WATER SYSTEMS - OPERATIONS AND MAINTENANCE
GREENS CREEK MINE

JULY, 1996

BY:

KENNECOTT GREENS CREEK MINING CO.
P.O. Box 32199
13401 Glacier Highway
Juneau, AK 99802
<u>Contacts:</u>

Dale shrum	Phone:907-790-8429	Fax: 907-790-8428
Steve Iwinski	Phone:907-790-8460	Fax: 907-790-8478

DOCUMENT TRACKING

Date of Original Manual Section ___
Revision Number ___
Revision Date ___

DOCUMENT COPY NUMBER: ______

PERSON RESPONSIBLE FOR THIS DOCUMENT COPY: ______________________

SIGNATURE: ___________________ DATE OF RECEIPT: ___________________

REVISIONS:

REVISION DATE/ AND INITIALS:	**SECTION AND SUB-SECTION REVISED**: NOTE: All revisions shall be inserted on dated pages with minor revisions highlighted and deletions lined out. Major revisions shall be made by Section, all pages shall be dated with original and revision dates. See example at top-right corner of this page.

NOTE: This list will be updated as revisions are made to the O&M Guidance Document.

Date of Original Manual Section ___
Revision Number ___
Revision Date ___

ORGANIZATION CHART
(O&M and Environmental)

*******************Insert the O&M Organization Chart**********************

NOTE:This information will be updated as revisions are made to the O&M Guidance Document.

KEY STAFF LISTING
(O&M and Environmental)

Title/Name	Office Location	Phone Number	FAX Number
General Manager/ Clynt Nauman	Mill Administration Office	907-789-8110	907-789-8108
Process Manager/ Tom Zimmer	Mill Office	907-789-8160	907-789-8108
Maintenance Coordinator/ Dale Shrum	Hawk Inlet Office	907-790-8429	907-790-8478
Environmental Manager/ Bill Oelklaus	Hawk Inlet Office	907-790-8470	907-790-8478
Administrative Assistance/Person Varies but will assist in contacting responsible parties.	Mill Administration Office	907-789-8100	907-789-8108
Environmental Assistance/ Dan Benefield	Hawk Inlet Office	907-790-8422	907-790-8478

NOTE:This information will be updated as revisions are made to the O&M Guidance Document.

TABLE OF CONTENTS

LIST OF FIGURES

This draft list has descriptions of Figures and M3 Engineering and Technology Corp. or other source drawing designations.

FIGUREDRAWING NAME **PAGE**

NOTE: Will add the electrical drawings (panel and interconnection) as they are completed and verified, if needed to clarify.

LIST OF TABLES

1.0 INTRODUCTION

1.1 PURPOSE

The Kennecott Greens Creek Mine Water Operations and Maintenance (O&M) guidance document provides general and specific O&M procedures for water systems associated with the mine project. Systems include those for water supply, water recycle, water treatment, stormwater, and excess water discharges. The document provides general information for use in training and overall system understanding and specific information for actual operation and maintenance of systems and components.

1.2 OBJECTIVES

The objective of the O&M document is fourfold:

1. Provide an introduction and general training program to facilitate general comprehension of site water system concepts, operation, and maintenance.

2. Present O&M guidance on a systems basis (i.e., component, subsystem, and overall system coordination).

3. Serve as a tool to facilitate the planning and design of water system improvements.

4. Provide a central and coordinated reference for detailed component water system O&M.

1.3 O&M ORGANIZATION

The operations and maintenance organization is illustrated on **Figure 1-1**. Adequate personnel are dedicated to the O&M function and trained to facilitate effective and efficient operations and maintenance of the Kennecott Greens Creek Mine water systems. The organization will be reviewed annually during General Plan of Operation preparation. Adjustments in the organization or staffing requirements will be made as needs are identified.

The key contacts for Project O&M will change as the Project construction and operation phases transition and as the O&M organization is refined. Therefore, no listing of contact personnel is included in the text of the O&M documentation. The current Project organization and contact listing is included in the introductory pages of **Appeidices A and B**. A current organization chart and contact listing is included behind the Revision List after the title page of this document. These three listings will be updated as changes and refinements are made.

1.4 HOW TO USE THIS O&M DOCUMENT? (CONTENT AND FORMAT)

The guidance is presented in a format that can be used by the operations and maintenance staff and by agencies. The text is intended to provide the narrative O&M guidance and is accompanied by relevant drawings to convey the water system O&M concepts. The narrative will be used for familiarization, training, concept presentation, and system coordination. Detailed system, sub-system, and component information including information from the manufacturers and suppliers and site-specific information is provided in a detailed guidance section and Appendices A and B.

The key criteria used in developing the narrative and detailed portions of this document are as follows:

- Keep it user friendly
- Provide general information for training and detailed information for actual system/component O&M
- Strive for operator understanding of the systems instead of rote step-by-step checklists for every conceivable scenario
- Provide all the necessary information and tools needed for O&M in a central location and format
- Use lists, data sheets, references to manufacturer/supplier data, and tabulations instead of long, repetitive narrative sections

The format of the O&M document is as follows:

<u>NARRATIVE SECTIONS</u>

Introduction
(Purpose, objectives, water systems descriptions, water balance and management concepts, and O&M tools)

System Control Interfaces
(Control philosophies, conceptual designs, control system configurations)

Systems O&M Discussions
(Narrative discussion of system, sub-system, and component control and O&M procedures. Thirteen water systems)

<u>DETAIL SECTIONS</u>

Detailed System/Component O&M
(Introduction to the O&M procedures and files in **Appendix A & B**)

Appendices
(Maintenance system and detailed system/sub-system/component information)

The detailed component and sub-system O&M information is provided in the **Appendices**. **Appendix A** contains a section that explains the computerized maintenance information and management system (MIMS). The MIMS system provides detailed maintenance schedules and information including equipment lists and numbers, inventories of spare parts, maintenance work order procedures, equipment histories and cost data, and maintenance scheduling and follow-up. The MIMS system will be described in greater detail in a subsequent section.

Appendix B is a multi-cabinet file system, located in each of the major operations and maintenance areas, that contains detailed component-by-component O&M information. The information is supplied by the component or system manufacturer or supplier and may be supplemented by site-specific narrative, data sheets, lists, or schedules to coordinate the components into the overall control and O&M system. Equipment, component, and system names and numbers are as defined in the MIMS document to provide a coordinated O&M nomenclature.

1.5 SITE WATER SYSTEMS

The Project site has different types of water systems, as well as dynamics within the individual water systems. **Figure 1-2 (M3 Design Drawing, 100-10-204)** illustrates the locations and physical interconnections between Project water systems. Logically, the following water systems have been defined and are described in this document:

System 1.0 Fresh Water 920
System 2.0 Stormwater 920
System 3.0 Process Water 920
System 4.0 Sewage 920
System 5.0 Water Site D/23
System 6.0 Stormwater Pond 6
System 7.0 Process Water Pond 6
System 8.0 Fresh Water Hawk Inlet
System 9.0 Stormwater and Process Water Hawk Inlet
System 10.0 Sewage Hawk Inlet
System 11.0 Miscellaneous Water Systems (pipelines, roads, bridges, ditches, culverts, etc.)
System 12.0 General Water System O&M Functions (housekeeping, general maintenance, valves, coatings/linings, freeze protection, etc.)

Water systems are described by the water type and the location of most of the system facilities. The system number corresponds to the Section number in Section 3, System O&M Discussions (i.e., Section 3.5 covers System 5, the Water Site D/23 System).

1.6WATER BALANCE

The overall Project water balance illustrated in **Figure 1-3 (100-10-202)** provides a good summary and allows visualization of the various water systems as well as the interfaces between systems. The water balance is based on site hydrology (rainfall, snowfall, and runoff characteristics), site configuration (disturbed areas contributing to water runoff), process water needs and excess process water quantities, domestic water needs and discharges, and their respective facilities provided to manage the various water streams. The water balance is effected by storm flows (peak flows). Generally, equalizing storage in the form of ponds, tanks, or grit basins are provided to limit peak flow rates.

