Appendix D

Treated Water Infiltration System - Discharge Management Plan

(Appendix J of Application sent to MDEQ)

Application

Kennecott
Eagle Minerals

Eagle Project
Michigamme Township –
Treated Water Infiltration System
Discharge Management Plan

Project No.: 04W018

Kennecott Eagle Minerals Company
Marquette, Michigan

April 2006

Foth

Eagle Project

Michigamme Township - Application for Mineral Extraction Permit

Project ID: 04W018

Prepared for

Kennecott Eagle Minerals Company

ISO 14001:2004 Registered System

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Eagle Project
Michigamme Township -
Treated Water Infiltration System
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1 Purpose

This Discharge Management Plan is intended to be used by the operation staff to aid in operating and managing the treated wastewater infiltration system (TWIS). Detailed operation procedures will be available in the operation and maintenance manual.

2 Management of Treated Water Infiltration System

2.1 Design Basis

The TWIS is designed as a rapid infiltration system operated continuously. Wastewater will be distributed evenly over the TWIS area through a system of buried pipes (see Figure 1 and 2). The purpose of the TWIS is to provide a consistent means of returning treated water to the groundwater system.

Maximum Daily and Annual Discharge Volumes
The TWIS is designed for a maximum daily volume of 400 gpm (576,000 gpd). This flow rate was used in designing the footprint of the TWIS. The annual discharge volume will be less than the maximum daily amount and will average less than the design flow for the wastewater treatment plant of 350 gpm (504,000 gpd).

2.2 Application Rates

The selected average wastewater application rate is 0.5 feet per day. When this value is applied based on the design flow rate for the TWIS of 400 gpm (576,000 gpd or 77,000 cubic feet) the required area is 153,000 ft^2 (3.51 acres). Note that the design treatment application rate for the entire system is less than the allowable capacity of the subsurface based on the minimum measured infiltration rate at test pit QAL037. Based on data from QAL037 and R 323.2233 (4)(v) the maximum application rate for any given cell shall not exceed 10 gpd/ft^2.

2.3 Discharge Area

The area selected for groundwater infiltration is 150 feet by 1,020 feet for a total area of 153,000 ft^2. This area was determined by using the design flow rate and the design hydraulic application rate and calculating the required area. The groundwater infiltration is divided into five separate infiltration cells as shown in Figure 1.

2.4 Means for Even Distribution of Wastewater

Wastewater will be distributed over the infiltration cells by means of perforated pipe. The pipe contains engineered orifices to allow for the discharge of a precise amount of water from each orifice. The system design is based on orifices of 5/16 inch diameter that will discharge 2.7 gpm when subject to a pressure of 5 feet. The entire system is designed to limit the head loss in the header pipe segments to less than 10% of the pressure at the orifice. Once the system is pressurized, flow distribution will be even over the piping system with the flow being controlled by the pressure drop across the orifice.

The piping system is designed with laterals spaced 10 feet apart and the orifices spaced 10 feet apart. When the wastewater is discharged, it will flow downward and spread to achieve a uniform distribution over the entire application area. Figure 2 contains details on the piping and distribution system

2.4.1 Load and Rest Cycles

MDEQ regulations (R 323.2236) require that a minimum of two infiltration cells be used for the TWIS and that the cells be alternatively loaded and rested. For the Eagle Project the TWIS has five infiltration cells. During operations one cell will be rested each month. The other four cells will be used for the infiltration of treated water. Resting individual infiltration cells will allow the soil beneath the infiltration piping to drain. The prescribed resting schedule for the Eagle Project is provided in Table 1 and shall be followed by the operator:

Table 1
Schedule for Load Rest Cycles

Month	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5
1	**Rest**	Active	Active	Active	Active
2	Active	**Rest**	Active	Active	Active
3	Active	Active	**Rest**	Active	Active
4	Active	Active	Active	**Rest**	Active
5	Active	Active	Active	Active	**Rest**

[1]After the above cycle is complete the load and rest cycle is repeated. Per MDEQ the maximum application rate for any cell shall not exceed 324,500 gpd (10 gpd/ft^2). This is based on the minimum measured infiltration rate at test pit QAL037 and R 323.2233 (4)(v).

