals, etc. Disinfectant and chlorine bleaches should be kept to domestic uses.
- 3. Do not leave taps or faulty toilets running. The excess water may overload the system.
- 4. Do not connect any other electrical load to the fuse or breaker feeding the plant as it will cause damage to the controls.
- 5. Never put large amounts of grease (i.e. old grease from deep flyer) into the sewer lines.

# 4. Sludge Management and Disposal

Based on the design loadings of the treatment unit (50 camp residents) it is estimated that approximately 0.02 m³/day of (gravity thickened) sludge will accumulate in the RBC treatment unit. This volume of sludge production will require pump out twice per year based on the primary settlement chamber capacity. Assuming the Ulu camp operates eight months of the year, it is estimated that approximately 5 m³ of gravity thickened sludge will be generated in the treatment unit on a yearly basis. The bulk of the sewage sludge will be generated in the primary settling tank at an expected solids content of up to 10% by weight. Sewage sludge settled in the final settlement tank is expected to have a lower solids content (up to 5% by weight).

As discussed in Section 3.6, records will be kept of sewage sludge volumes removed from the treatment unit and disposed of on-site. These records will be included in the annual report to the Nunavut Water Board, as specified in the water license.

Sewage sludge will be disposed of on-site in a shallow "above-ground sump". The same area will be used for each deposition of sludge in order to consolidate the waste into one area of the camp. This sump will be signposted noting the potential exposure hazards and will be located within the site disturbance area, above the high water mark of any waterbody and no closer than 31 metres from any waterbody. Deposited sewage sludge will be covered by waste rock that has been determined to be non-acid generating and non-metal leaching.

# **5. Emergency Response**

The Sewage Treatment System is checked on a regular basis; however, should a failure occur all overflow/releases would report directly to East Lake basin. Problems with the collection system and piping would be a little more widespread as the camp area has been maintained quite level with a few small depressions and appropriate grading for miscellaneous collection.

Release from East Lake occurs naturally and flows toward Ulu Lake. The majority of flow after spring melt is considered to take place among the boulders in the outflow channel and below surface. Tentative plans during final construction include the addition of a containment berm to provide an additional barrier prior to reaching Ulu Lake.

If a failure should result along the heat traced two (2) inch pipeline between the camp and East Lake, a shutdown of the system would be required and repairs undertaken. The effluent in the sump, if mixed with mine water would be analyzed prior to discharge to the environment, and only upon NWB approval. Ten (10) days prior any discharge, the AANDC Inspector would be notified.

Appropriate response team action would have repairs completed to the satisfaction of the supervisor in charge and effluent returning directly to East Lake.

**Table 2: Response Plan for Sewage System Failure** 

24 HOUR CRILL REPORT		
24 HOUR SPILL REPORT LINE	(867) 920-8130	
INITIAL SPILL RESPONSE	<ul> <li>Notify the Project Manager or designate immediately via radio, phone or in person and initiate the response team;</li> <li>Spill reported via the 24 hour emergency spill line, above;</li> <li>If necessary, direct the initiation of shut down procedures for the pumping system in order to STOP the flow of sewage through to the environment (East Lake). If the failure is piping related, the sewage discharge will be shut down. Provisions, if in place may provide an alternative/temporary disposal to the mine portal sump for storage;</li> <li>A detailed spill report shall be submitted.</li> </ul>	
HAZARDS	<ul> <li>The sewage stream from the site contains grey water from all sources (drys, all accommodation and shower facilities, kitchen and all washroom facilities on site).</li> <li>There are no chemicals used in the process;</li> <li>Due to the nature of the source, health risks are associated with bacterial infections and disease that may be transmitted through exposure.</li> </ul>	
ACTION FOR FIRE	Non-flammable	
RECOVERY	<ul> <li>Ground contamination; any sewage material that has escaped from the containment areas onto surrounding tundra shall be removed, where possible and disposed of within the designated area for burial of sewage sludge;</li> <li>If required, esker material and/or crushed wasted rock shall be used to fill any depressions left after excavation of the spill material.</li> <li>Solutions, where contained shall be pumped back into the sewage treatment system or sampled and released if suitable;</li> <li>Water contamination; these areas are difficult to mitigate as movement of contaminated material (and water) may continue long after the initial incident;</li> <li>Local authorities should be contacted regarding advice for cleanup or additional work to be carried out. AANDC Water Resources, Env. Can., Dept. of Fisheries and Oceans.</li> </ul>	
DISPOSAL	<ul> <li>Contaminated materials are to be stored until disposal within the designated sewage sludge disposal area.</li> </ul>	
PROPERTIES	<ul> <li>The exploration site sewage system contains a mixture of camp waters including camp drys, accommodation washroom facilities and kitchen.</li> <li>Water accounts for greater than 90% of the component which is used during day to day activities;</li> <li>The remainder is organic solids which are treated within the package facility.</li> </ul>	

ENVIRONMENTAL CONCERNS	•	Solution only mildly toxic to fish and other aquatic organisms due to the low dissolved oxygen that may occur due to biological loading; Effluents could contain minor amounts of nutrients (nitrogen and phosphate components) that may promote plant growth in downstream water bodies.
CONTAINERS	•	N/A
SUPPLIER	•	N/A

#### 6. References

Letter from C. Spagnuolo, Environment Canada, to P. Beaulieu, NWB, Re: NWB1ULU0008 – Wolfden Resources Ltd. – Ulu Advanced Exploration Project Revised Sewage Treatment and Solid Waste Disposal Operation and Maintenance Plan, Revised, dated March 20, 2006.

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