The water balance considers internal recycle, water source reduction programs, and five different component treatment systems. The water balance ultimately determines the amount of water that is released by the Project to area receiving waters.

The balance and therefore the amount of water released from the site is totally dependent on seasonal fluctuations in flow, process recycle rates, and the amount of tributary site area. Therefore, the water balance is a dynamic tool to access Project performance and use in planning water handling strategies, as well as O&M procedures.

1.7WATER MANAGEMENT CONCEPTS

Water management has evolved at the Greens Creek site. The recommissioned Project will recycle more water in the process. Treatment will be modified from a passive pond system to a highly controlled series of physical-chemical treatment systems. This modified treatment system will provide additional opportunities for recycle and eliminate peak concentrations of key parameters in site discharges that were caused by stormwater overwhelming the passive treatment processes.

The water management controls will be coordinated to tie together the various water systems that are connected by pipelines and therefore cascade hydraulically. Water sub-systems and components are controlled by local control loops and are coordinated with the overall control system.

Management requirements for water in the Greens Creek Mine system are summarized as follows:

- Contain and control all possible site and process water
- Treat and recycle all water possible
- Provide and maintain operational flexibility
- Comply with water quality criteria
- Monitor operation of water systems and coordinate control of systems that are inter-tied hydrologically
- Provide and use storage in the collection and treatment systems to limit water balance discharge flows
- Develop operational and maintenance criteria to use as performance goals
- Monitor O&M performance and adjust procedures and management strategies

The recommissioning design improvements for the Project reflect the water management concepts outlined. Redundant system components have been installed where needed to assure reliability. Flexibility has been provided through the use of multiple treatment and piping options. Control systems have incorporated logic that interties control and information systems. Systems were designed and constructed to maximize water reuse, to facilitate source reduction, and to maintain a water balance within the limits of the permitting authority.

1.8SYSTEM O&M TOOLS

Water system O&M management is simplified by using summary tools to illustrate the systems or to put a procedure into a format that is organized and automated. Several of the key tools meeting these criteria are illustrated in the following sections.

1.8.1 P&IDs

Process and instrumentation diagrams (P&IDs) are the basis of the remaining discussion in this guidance document. P&IDs summarize the water system characteristics. P&IDs include system components (pumps, units), piping, valves (control, automated, and non-automated), instrumentation and control elements, control paths (pneumatic, electric, or hydraulic), and interfaces with other systems (piping, instrumentation, or control).

P&IDs are powerful tools. The overall water system P&ID shows each of the water subsystems **(Figure 1-4, Void 100-17-200).** P&ID are used in subsequent sections to display and illustrate the characteristics of each sub-system and component. The following example illustrated in **Figure 1-5** is provided to help demonstrate how P&IDs work and to provide an introduction to the use of a P&ID. **Figure 1-6 (100-17-201)** illustrates the abbreviations and notations used on the P&IDs.

The simplified process and instrumentation circuit illustrated in **Figure 1-5** represents a sump pump system (two pumps, one as stand-by) pumping to an up-slope tank. Flow enters the sump from three sources (sediment pond, curtain drain, and seeps). The sump and tank are connected by pipe (shown as solid line with size) and control circuits (shown as dashed). Valves illustrated in the pipe are non-automated gate and check valves. The pumps are controlled by a level controller (LC) at the sump and a level controller (LC) at the upper tank. Both level controllers get signals from level elements (LE) in the sump or tank.

The sump pumps have a sequence controller that cycles a different lead pump on every time the sump is drained and a pump cycles. Pumps cycle on and off at set elevations. A high level in the sump will turn on the second sump pump in the event the first fails. A higher level alarm will sound if pumps fail or cannot pump the inflow for a variety of reasons.

The control in the upper tank monitors water level and will not allow the sump pump to come on if the level is too high. A higher level alarm will indicate excessive water in the tank.

P&IDs will include actual set points for control elevations and alarms where possible.

As illustrated from this example, almost every detail of the system components, operation, and control can be discovered by properly reading the P&ID. The example is relevant to the Greens Creek Water System as it is similar to the Site D/23 system for transferring water from Pond D to Pond 23 facilities.

A key element to actual O&M training must be familiarization and use of the powerful tool, the P&ID.

1.8.2 MIMS

The Mincom Information Management System (MIMS) is a set of fully integrated modules for material management, maintenance, operations, and accounting. MIMS is a single source software solution that inter-ties the sharing of maintenance information between the numerous entities responsible for maintenance on a Project as complex and widely distributed as the Greens Creek Mine Project. MIMS will allow operations, maintenance, and environmental groups to have a coordinated system to track water system maintenance status, schedules, and cost.

The maintenance modules on MIMS store information on equipment and maintain a history of all routine and emergency maintenance records. A key feature of the system is a numbering system that will be used to identify every system component and will be used to track and file information in this document and for all O&M functions. The MIMS system includes the following:

•MIMS Maintenance Scheduling:

The scheduling routine creates schedules of recurring maintenance tasks to be performed on specific equipment and components. It predicts service intervals based on elapse times and use. The system predicts materials and labor requirements and prepares anticipated maintenance schedules and work orders. A history of scheduled and other maintenance tasks is maintained and reports on maintenance performance and cost are provided.

•MIMS Equipment Register:

The MIMS equipment register identifies all items of equipment, technical information, and warranty status, groups equipment in a system manner, numbers all equipment in a logical order, and provides reporting of equipment costs.

•MIMS Spares Register:

Maintains a complete spare parts register and inventory of available spare parts. Produces a suggested spares requisition.

•MIMS Component Tracing:

Tracks the operational history of a component. Can be used to identify problem equipment or similar equipment for coordination of maintenance or spare parts.

•MIMS Equipment Costing and History:

Links the maintenance modules to the accounting modules. Accumulates all costs, or operating and maintenance, and reports individual labor, fuel, oil, maintenance cost, etc.

•MIMS Work Orders:

The only manner of getting maintenance performed. Identifies the work to be done, priority, and special requirements and resources needs. Identifies safety instructions, procedures, spare parts needed, labor estimates and costs. After a job is completed, allows systematic follow-up to assure performance.

•MIMS Operating Statistics:

Automatically reports on downtime and reasons. Evaluates problem equipment or processes and suggests responses. Assists with budgeting.

•Project Control/Condition Monitoring:

Looks at trends and costs. Monitors indicator parameters (vibration or leakage for example) to allow scheduling of maintenance.

•Other Options:

The maintenance system can be used to enhance the operations and monitoring programs by creating schedules and tracking recurring functions, by including chemical inventories in the scheduling modules, or by tracking costs and benefits of various operational or monitoring functions.

The initial MIMS product that is critical to this document is the equipment, component, and system numbering/identification system that will be used to create the equipment register and to track all O&M functions. The numbering/identification system is described in detail in the MIMS guidance in **Appendix A** and summarized herein as follows:

•Equipment Class (mobile, fixed, leased, underground, surface, utility, etc.)

•Productive Unit/Equipment Group Identifier (To be coordinated yet!!!)

- •Equipment Number (tag number mounted on equipment and used on design drawings. Letter code for equipment type [DB - degritting basin, MC - mobile power center, TN - tank, SP - slurry pump, etc., followed by a numeric designator])

- •Description of Equipment (name and brief description)

- •Purchase Date (start of tracking history)

- •Cost Center (water is 5500, etc.)

Table 1-1 illustrates a portion of an equipment list with entries for each of the numbering/identification tags. Using these tags and the MIMS system computer terminal, any piece of equipment can be located and relevant maintenance information can be accessed. Refer to the MIMS guidance for a full description of the system and the complete range of options for each category of the numbering/identification system.

The MIMS guidance also provides instructions for input of new data and updating of file information.

The primary use of the MIMS system is to systematically schedule routine maintenance and facilitate an orderly method of handling all maintenance activities. The Work Order system is in place to facilitate orderly maintenance and to account for all maintenance costs.

A file of "Standard Jobs" is resident in the MIMS Work Order system. Each standard job contains a description of the job, the work to be performed, the parts needed, and the time and materials needed to complete the job. Using standard jobs as guidance, most routine maintenance duties are scheduled and listed daily as Work Orders along with the resources needed to complete that day's job list. **Figure 1-7** illustrates several of the relevant Work Order forms.