The operator will need to open the influent gate and open the discharge valve for each cell in operation. When a cell is rested, the operator will close the influent gate and close the discharge valve.

2.5 Strategies for Adverse Weather

The TWIS is designed for continuous operation in all weather. The wastewater distribution piping is buried at a depth to prevent freezing. The TWIS is elevated above the existing grade to allow surface water to runoff the infiltration area. A drainage ditch is installed around the perimeter of the TWIS to drain surface water away from the system. The operator will need to complete weekly inspections of drainage around the TWIS. If drainage obstructions are noted, such as woody debris, the operator shall remove the obstruction to allow normal drainage of storm water runoff.

2.6 Monitoring

The TWIS is designed to be simple to operate, maintain and monitor. The items to monitor and control are:

- Flow to the TWIS.
- Flow to each infiltration cell (based on number of dosing cycles).
- Water level in each dosing chamber including high level alarms.
- Infiltration cells in operation (based on position of isolation valves).

The above items will be monitored and controlled by a computer based System Control and Data Acquisition (SCADA) system. Data from the distribution chamber will be sent to a main computer system via direct wiring or radio transmitter. The main computer system will be able to monitor the status at the distribution chamber and control valves to isolate individual infiltration cells. The operator will need to monitor performance data from the SCADA system and respond to conditions outside of prescribed units per Section 2.7.

The operator will need to monitor water quality parameters necessary to maintain compliance with the discharge permit requirements. If any water quality parameters indicate a potential for non-compliance with the discharge permit requirements, treated water should be pumped back to the contact water basins.

In addition to monitoring the system operation, groundwater will be monitored to measure the groundwater levels in and around each cell. Observation pipes are installed in the infiltration cells to monitor water levels. Each observation pipe extends about two feet below the bottom of the infiltration system. The water level in the observation pipes shall be checked weekly to determine if water is ponding in the infiltration cells. Monitoring water levels in well QAL031D (Figure 1) will provide data on mounding in the aquifer directly adjacent to the facility. Well QAL031D is not a compliance well. Finally, compliance monitoring wells will be placed down gradient of the TWIS. Monitoring of the compliance monitoring well shall be completed in accordance with the conditions of the Groundwater Discharge Permit.

Figure 3 displays a schematic flow diagram for operations of the TWIS. In addition to monitoring effluent water quality as described above, the operator may find that the following conditions need to be addressed:

- **Unequal Flow to Infiltration Cells** – This situation results in uneven loading to the infiltration cells. The operator should check the valves and gates at each dosing chamber to make sure they are fully open and operating properly without leaks around the weirs. The operator should check the dosing siphon operation and repair or replace parts as needed. Check the weir elevations and adjust as necessary to have all weirs at the same elevation.

- **High Water Alarm in Dosing Chamber Cell** – This situation identifies a malfunction in the dosing chamber operation. The operator should check the dosing siphon operation and repair or replace parts as needed. The operator should check the valves and gates at each dosing chamber to make sure they are fully open and operating properly without leaks around the weirs. The downstream pipeline could be plugged and should be checked to verify it can flow at design capacity.

- **Infiltration Cells in Operation** – The infiltration cells in operation should be checked against the load and rest cycle chart and adjusted if necessary.

- **Observation Pipes** – There are a total of ten observation pipes in the TWIS. The observation pipes extend two feet below the bottom of the infiltration cells. If water is observed in the observation pipes and is persistent, the operator should determine the

cause of the high water level. The operator should check records to determine if the cell is hydraulically overloaded and fix the problem. The cell with the high water level should be rested. If the high water level persists, the system may need to be inspected. Potential causes for water in observation pipes are clogged soil or clogged piping. Inspecting and repairing the infiltration system will require the area to be excavated.