Special Work Orders are developed for non-standard jobs as the need is anticipated or developed as the result of an emergency or failure of a system component. All maintenance activities are performed by maintenance personnel in accordance to Work Orders and all costs, materials, and equipment needed for the job are tracked.

The Work Order procedure includes follow-up by the maintenance and accounting staff to be certain that the work is completed and the resources are properly used. Refer to the MIMS guidance in **Appendix A** for complete details of Work Order system.

Work Orders are the basis for making the maintenance system work and for tracking system and component performance and cost.

2.0 SYSTEM CONTROL INTERFACES

2.1CONTROL PHILOSOPHY

The Greens Creek water systems consist of a number of separate systems as listed previously in the INTRODUCTION. The systems and their interconnecting piping and signals are shown on **Figure 2-1** , Water Systems Interface Diagram. The controls and interfaces for each system are further described in the Sections which follow covering each separate system.

System, sub-system, and component control is a tiered procedure. Control steps begin at the component and build into a system-wide control. Control priorities are as follows:

•Component protection and safety control (motor, equipment, process limit controllers such as heater cut-outs, amperage limit switches, lock-outs, or high level or low level limit switch cut-outs)

•Sub-system control (level controllers, pump on-off controllers, pressure switches)

•System control (level controllers, process loop controllers [pH, ORP], flow controllers, or water quality limit controllers)

•Inter-system interfaces (feed-back control between systems such as flow or level limits, pH or ORP controls, and water quality limits that are transmitted to central monitoring, alarm, or master control systems (Central Control System [CCS]))

Inter-system control interfaces are few. For the most part, systems are controlled locally with alarms and selected process variables transmitted to the CCS (Central Control System) for monitoring and data acquisition. In some cases it is necessary to transmit signals among systems. These interface signals are shown on the Water Systems Interface Diagram (**Figure 2-1**) and listed and described in the write-ups for each separate system.

At present, the CCS serves primarily as a collection point for alarm signals and a few process variables. It is anticipated that in the future the CCS will be developed as a full monitoring and data acquisition system, including status display, alarm display, and logging, display and recording of important process variables, performance data, trending, and report generation. This is the "target system". The PLC's and signal communications equipment being provided are suitable for future incorporation of supervisory control as well, but at this time it does not appear that supervisory control is either necessary or desirable.

The complete central monitoring and data acquisition system is the target control philosophy. Work toward the target system will be step-wise as the system is recommissioned and expansion is planned.

Recommissioning operations personnel requirements will be greater initially, and may be reduced as the target control philosophy is reached.

2.2CONTROL PROGRAM CONCEPTUAL DESIGN

The control system for the recommissioning start-up is defined not only to meet the local and sub-system control needs, but also to partially incorporate the target control philosophy and allow for upgrading to the target system. Generally, no interactive computer control system will be in place to coordinate control with the combined water systems. Sub-system and local control will be either analog or programmable logic controllers (PLC's) located in the sub-systems.

2.3INTEGRATION OF EXISTING AND LOCAL CONTROL SYSTEMS

Interface capability will be built into the PLC's for future upgrading. In fact, all PLC's used will be coordinated with existing system controls and will be from one manufacturer (Allen Bradley). The Allen Bradley PLC's will all have interface capability both with one another and with future computer equipment.

As the Central Control System (CCS) is developed, (existing and recommission Project controls) more signals will be sent to the central system. Operational status will be observed at the central system. Local displays of performance status will remain if included in the initial designs. Control instructions will be issued either by operations personnel locally or at the central control.
Ultimately, control status, process monitoring records, performance data, level and flow information, and other systems data will be available from the central control system in various report formats. Histories of valve position, flow by minute-day-month, chemical usage, pH or turbidity records, and many other system data will be available.

The key factor is that the systems are designed to interface with the target system. As the Project generates cash flow and develops the control logic for the new and existing water systems, progress toward the target system can be made.

3.0 SYSTEMS O&M DISCUSSIONS

The individual water systems will be discussed in a standard format outlined in the Table of Contents. By standardizing the discussion format, readers can learn and anticipate content and detail that is provided to facilitate training and general familiarization with the systems, components and interfaces.

Normal operation and maintenance activities are outlined as are troubleshooting guidelines for abnormal conditions. Detailed system and component O&M information from system or equipment manufacturers or suppliers is found in **Appendix B** files.

3.1 FRESH WATER 920 SYSTEM

3.1.1 PURPOSE OF SYSTEM

The fresh water system at the 920 mill site is in place to acquire, treat, store, and distribute water from Greens Creek for mill, fire suppression, mine, and domestic uses.

3.1.2 SYSTEM DESCRIPTION

The fresh water system at the 920 mill site is depicted in **Figures 3.1-1 and 3.1-2 (Original design KGCMC drawings XXXXXX)**. The P&ID, **Figure 3.1-3 (600-17-200)** illustrates the overall water system components, controls, and interfaces (piping and control).

A subsurface (submerged) intake screen system in Greens Creek infiltrates water from the creek to system suction pipes. The intake strains the water through sand in the creek bed as it is removed from the creek. The intake can be backwashed by water and air scoured if sand over the intake pipes begins to plug with fine sediment and debris. Intake screens are slotted and installed in a bed of stream gravel and sand behind a concrete stream bed control dam. The dam incorporates a flow measuring weir and flow monitoring system (LE). Fresh water intake from the creek must cease if stream flow is below 2.5 cfs as a precaution to in-stream habitat loss. The level transmitter (LT) at the weir sends the signal to the central control system (CCS) and notification (alarm) is issued if flow drops below 2.5 cfs in the creek.

Water from the intake flows to a wet well through up to 3, 12-inch pipes and is pumped to a filtration system where sand filtration and hypochlorite disinfection treat water before distribution to domestic use points. A pipe loop is used to provide adequate contact time to assure proper kill of problem organisms. Process and fire suppression water is piped to storage without disinfection. Three pumps (PP-45,46,&47) are provided (one lead and two lag pumps operating in sequence on demand responding to tank level).

Filtration is a two tank system using dual media sand pressure filters. Filtration may be aided by polymer preconditioning to coagulate particulate in the water (fine mineral or organic material, possibly micro-organisms), but this in not the normal operating condition.

Filters are backwashed using water in system storage or from direct pump output. Backwash can be initiated automatically if pressure losses across the filters exceed a set point or by hand-switching. Backwash duration is timer controlled (8 to 12-minutes typically) and sequenced or can be overridden by hand-switching.

Filtered, non-disinfected water is routed to the 1160 (base at elevation 1160 feet) storage tank (TK-01), directly to the mill fresh water tank, or to filter backwash. Water is distributed from the storage tank to process use points in the mill or kept in storage for fire suppression emergencies. Draw from the storage tank is by gravity flow, on demand (i.e., as valves are opened). The tank is the high point in the system and controls the pressure available in the distribution system by virtue of elevation of water in the tank. The storage tank has two outlets. The lower outlet supplies the fire suppression system, and filters and chlorination system for domestic water supply. The upper tank outlet is above the fire storage level and provides mill and mine water. Thus, fire suppression storage reserve is automatically maintained in the tank by this design feature.

Control of the water system is based on demand and corresponding storage tank level (LE/LT, LIC). The supply pump system has local controls that start and stop the pumps as called for by decreasing tank level. If the supply pumps are off because the storage tank is full, water is supplied to the filters and disinfection system from storage. The filters have a PLC to control backwash and service functions. Pneumatic valves on the filter face are cycled by the controller or by hand-switching. Tank level is monitored and an alarm is initiated at the low level set point (the fire storage reserve level).

*************End of Tag # Review*************************5/15/96****************

3.1.3 COMPONENTS OF SYSTEM

Components and sub-components of the 920 fresh water system include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

A-Intake
- -Dam **(PUT IN A MIMS NUMBER ##### FOR EACH ITEM LATER)**
  - -Weir
  - -Level element
- -Slotted intake screens

- Gravel/Sand bed
- Suction/Backwash pipes
- Stream staff gage

B-Pump house

- Wet well
  - Grates
  - Gates
  - Valves
- Triplex Peerless pumps
  - Hour meters
  - Packing (pump seals)
  - Lead, lag, standby pumps
  - Valves (check, gate)
  - Level elements (pump low level control and alarm elevations)
  - Pump start-stop-alarm-sequence controller
  - Intake screen backwash system (valves and pipes with air connection for portable compressor)
- Filter System
  - Filter cells
  - Sand media
  - Filter underdrains and inlets
  - Pneumatic and manual filter valves and piping
  - PLC
  - Analog backwash controller sequencer
  - Differential pressure backwash controller
  - Air release valves
  - Backwash flow rate controller
- Disinfection system
  - Chemical (hypochlorite)
  - Mix tank
  - Mixer
  - Feed pump(s)
  - Piping and valves
  - On-off controller
  - Level controller, alarm on low level
- Treatment building
  - Ventilation system
  - Heating system
  - Electrical and control interfaces
  - Lighting system
- General (applies to the component system)
  - Maintenance items

C-Storage tank
- -Piping and valves
- -Level element
- -Lining and coating system
- -Access facilities (ladder, hatches, fittings)
- -Level element controller
- -General
  - -Maintenance items

3.1.4 INTERFACES WITH OTHER SYSTEMS

The interfaces with other site systems is primarily by piping. Control interfaces are limited to alarms. The piping and control interfaces are listed as follows:

<u>Piping Interfaces:</u>

- 4-inch unfiltered water pipe to the mine
- 6-inch unfiltered water pipe to mill fresh water tank
- 4-inch filtered, disinfected water pipe to mill and offices (domestic use)
- 4-inch backwash water to **Pond A sediment pond**
- 10-inch fire pipe to site and site facilities

<u>Control Interfaces:</u>

- Low level (flow in Greens Creek to Mill central control panel)
- Low 1150 storage tank level to Mill central control panel

Water demand by the mill, mine, fire suppression, and domestic uses simply draw on the storage reservoir as use valves are opened. As the tank level falls with use, the water supply system is started to attempt to keep the storage tank full of filtered, disinfected water.

The control interfaces between the fresh water 920 system and the central control system (CCS) is in the form of transmitted level signals that are converted to flow in Greens Creek and 1150 tank level. In the event of a low creek flow or a low tank level, alarms are issued.

3.1.5 OPERATIONS

3.1.5.1 Process Design Criteria and Indicators

Water system design criteria and operational indicators are tabulated in **Table 3.1-1**.

Table 3.1-1 Fresh Water 920 - Design/Control Criteria

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS

Intake	Flow range at intake - If Greens Creek is at 4.0 cfs up, up to 700 gpm (1.6 cfs) may be diverted at the intake	Observe water level in creek and wetwell daily under load. Notify mill operations when creek flow is below 4.0 cfs (auto-control will also). Stop water intake at <4.0 cfs in stream and go to in-mill water

		conservation/recycle mode

	Backwash/scour - when water level in wetwell is >2-feet lower than creek level	Bring in the portable air compressor and pipe backwash water from the pipe to the 1150 tank (pump discharge). Carefully backwash to not disturb the intake piping and screens.

	Observe the stream bed over the intake screens	Add gravel or remove debris if necessary.

Wetwell	Low level in wetwell will stop fresh water pumps	Observe daily and backwash/scour intake bed if wetwell water level is

		>2-feet lower than creek level.

	Adjust low level to control cavitation and air in pump suctions	

Pumps	3, 30 Hp, 250 gpm units, operate sequentially in response to tank level. Maximum capacity of 700 gpm.	Change lead-lag-lag pump sequence monthly to even wear.

Filters	Design flow at 5 to 7 gpm/ft^2 = 750 gpm peak rate	Check pump output to confirm that

		filter rate is not overloading filters.

	Backwash rate at 12 to 15 gpm/ft	Adjust backwash rate control valve to limit flow and washing media (sand) from filters.

	Air release from filters	Check for air binding of filters and confirm air release valves are working at top of filter units.

	Backwash at set headloss between inlet and outlet of filters (15 to 30 psi difference)	Set point on automated controller or hand-switch initiate and observe backwash sequence.

	1.5 to 2.5 feet of mixed media depth per filter (0.5 to 1-foot sand, 1 to 1.5-feet coal)	Check media periodically (1 to 2 year intervals) and add coal as needed.

Tank	Storage 600,000 gallons (half for fire storage)	Maintain fire storage in tank at all times (except during major fire suppression use). Adjust control points to start supply pumps as tank draws down 1 to 3 feet, start second pump if tank draws down 5 to 8 more feet, and to alarm at mid-tank level. Stop all pumps on full tank.

Disinfection	Hypochlorite (dry mix in water to saturated solution)	Check mix tank, mixer, and

System		connections.

	Manual feed rate up to 40 mg/l at peak flow	Check pump operation and control interface.

NOTE: See **Appendix B** for detail manufacturer and supplier component or system information

3.1.5.2 Start-up and Normal Operation

Start-up and normal operation discussions assume that the system is in full operational status and all systems are fully maintained and functioning.

Start-up

The following sequence is a checklist of procedures to enable the fresh water system at the 920 site. References to the manufacturer's and supplier's O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions (i.e., filter controller). The general start-up procedure follows:

1)Open the 3 butterfly inlet valves on the pipes from the intake (at the pump house wetwell).
2)Let water flow into the wetwell and stabilize (fill and settle).
3)Check use point situation:
 - -Mine use valves closed or limited
 - -Mill fresh water tank float valve working
 - -Valves to filters closed initially

4)Check valve positions:
 - -Close 1150 tank drain valve
 - -Open 1150 tank inlet valves (2)
 - -Open 3 pump outlet valves

5)Check controllers
 - -1150 tank level signal
 - -Tank level to pumps
 - -Pump sequencer
 - -Filter controller sequence
 - -Chlorine on-off controller

6)Motor control center and lock-out verification
 - -MCC and lock-outs at "on" status

7)Start-up supply pumps
 - -Switch pumps manually to on, one at a time, to check operation
 - -Switch all off
 - -Switch all pumps to auto in sequence (allow time for each pump to come up to speed before switching the next)
 - -Confirm operation (if 1150 tank is below fire storage level, 2 pumps should run, otherwise one pump)
 - -Observe operation
   - -Pumps, valves, leaks, level control
   - -Adequate water depth in wetwell (no air entrainment in pump suction)

-Confirm that pumps cycle at proper tank levels
-Confirm use points are on-line and operational (valves, tanks, rate control)

8)Start filtration system (chlorination and filtration)

-Refer to system manuals in **Appendix B**
-Mix hypochlorite solution
-Power the system controllers and set controllers for start-up
-Open water supply valves to filters and chlorination system
-Sequence filters to filtration mode

-Check valve operation
-Check flow rate
-Check hypochlorite solution pump operation
-Set desired chlorine dosage (normal range 4 to 10 mg/l) (see pump Manufacturer's instructions)
-Confirm chlorine dosage daily each season as creek flow changes to develop proper dosage rate to provide a residual of 1 mg/l in the domestic distribution system (use Hach chlorine test kit)
-After an hour or more of filtration, cycle filters through backwash
-Confirm backwash flow rate and adjust to Manufacturer's recommended rate
-Confirm backwash operation and sequence back to filtration mode
-Confirm the differential pressure set point for automatic backwash initiation (see Manufacturer's recommended set point and procedure)

-Check filtered water turbidity (should be <5NTU with a goal of <1NTU)

Normal Operation

Normal operation assumes no failures or breaks. Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database.