2.7 Scheduled Maintenance

The TWIS contains five separate discharge chambers and infiltration cells. Each discharge chamber and infiltration cell can be isolated for inspection and maintenance. Isolation will be done through valves and gates.

The infiltration system is designed to minimize maintenance and allow reliable operation. The discharge chambers have dosing siphons to control the water flow. These systems have no moving parts but the dosing siphons should be routinely inspected and cleaned to make sure all air and liquid passages are clear.

The infiltration cells will be monitored using the groundwater observation pipes to determine if water distribution is even and if there are any restrictions to infiltration. Water ponding in a cell will indicate a problem with the water distribution system or clogging of the soil. If physical repair is required, individual infiltration cells can be isolated for repair (as described in Section 2).

The flow meter and level sensors should be annually calibrated and maintained to provide consistent and accurate measurements.

2.7.1 Vegetative Cover Control and Removal

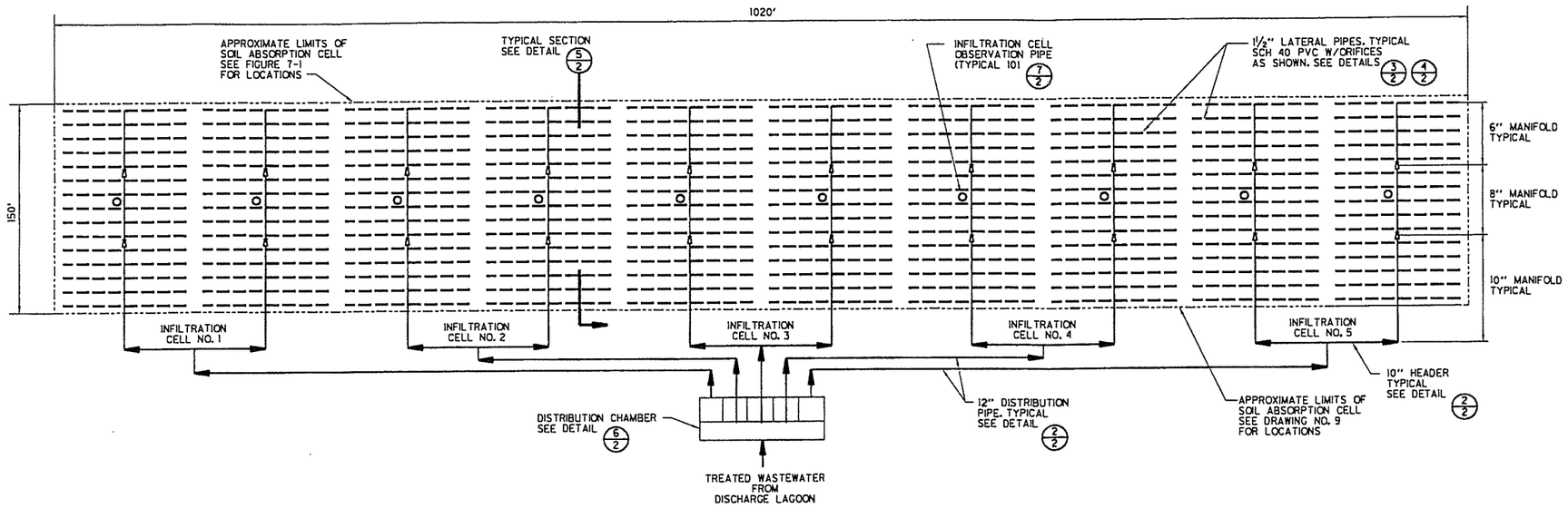
The TWIS will be designed for subsurface disposal. Vegetative cover will have no impact on the groundwater disposal rate or treatment of the groundwater. Vegetative cover will be important in providing winter protection from frost. The vegetation should be a perennial grass type.

Wastewater Characterization
The wastewater treatment plant will produce an effluent that meets the applicable discharge requirements. The wastewater characteristics are shown below in Table 2.

Table 2
Estimated Effluent Quality

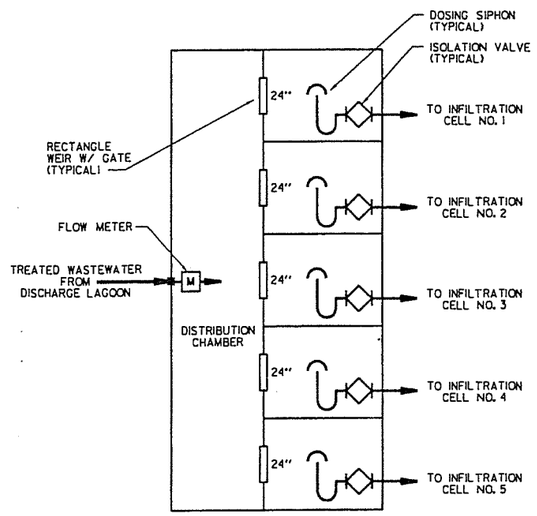
Parameter	Influent Wastewater	Effluent
Flow (gpm)	500	350
Aluminum, µg/l	140	1.9
Antimony, µg/l	19	1
Arsenic, µg/l	33	1.7
Barium, µg/l	28	1.4
Beryllium µg/l,	1.0	0.05
Boron, µg/l	3,671	174
Cadmium, µg/l	11	0.6
Calcium, µg/l	63,345	25
Chloride, µg/l	825,963	44,000
Chromium, µg/l	8.5	0.5
Cobalt, µg/l	652	9.2
Copper, µg/l	145	7.2
Fluoride, µg/l	706	41
Iron, µg/l	6,467	3.2
Lead, µg/l	9.0	0.5
Lithium, µg/l	85	4.2
Magnesium, µg/l	32,317	17
Manganese, µg/l	992	2.4
Mercury, µg/l	0.041	0.0021
Molybdenum, µg/l	21	1.1
Nickel, µg/l	33,403	4.9
Nitrogen (Ammonia), µg/l	10,163	2,328
Nitrogen (Nitrate), µg/l	50	30
Phosphorus, total	18.5	0.8
Potassium, µg/l	9,842	1,200
Selenium, µg/l	26	1.3
Silver, µg/l	4.3	0.2
Sodium, µg/l	411,536	30,000
Strontium, µg/l	2,031	95
Sulfate, µg/l	167,099	1,700
Thallium, µg/l	7.1	0.4
Vanadium, µg/l	6.3	0.3
Zinc, µg/l	351	18

Prepared by: JJF1
Checked by: HJA



1/2 TREATED WATER INFILTRATION SYSTEM - SCHEMATIC

NOT TO SCALE



6/2 DISTRIBUTION CHAMBER

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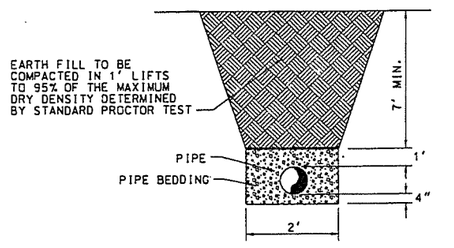

2/2 TYPICAL TRENCH SECTION FOR BURIED PIPELINES

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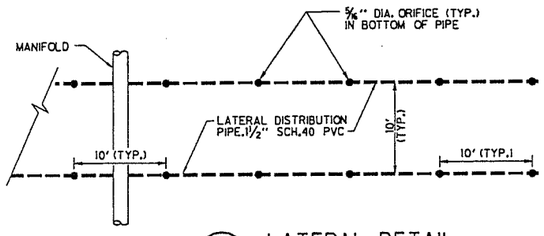