WATER SYSTEM 920 OPERATION CHECKLIST:

Date:_______

OPERATIONS (daily unless noted):Initial and Date

1) Observe intake for debris, plugging, dam condition_____
2)Measure wetwell water level (low indicates intake plugging or excessive pumping)_____
3)Dam condition and weir level (confirm creek flow with staff gage)_____
4)Pump operation and sequencing _____
5)Valves, piping issues (leaks, valve operation)_____
6)Filtration system operation_____
 -Observe headloss across filter daily _____
 -Check auto-backwash cycling or initiate by hand-switch_____
 -Maintain hypochlorite solution_____
 -Confirm hypochlorite pump operation_____
 -Measure chlorine residual and turbidity weekly at a use point in office building_____
7)Inspect 1150 tank weekly (level, overflow, control elements)_____
8)Safety Inspections weekly_____
9)Other items:____________________________
____

Comments: ____
____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____________________________________
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________

Follow-Up by MIMS; Date and Responsible Party:_________________________

3.1.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Intake Screen Restricted

The intake screen in Greens Creek may become obstructed by fine organic and inorganic material that accumulates during flood conditions or during long-term operation. The inlet effectively filters particulate in the creek water through sand and gravel before the flow enters the slotted screens and the pipes to the water supply pump station wetwell. Restrictions will cause head loss, and water flow to the wetwell may be slowed so that the level in the wetwell will be pumped down. This could cause pump damage due to cavitation or air entrainment in the pump suctions.
When a restricted inlet is noted, the following procedure is recommended to essentially "backwash" the sand/gravel bed in the stream:

1)Be sure that adequate water is available in the 1150 storage tank to sustain operations and fire protection. If necessary, go to maximum in-mill recycle to decrease fresh water demand.
2)Shut off all supply pumps.
3)Close all 3 inlet valves (butterfly valves in the wetwell requiring a 90 degree turn to close).
4)Check to see that the main air valve to the pump station (outside) is closed. This valve should be closed <u>except</u> as cycled during this operation.
5)Inside the pump house there are air lines to each of the inlet pipes. Open one of the valves at a time to air flush one third of the inlet.
6)Open the main air valve (outside) for 10 seconds, then close it for 60 to 75 seconds. Watch the stream for water clarity over the flushing section. Repeat the 10 second air blasts until clear.
7)Repeat with the other two valves on the inlet (one inlet pipe at a time only).
8)After all 3 sections are clear, close all air valves (3 inside, 1 outside).
9)Open all 3 water inlet valves.
10)Allow wetwell to settle for 15-20 minutes before turning the water supply pumps to the AUTO position and re-starting other system components as necessary.

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- •Pump not operating when called for
- •Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

<u>Pump Not Running:</u>

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

<u>Pump Running, Not Producing:</u>

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached, or functional where the valve will no longer operate but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Depending on location and failure mode, valve failure may allow scheduling of valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1) Recalibrate according to manufacturer's recommendations and design criteria set points
2) Place system in service and observe operation
3) If control failure persists, prepare a Work Order for I&C technical maintenance
4) Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Tank Overflow or Low Level

1) Check tank valve positions
2) Check control set points (adjust as necessary)
3) Check control elements such as LIC, LE, and LT for proper operation, power, and signal
4) Check supply system and pipes for leaks if tank is low

Low Flow In Greens Creek

In the event annual cold weather conditions limit flow in Greens Creek to less than 4.0 cfs, an alarm will be signaled and maximum water recycle procedures implemented in the mill. Fresh water supply system operations should be modified as follows:

1) Shut down 2 of the supply pumps to limit withdrawal to 250 gpm
2) Confirm the mill is in the maximum recycle mode of operation (250 gpm maximum demand)
3) Monitor tank level to determine if additional throttling of demand is necessary

3.1.6 CONTROL

The fresh water systems are primarily local control systems. MCC lockouts form the basis of control. Each unit has an additional control circuit lockout if located remote from the MCC. Control circuit lockouts are for emergency cut-off of equipment, NOT for day-to-day switching nor for official maintenance lockout. For safety, **always use MCC lockouts** when performing maintenance.

Pumps have run time meters that allow monitoring of service time and scheduling of maintenance. The next phase of local control are level switches for low or high level alarms or shutoffs. These are provided for the water supply pump sump and storage tank low level cutoffs and alarms. Local control of the chlorination system consists of start-stop when the filters are in service. Filter control is accomplished locally with a PLC supplied with the filter package. The PLC cycles valves and initiates backwash sequences in response to differential pressure across the filters or hand-switching.

Local control is coordinated between components of the fresh water system for supply pump control in response to tank level. Pumps are sequenced on as tank level falls.

Interfaces with other site systems take the form of piping and control interfaces. Control at the ends of the pipe interfaces are hand operated valves or control valves to maintain supply.

The responses to the control interfaces shall be to initiate maximum recycle on low creek flow and to respond with O&M personnel to determine the reason for low storage tank level and to initiate a fix.

3.1.7 MAINTENANCE

3.1.7.1 Short-Term

See the Operation Checklist (Section 3.1.5.2) for day-to-day maintenance items. In addition, the following tabulated short-term maintenance activities are needed:

SHORT-TERM MAINTENANCE CHECKLIST - WATER SYSTEM 920:

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1) Grease all fittings _____
2) Check all drives (gear, belts) _____
3) Check all pipes and valves for leaks/damage _____

Monthly Items:

1) Check for filter media in backwash flow _____
2) Check motor operating vibrations (motors, drives, bearings)_____
3) Observe lining/coating systems_____

Annual or Semi-annual Items:

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check filter media (depth and condition)_____
3) Clean and inspect electrical and I&C panels and elements_____
4) Other items:_________________________

____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____
__

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _________________________________

Follow-Up by MIMS; Date and Responsible Party:______________________________

3.1.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the chlorine pump)

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.2 STORMWATER 920 SYSTEM

3.2.1 PURPOSE OF SYSTEM

The stormwater system at the 920 mill site is in place to route, contain, treat, store, recycle and export stormwater from the mine and mill site. Mine drainage is handled by this system.

3.2.2 SYSTEM DESCRIPTION

The stormwater system at the 920 mill site is depicted in **Figures 3.2-1 through 3.2-4 (100-10-203, 600-17-207, 600-15-201, 600-17-208)**. The P&ID, **Figure 3.2-5 (600-17-200)** illustrates the overall water system components, controls, and interfaces (piping and control).

The 920 mill site stormwater system starts at the upper site boundary. Rainfall and snow melt enters site ditches and culverts for routing to the lower site stormwater facilities. The site is separated by a drainage divide to a north drainage area (No. 1 on drawings) and a south area. Site ditches are sloped to limit erosion or are lined. Culverts are used where traffic or site operations use the site.

Stormwater from the north end of the site flows to degritting basin DB-01 where mine drainage (excess mine water) is also piped. Mine water can be diverted to the mine water pump station for recycle to the mill process water treatment plant standpipe. Heaviest grit is removed in DB-01 and flow is routed to Pond A.

Stormwater from the south drainage area is ditched and piped to degritting basin DB-02. DB-02 also accepts flow from the domestic sewage treatment plant and Process Water Tank No. 1 overflow. Process overflow would occur only when there is excess water in the process system (i.e., more water than the recycle and treated water export systems can handle). Degritted flow from DB-

02 is routed over weirs to a gravity pipeline to the Site D/23 water system (up to 400 gpm) or during peak flows by ditch to Pond A.

Pond A is lined with a synthetic liner to eliminate release of collected stormwater that may have come into contact with ore, concentrate, or other site materials. Pond A serves as a secondary settling basin and equalizing storage (i.e., storage of short-term peak flows). Normally Pond A will be maintained nearly empty to provide the maximum storage availability. Pond A is drained by pumping to the Site D/23 system or to the process water standpipe for treatment and recycle or export. Two XX horsepower pumps are provided in a wetwell in the pond. One pump is standby. A third pump (submersible) transfers Pond A water to a wetwell adjacent to the pond for transfer to the Process Water Tank. Two XX horsepower submersible pumps are located in the adjacent wetwell.

A solenoid operated valve is installed on the Pond A pump discharge line for drain down during freezing conditions. A normally closed valve on the Pond A discharge routes flow to Process Water Tank No 1 instead of Site D/23, if additional water is needed in the mill system.