3/2 LATERAL DETAIL

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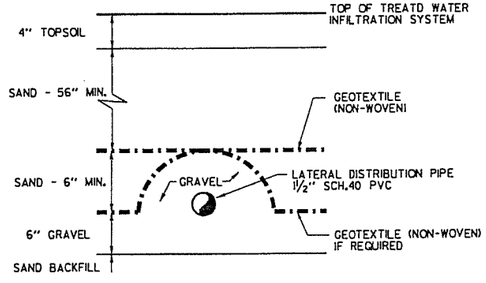

4/2 LATERAL DISTRIBUTION PIPING DETAIL

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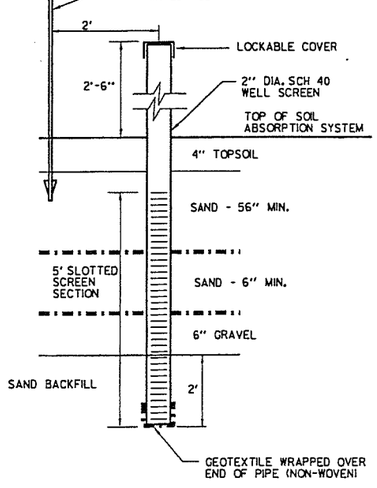

7/2 INFILTRATION CELL OBSERVATION PIPE DETAIL

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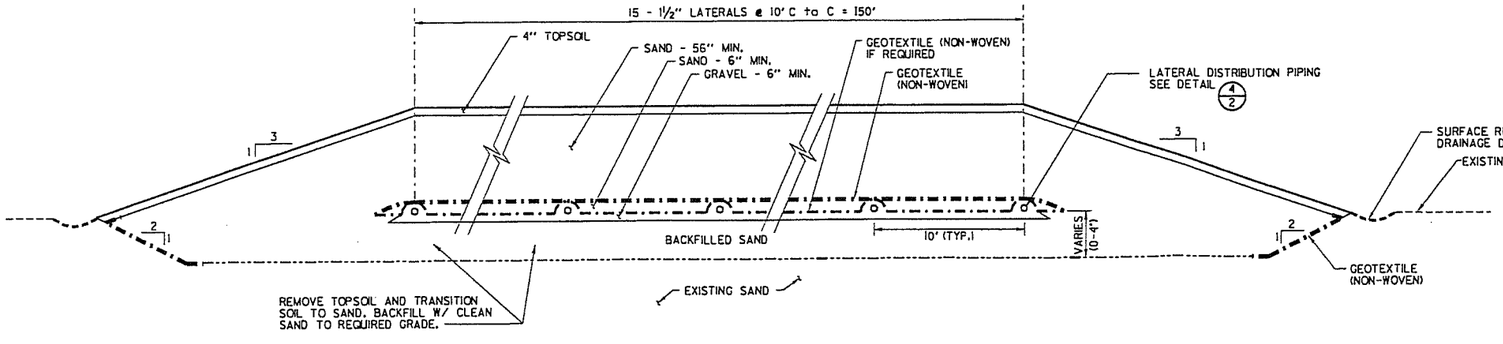

5/2 TREATED WATER INFILTRATION SYSTEM - TYPICAL SECTION

NOT TO SCALE

Foth Infrastructure & Environment, LLC				
REVISED	DATE	BY	DESCRIPTION	
CHECKED BY:		PAK		DATE: MARCH '07
APPROVED BY:		SVDI		DATE: MARCH '07
APPROVED BY:				DATE:

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FIGURE 2

TREATED WATER INFILTRATION SYSTEM DESIGN AND DETAILS

Scale:	NOT TO SCALE	Date:	MARCH, 2007
Prepared By:	JRB2	Project No.	04W018

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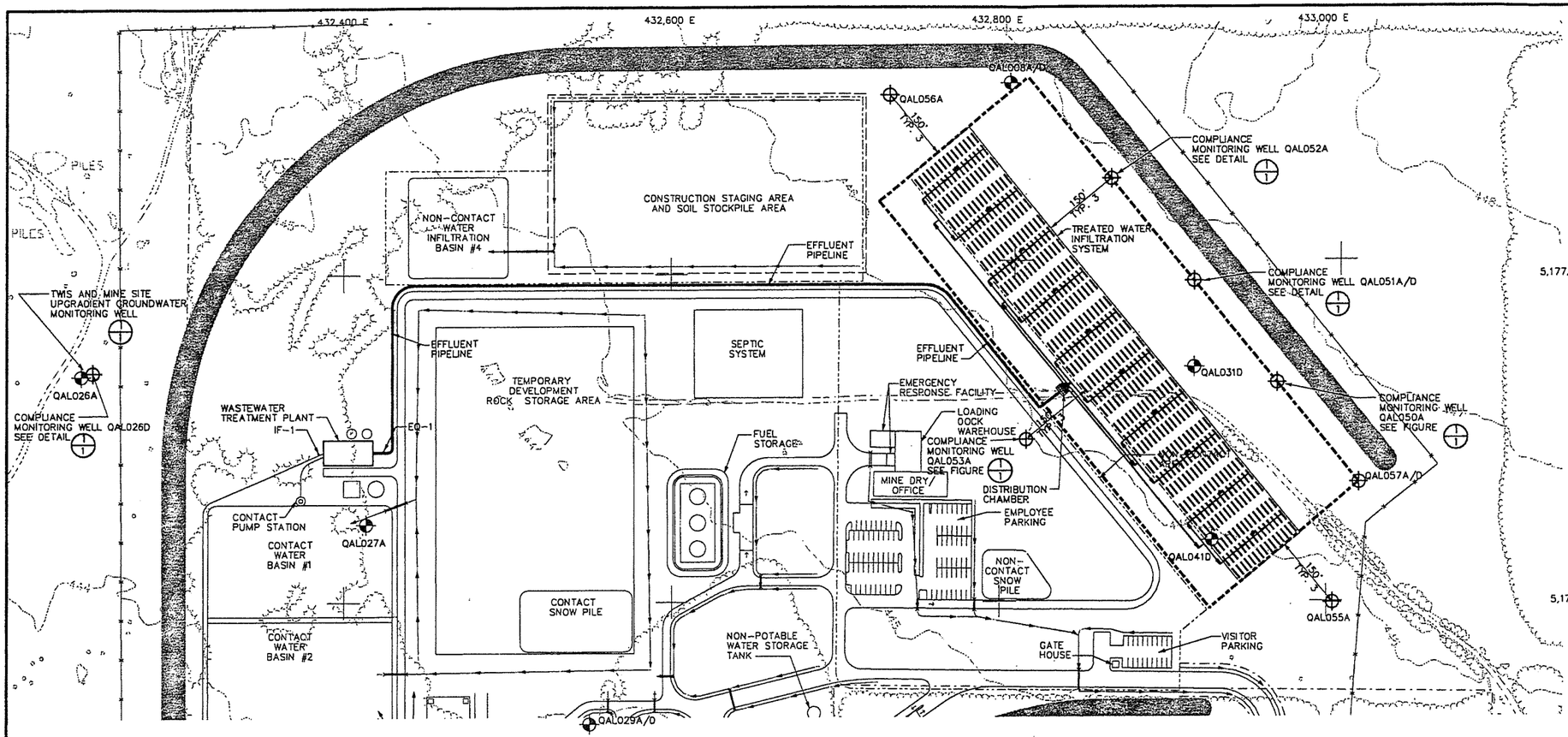
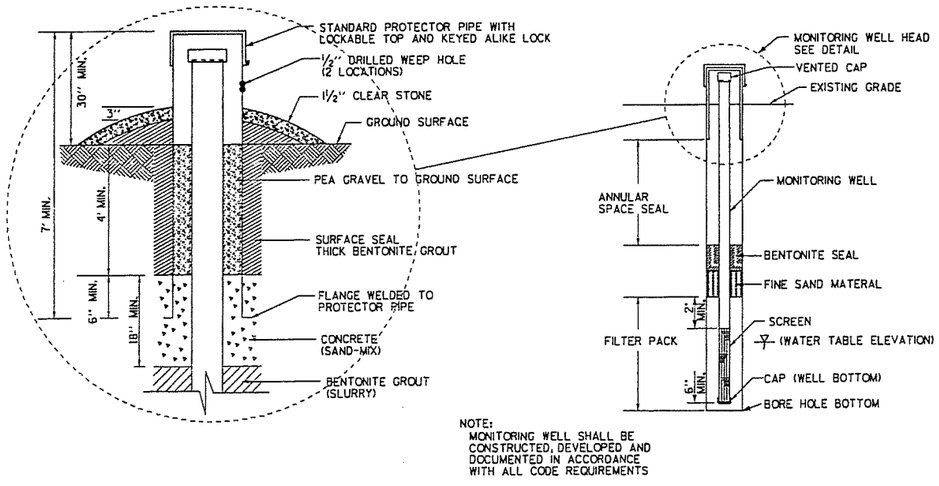


TREATED WATER INFILTRATION SYSTEM LAYOUT

0 40M 80M



NOTE:
MONITORING WELL SHALL BE CONSTRUCTED, DEVELOPED AND DOCUMENTED IN ACCORDANCE WITH ALL CODE REQUIREMENTS

1/1 MONITORING WELL DETAIL

NOT TO SCALE

NOTES:

1. WELLS QAL041D AND QAL027A TO BE ABANDONED PER R 323.2223 (4)(j)
2. WELL QAL031D TO BE USED FOR MONITORING GROUNDWATER LEVELS ONLY. QAL031D IS NOT A COMPLIANCE MONITORING WELL.

Foth Infrastructure & Environment, LLC				
REVISED	DATE	BY	DESCRIPTION	
CHECKED BY:		PAK	DATE:	MARCH '07
APPROVED BY:		SVDI	DATE:	MARCH '07
APPROVED BY:			DATE:	

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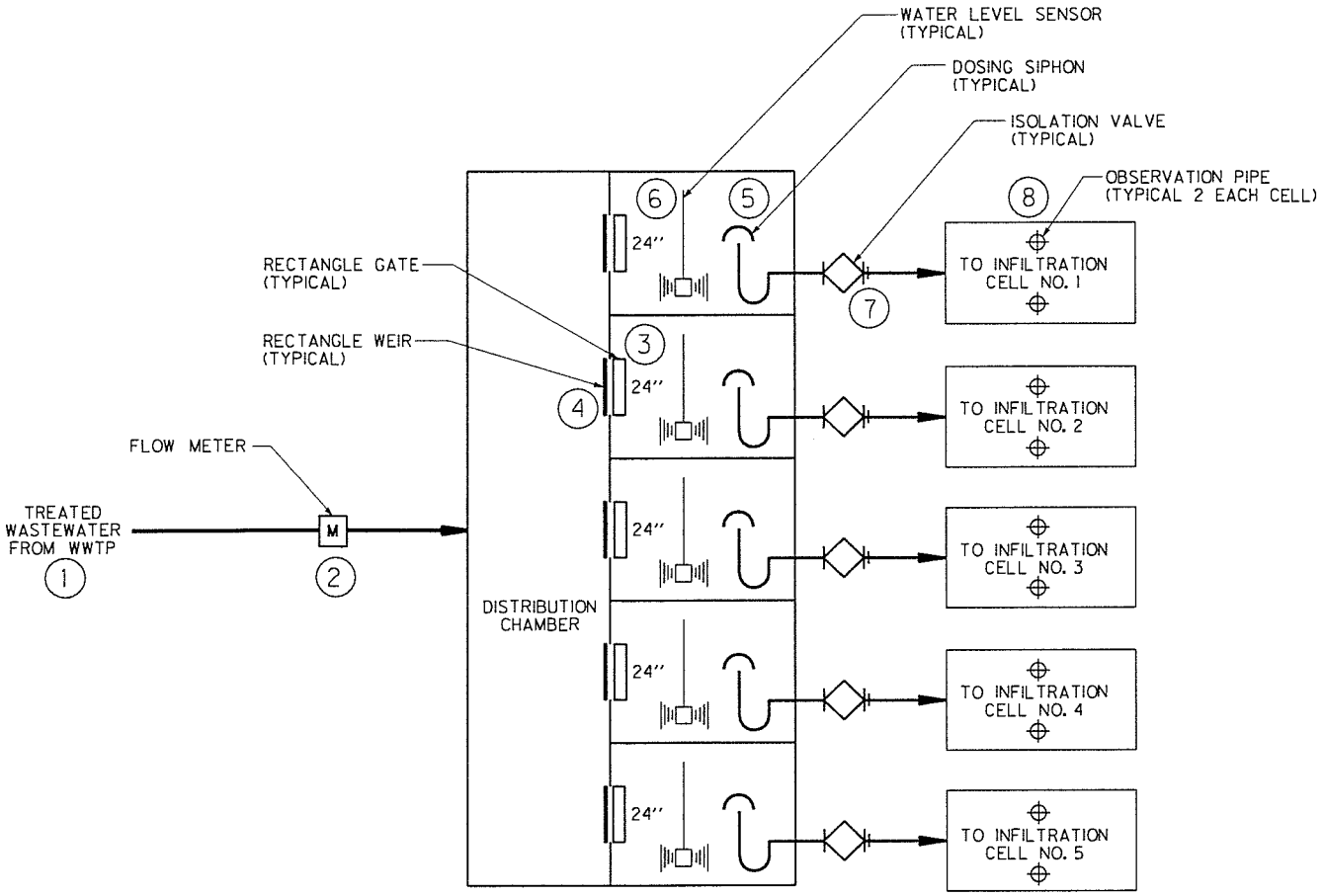
FIGURE 1

TREATED WATER INFILTRATION SYSTEM LAYOUT AND DETAILS

Scale:	AS SHOWN	Date:	MARCH, 2007
Prepared By:	JRB2	Project No.	04W018



DISTRIBUTION CHAMBER

NOT TO SCALE