Key features of the stormwater 920 system include:

•Maximum recycle of water
•Increased storage due to Pond A size and water management
•Pretreatment of all water to Pond A to cut sediment cleaning
•New lining system

Control of the stormwater system is largely automated and passive. That is, most of the flow routing is by gravity controlled weirs or valves. The process water pump system has local controls that start and stop the pumps as called for by decreasing process water tank level. This is the preferred routing for the dewatering of Pond A as water is recycled. The submersible pump in the main pump wetwell automatically pumps water to the adjacent wetwell. If the supply pumps are off because the storage tank is full, water is removed from Pond A by the main pump station pumps. The main pumps are controlled by Pond A level. The goal is to keep Pond A at the lowest possible level. Therefore, the main pump starts as the pond level raises approximately 4-feet and shuts off when the wetwell is drained. Pond A level is monitored and an alarm is initiated at a high level set point (3-feet before the overflow level is reached).

3.2.3 COMPONENTS OF SYSTEM

Components and sub-components of the 920 stormwater system include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

A-Ditches and culverts
-Liners (**PUT IN A MIMS NUMBER #### FOR EACH ITEM LATER)**

-Erosion control (matting and rip-rap)
-Pipes (CMP)
-Drop inlets
-Drop structures
-General
  -Maintenance items

B-Degritting Basins (DB-01 and 02)
-Inlets
  -Energy Dissipators (baffles or flex pipes)
  -Gates
  -Valves
-Grit settling chamber(s)
  -Rail guards
  -Drains
  -Valves (slide, gate)
-Outlet weirs

C-Main Pump Station (in Pond A)
-Submersible pump
-Vertical turbine pumps
-Wetwell
-Valves (check, butterfly, solenoid)
-Access to pump station

D-Recycle Pump Station (adjacent to Pond A)
-Submersible pumps
-Valves (check, gate, butterfly)
-Wetwell

E-Pond A
-Liner
-Sediment baffle

F-General components
-Electrical and control interfaces
-Lighting system
-General (applies to the component system)
  -Maintenance items
-Level elements
-Lining and coating system
-Access facilities (bridge, hatches, fittings)
-Level element controller
-General
  -Leaks
  -Maintenance items

3.2.4 INTERFACES WITH OTHER SYSTEMS

The interfaces with other site systems is by piping and controls. These are listed as follows:

Piping interfaces:

- •4-inch mine water to DB-01 or Pond A recycle pump station
- •10 & 12-inch surface water drainage pipes to DB-02
- •Site runoff ditches to DB-01 & 02
- •4-inch treated domestic sewage effluent pipe to DB-02
- •8-inch process water tank overflow to DB-02
- •6-inch mine or Pond A recycle water to process water tank no. 1
- •8-inch Pond A water to process water standpipe (backup supply)
- •8-inch DB-02 or Pond A water to export

Control Interfaces:

- •Low level in Pond A stops main Pond A pumps, submersible transfer pump, and therefore flow out of Pond A to other uses or disposal. Notifies other use points.
- •Low level in recycle pump station to stop recycle pumps and flow to the process water standpipe (treatment). Notifies other use points.
- •High level in Pond A alarm before overflow
- •Pump failure alarm

Water for the mill process water is drawn from the pump station adjacent to Pond A as level in the process water standpipe falls. Water can be manually routed from the Pond A main pumps to the process water tank No. 1 if needed (normally at start-up to fill tanks). If sufficient water is not available in Pond A or from the mine, a level switch will not allow the pumps to attempt to transfer site water to the mill.

Passive interfaces occur between systems as gravity piping interconnects the mine to the pump station, degritting basin 02 to the Site D/23 water system. More active piping interfaces occur as water is pumped from Pond A main pump station to the Site D/23 water system and from the adjacent pump station to the mill.

The control interfaces between the stormwater 920 system and the central control system (CCS) is in the form of transmitted level signals that provide Pond A level and alarm as level approaches the overflow.

The responses to the control interfaces shall be as follows

1)On low pond or wetwell level, other make-up water sources may be needed. Confirm that the Site 23 recycle, the internal mill recycle, or the fresh water source can and is supplying adequate water.

2)As Pond A level approaches high level, check the proper operation and routing of the pumps from Pond A. Confirm the inflow sources and conditions. If Pond A is nearly full, a failure of export or recycling pumping or a large storm event is evident. Confirm causes and respond. Pumping must be put on line or repaired. Large storm events should be monitored, but if the event considerably exceeds a 10-year event (approximately 4.2 inches of rain in 24 hours at the mill), pond filling and possible overflow would be a normally anticipated result.

3)Pump failure mode should be identified and repairs initiated within a few hours to keep recycle rates up and pond levels low.

3.2.5 OPERATIONS

3.2.5.1 Process Design Criteria and Indicators

Stormwater 920 system design criteria and operational indicators are tabulated in **Table 3.2-1**.

Table 3.2-1 Stormwater 920 - Design/Control Criteria

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS
Degritting Basins	Designed to settle the largest grit in the runoff flow. Detention goal is 1-hour, but site configuration limits sizes. All grit basins are followed by settling ponds or other treatment.	Observe sediment level in basin and remove when 1 to 1.5 feet accumulates.
	Inlet to DB-01 is controlled by gates and valves to route flow to either side of the basin or to route mine water to the basin or to the adjacent pump station. Energy is dissipated by a perforated baffle.	Route flow to Pond A of the parallel basin when cleaning.
	Inlet to DB-02 in controlled by flex hoses on the inlet pipes and sand bags. Hoses route piped runoff to the basin or Pond A. Sand bags are used to route ditch runoff to the basin or Pond A.	Route flow to Pond A when cleaning.
Wetwells	Low level in wetwell will stop pumps.	

	Volume of wetwell to limit pump cycling to no more than 10 per hour.	
Pumps	2, 30 Hp, 1250 gpm vertical turbine export pumps in main pump station, operate with one at standby in response to pond level. Maximum capacity of pipeline approximately 1250 gpm. Cannot cycle on if Site D/23 pond or wet well is above a high condition.	Change lead-standby pump sequence monthly to even wear.
	2, 10 Hp, 300 gpm submersible pump in the main pump station to transfer water to the adjacent wetwell. Operates in preference to the export pumps to recycle water back to the mill when the mill can accept water (tank level signal). Pump on when Pond A level is <4-feet if mill accepts water.	Confirm operation and starting before the export pumps.
	2, 30 Hp, 300 gpm submersible pumps in the adjacent pump station to transfer water to the mill when the main pump station submersible is on and the mill can accept water (tank level signal). Lead standby mode.	Change lead-standby pump sequence monthly to even wear.
Pond A	Storage 4.0 acre-feet. The pond is designed to limit sediment accumulation (pretreatment). A two cell pond will accumulate most sediment in the shallow end of the pond for cleaning.	
	Pond liner - reinforced synthetic.	Visibly inspect the liner for tears periodically.
	Air release from pipelines	Check for air entrainment at the pump suctions. Confirm air release valves are working along the

		pipeline.

NOTE: See **Appendix B** for detail information from manufacturers and suppliers.

3.2.5.2 Start-up and Normal Operation

Start-up and normal operation discussions assume that the system is in full operational status and all systems are fully maintained and functioning.