(1) IF WATER DOES NOT MEET WATER QUALITY REQUIREMENTS ROUTE BACK TO CONTACT WATER BASINS.

(2) MONITOR TOTAL FLOW TO THE TWIS.

(3) OPEN OR CLOSE GATES AS REQUIRED TO OPERATE CELLS.

(4) CHECK WEIRS FOR ELEVATION, CHECK AND MAINTAIN THEM TO PREVENT LEAKAGE.

(5) CHECK AND MAINTAIN FOR PROPER DOSING SIPHON OPERATION.

(6) CHECK AND MAINTAIN WATER LEVEL SENSORS TO INSURE PROPER MONITORING OF FLOW AND HIGH WATER ALARM.

(7) OPEN OR CLOSE VALVES AS REQUIRED TO OPERATE CELLS.

(8) MONITOR OBSERVATION WELLS FOR GROUNDWATER MOUNDING.

Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	PAK	DATE:	MARCH '07
APPROVED BY:	SVDI	DATE:	MARCH '07
APPROVED BY:		DATE:	

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FIGURE 3

DISCHARGE MANAGEMENT PLAN OPERATION GUIDE

Scale:	NOT TO SCALE	Date:	MARCH, 2007
Prepared By:	JRB2	Project No.	04W018

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3/7/2007 jrb2