Start-up

The following sequence is a checklist of procedures to enable the stormwater system at the 920 site. References to the manufacturer's and supplier's O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions. The general start-up procedure follows:

1)Confirm condition of ditches, culverts, and other collection system features and maintain as needed.
2)Route all flows to the degritting basins.
3)Let water flow into the main pump station wetwell.
4)Motor control center and lock-out verification
    -MCC and lock-outs at "on" status
5)Check main pump and submersible pump readiness (test pump each by hand-switching)
    -Open discharge valves and solenoid on main pumps and discharge valve on submersible
    -Confirm rotation and flow.
6)Check recycle pump operation
7)Check valve positions:
    -Close valve on line to process water tank No. 1
    -Open valve to Site D/23
    -Open 5 pump outlet valves
    -Close solenoid valve
    -Open valve between recycle pump station and Pond A
8)Check controllers
    -Process water standpipe level signal
    -Wetwell level signals
    -Pump sequencers
    -Pump on-off controllers
9)Start-up pumps and controls
    -Switch pumps to on, one at a time to check operation
    -Switch all off
    -Switch all pumps to auto in sequence (allow time for pump to come to speed before switching another
    -Confirm operation
    -Observe operation
        -Pumps, valves, leaks, level control
        -Adequate water depth in wetwells(no air entrainment in pump suction)

-Confirm that pumps cycle at proper levels
-Confirm use points are on-line and operational (valves, tanks, rate control)

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence with maximum recycle is as follows:

- Route mine flow to recycle pump station for recycle to the mill for treatment
- Route all surface runoff to the degritting basins
- Runoff from DB-01 to Pond A pumped to mill from main pump station and adjacent pump station for treatment and recycle (except peak flows pumped to Site D/23 water system for export)
- Gravity flow of DB-02 runoff to Site D/23 water system (except peak flows to Pond A and then to Site D/23 water system)

If the mill operation or treatment systems cannot accept maximum recycle, waters can be stored for short periods or routed to Site D/23 using one or more of the following options:

- Shut off the recycle pump station (no recycle)
- Shut off main pump station transfer pump (only mine water recycled)

Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database.

STORMWATER SYSTEM 920 OPERATION CHECKLIST:

Date:_______

OPERATIONS:Initial and Date

1) Observe ditches, culverts, pipes, Pond A, and drops for debris, plugging, damage or erosion conditions_____
2)Observe degritting basin level and grit accumulation_____
3)Confirm proper flow to Pond A, recycle pump station, or pipeline to Site D/23 staff gage)_____
4)Observe wetwell condition (debris, controls, operation)_____
5)Pump operation and sequencing _____
6)Valves, piping issues (leaks, valve operation)_____
7)Check controls and alarms_____
8)Inspect flow end points weekly (level, overflow, control elements)_____
9)Determine Operational Mode:
    -Mine to recycle, runoff to recycle (except peaks)
    -Flow to Site D/23 with minimal recycle
    -Combination
9)Safety Inspections weekly_____
10)Other items:_________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________

Follow-Up by MIMS; Date and Responsible Party:__________________________

3.2.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and the details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Water Collection Conveyance Failure

Failures or plugging of runoff collection ditches, culverts, drop inlets, or drop structures can result in site erosion and possible discharges of stormwater outside the containment, treatment, and export system. However, in most cases, the site is adequately contained so that flow will run overland to lower ditches or conveyances to degritting basins.

It is necessary that any failures in the collection and conveyance system be repaired as soon as possible to minimize erosion and the chance of discharge. Clean debris; repair eroded areas; and repair or replace liners, rip-rap, drop inlets or drop structures. Unplug or repair damaged or plugged pipes.

In worst-case events (such as a major slide or wash-out) temporary water conveyances may be required. These can be rock with synthetic lining, hay bails, temporary pipes, and other similar systems. Act rapidly to limit damage and chance for discharge.

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- Pump not operating when called for
- Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

Pump Not Running:

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip

5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached or functional where the valve will no longer operate, but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Valve failure may allow for scheduled valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations and design criteria set points
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Pond A High Level or Potential Overflow

Pond A has been increased in size and has more than adequate capacity for complete containment of >10-year runoff events. If Pond A reaches a high level, an export or recycle system failure is the likely cause. Refer to pump and export system maintenance (see **Appendix B** for additional equipment-specific information).

3.2.6 CONTROL

The stormwater systems are primarily local control systems. Piping, valves, and MCC lockouts form the basis of control. Each electrical unit has an additional control circuit lockout if located remote from the MCC. Control circuit lockouts are for emergency cut-off of equipment, NOT for day-to-day switching nor for official maintenance lockout. For safety, always **use MCC lockouts** when performing maintenance.

Pumps have run time meters that allow monitoring of service time and scheduling of maintenance. The next phase of local control are level switches for low or high level alarms or shutoffs. These are provided for the main and adjacent pump wet wells for low level cutoffs and high level alarm in Pond A.

Local control is coordinated between components of the stormwater system for pump control in response to process water tank level or Site D/23 conditions. Recycle pumps are sequenced on as process water tank level falls. Main export pumps cannot cycle on if Site D/23 limits are out of a normal range (i.e., high pond level or high Site 23 wet well).

3.2.7 MAINTENANCE

3.2.7.1 Short-Term

See the Operation Checklist (Section 3.2.5.2) for day-to-day maintenance items. In addition, the following short-term maintenance activities are needed:

SHORT-TERM MAINTENANCE CHECKLIST - STORMWATER SYSTEM 920:

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1) Grease all fittings _____
2)Check all drives _____
3)Check all pipes and valves for leaks/damage _____

Monthly Items:

1)Check for pond liner and wetwell damage and debris_____
2)Check motor operating vibrations (motors, drives, bearings)_____
3)Observe lining/coating systems_____
4)Check degritting basin sediment accumulation (remove as necessary) _____

Annual or Semi-annual Items:

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check sediment pond accumulation (remove as necessary)_____
3)Clean and inspect electrical and I&C panels and elements _____
4)Other items:_________________________
____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____
__

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________

Follow-Up by MIMS; Date and Responsible Party:__________________________

3.2.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled pump rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the chlorine pump)
- •Replacement of Pond A liner

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.3 PROCESS WASTEWATER 920 SYSTEM

3.3.1 PURPOSE OF SYSTEM

The process wastewater treatment system at the 920 mill site is to collect, treat, discharge and/or recycle wastewater generated from mining, milling and associated ore concentration processes.

3.3.2 SYSTEM DESCRIPTION

The process wastewater treatment systems at the 920 are Chemical Precipitation Plants (CPP) and are depicted in **Figures 3.3-1 through Figure 3.3-3 (600-10-203,204,205)**. The system consists components and functions described below. The P&ID's, **Figures 3.3-4 and 3.3-5 (600-17-201, 203)** illustrate the wastewater system components, controls, and interfaces (piping and control). The system is configured and designed to provide maximum flexibility in treatment and distribution of water back to the mill or to approved NPDES discharge point 002.

Process wastewater is generated in the mining, milling and concentration system from fresh water distributed to the mill processes from the 920 fresh water system described in Section 3.1, from recycled stormwater runoff collected in the 920 stormwater system described in Section 3.2 or from underground mining operations.

Mill wastewater is collected for treatment at the process water tank which provides a common accumulation point within the mill for wastewater redistribution. From the process water tank, wastewater can be routed to the main 920 CPP wastewater treatment plant, recycled directly back to the mill, or discharged to the 920 reclaim tank. The 920 reclaim tank is an accumulation and redistribution point for treated wastewater from the main CPP or the existing auxiliary CPP. Distribution of water into and out of the CPP plants is dependent upon the water quality and quantity requirements of the mill and will be varied accordingly. **Figure 1-3 (100-10-202)** presents the general site process and stormwater balance flow sheet, which illustrates the primary and optional routing and handling of process wastewater.

Mine process water from underground is discharged to degritting basin 1, then to pond A pump station where it is pumped to the 920 auxiliary CPP for treatment. Treated mine process water is discharged to a clean water sump for recycling to underground operations. Alternatively, auxiliary CCP treated water may be routed to the Pond 6/Pit 5 systems, recycled to the mill or discharged to the reclaim tank.

Wastewater in the 920 reclaimed water tank can be discharged to two locations:

1) recycle through the mill, or;
2) discharged to an 8" HDPE pipeline for transport to the Pond 6/Pit 5 site.

At the Pond 6/Pit 5 site, the treated water can be routed directly for discharge to the existing secondary treatment pump station for discharge to NPDES point 002, to secondary treatment at the Filtration Plant (FP), or to storage within the surge capacity volume of Tank 6 or Pond 6. A full discussion of the process wastewater treatment and handling at the Pond 6/Pit 5 site is presented in **Sections 3.6 and 3.7**.

Key features of the 920 process water system include:

•Maximum recycle of water
•Increased wastewater treatment capacity
•Increased wastewater handling flexibility
•Backup treatment and handling systems located at Pond 6/Pit 5

Control of the process wastewater system is partially automated, but requires operator monitoring and execution of operations and maintenance procedures to maintain operation within prescribed operational parameters and NPDES discharge limits.

3.3.3 COMPONENTS OF SYSTEM

Components and sub-components of the 920 CPP's include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

Main Chemical Precipitation Treatment Plant (800 gpm rated capacity)

A. Process wastewater influent handling
 -Process water tank (See mill O&M plan)
 -Flow control valve
 -Flow meter/controller

B. Lime feed and storage
- -Incoming line from mill silo/slaker
- -pH sensor and controller
- -Pipes
- -Flow control valve

C. Acid feed and storage
- -Acid tote bin
- -pH sensor and controller
- -Chemical feed pump
- -Motor
- -Diaphragm
- -Check valves
- -Pipes
- -Safety/hazards

D. Peroxide feed and storage
- -Peroxide tote bin
- -Chemical feed pump
- -Motor
- -Diaphragm
- -Check valves
- -Pipes/tubing
- -Safety/hazards

E. Coagulant feed and storage
- -Coagulant (ferric iron solution) storage tank
- -Chemical feed pumps (2)
- -Motor
- -Diaphragm
- -Check valves
- -Plant influent flow sensor and controller
- -Pipes
- -Safety/hazards

F. Flocculent feed and storage
- -Polymer container/storage
- -Polymer blender
- -Motor
- -Flow meter
- -Polymer feed pump
- -Motor
- -Diaphragm
- -Check valves

G. Mix tank/reactor
- -Mixer motor

- -Pipes
- -Baffles
- -Valve
- -Mixer blades/shaft
- -Tankage

H. Flocculator/clarifier/thickener

- -Pipes
- -Mixer motor
- -Mixer paddles
- -Valves
- -Sludge pumps (2 - blowdown and recycle)
- -Motor
- -Impeller
- -Sludge rake motor
- -Clarifier modules (tube settlers)
- -Sample ports
- -Tankage

I. Effluent handling

- -pH sensor/alarm
- -Turbidity sensor/alarm
- -Level sensor/alarm
- -Pipes
- -Valves
- -Tankage
- -Pumps (2 - reclaim loop to mill)
- -Motors
- -Impellers

J. Sludge handling and disposal

- -Sludge disposal pump
- -Sludge recycle pump
- -Pipes
- -Valves

K. Control Systems

- -PLC/SCADA equipment

Auxiliary Chemical Precipitation Treatment Plant (300 gpm rated capacity)

A. Process wastewater influent handling

- -Pond A pump station
- -Flow control valve
- -Flow meter/controller

B. Lime feed and storage

- -Incoming line from mill silo/slaker
  - -pH sensor and controller
  - -Pipes
  - -Flow control valve

C. Flocculent feed and storage
- -Polymer container/storage
- -Polymer blender
- -Motor
- -Flow meter
- -Polymer feed pump
- -Motor
- -Diaphragm
- -Check valves

D. Mix tank/reactor
- -Mixer motor
- -Pipes
- -Baffles
- -Valve
- -Mixer blades/shaft
- -Tankage

E. Flocculator/clarifier/thickener (Densadeg Unit)
- -Pipes
- -Mixer motor
- -Mixer paddles
- -Valves
- -Sludge pumps (2 - blowdown and recycle)
- -Motor
- -Impeller
- -Sludge rake motor
- -Clarifier modules (tube settlers)
- -Sample ports
- -Tankage

F. Effluent handling
- -pH sensor/alarm
- -Turbidity sensor/alarm
- -Level sensor/alarm
- -Pipes
- -Valves
- -Tankage
- -Pumps
- -Motors
- -Impellers

G. Sludge handling and disposal
- -Sludge disposal pump
- -Sludge recycle pump
- -Pipes
- -Valves

H. Control Systems
- -PLC/SCADA equipment

3.3.4 INTERFACES WITH OTHER SYSTEMS

The interfaces with other site systems is by piping and controls. There are three main interfaces of the primary water treatment system with other systems. These systems are:

1) Auxiliary CPP
2) Mill/concentrator
3) Pond 6/Pit 5 site facilities.

Influent flow rates to both the main and auxiliary CPP's are controlled by flow control valves and flow meter control loop. Effluent routing back to the mill to underground or to Pond 6/Pit 5 is communicated with the mill water demand through piping and pumps at the reclaim water tank. As the mill demands additional recycle water, the pump rate to the mill increases and the overflow rate is decreased automatically to provide water for mill demand. Main CPP effluent overflow (i.e., water not recycled to the mill) is gravity piped to the Pond 6/Pit 5 facilities for further treatment or discharge. The quality of the overflow water as measured by sensors and controllers at the Pond 6/Pit 5 site, control if the water is discharged, sent to filtration plant (FP) for secondary treatment, or shunted to Tank 6 for additional primary treatment at the Pond 6/Pit 5 CPP. Influent flow rate to the auxiliary CPP is controlled manually and is determined by two factors: 1) the demand for recycled water in the mine, and 2) the demand for treated recycled water in the mill. Routing to the mine or mill is controlled manually. Once activated, the feed pump system to the auxiliary plant is controlled by level controls in the Pond A pump station and stormwater equalization tank. Controls and subsystem interfaces within the treatment facilities are described in Section 3.3.5 below.

Interfaces with other site systems consists of piping, valves, and operator communications. A listing of the principal interfaces is provided below:

Piping interfaces:
- -8" wastewater pipe from mill process water tank to the primary treatment plant.
- -2" freshwater pipe from freshwater system to the polymer blending system.
- -2" milk of lime pipe from mill lime slaker to the rapid mix tank influent pipe.
- -6" auxiliary treatment plant effluent pipe to reclaimed water tank.
- -10" treated effluent pipe to Pond 6/Pit 5.
- -2 -10" treated effluent pipes to reclaimed water loop for mill water supply.

-2" sludge blowdown pipe from Densideg sludge thickener to tailings thickener.

Control Interfaces:
-Low level/high level at reclaimed water tank
-*Control loops to mill, mine, and Pond 6/Pit 5 facilities?*

3.3.5 OPERATIONS

3.3.5.1 Process Design Criteria and Indicators

The main 920 CPP design criteria and operational indicators are tabulated in **Table 3.3-1**. The auxiliary 920 CPP design criteria and operational indicators are tabulated in Table 3.3.2. Though the two treatment plants are configured similarly, and may have the same effluent goals at some times, the effluent goals may be significantly different at other times and therefor requires different operational procedures. The auxiliary 920 CPP design criteria and operational indicators are tabulated in Table 3.3.2

Table 3.3.1 Process Water 920 - Design/Control Criteria

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS
Rapid Mix Tank	Designed to ensure complete mixing of reagents added immediately up- stream in the influent piping. The reagents include a coagulant, a peroxide oxidation agent, lime for pH elevation, or acid for pH depression. Control criteria are pH, dissolved metals, and suspended solids concentrations.	Mix tank mixer normally on at all times. Following treatment with reagents water should exhibit a particular color and solids character. The pH sensor/indicator/controller must be within prescribed range, typically 8.5 to 9.0 for NPDES discharge.
Flocculator/Reactor	Designed to receive precipitated and suspended solids from the rapid mix tank. Polymer is added to increase particle size and optimize settling. Control criteria are particle size and flocculation of particles, and settling rate.	Flocculator/Reactor agitator normally on at all times to optimize particle contact and flocculation. Judgement of particle size is visual, assessment of flocculation is visual, and the settling rate is periodically determined by the operator conducting defined procedure settling tests.
Clarifier/Sludge Thickener (Densadeg Unit)	Designed to provide complete solid-liquid separation. Clarifier receives outflow directly from the flocculator - reactor as this is an integrated portion of the system. Control criteria for the clarifier are effluent pH, dissolved metals, and suspended solids concentrations as measured in the reclaimed water tank. Control criteria for the sludge is the sludge volume index or sludge density. Control means are alteration of sludge recycle rate, alteration of total influent rate, alteration of upstream component operations.	The clarifier is a passive system dependent upon flow rate and the adequacy of upstream component performance. pH, suspended solids, and dissolved metals must normally be maintained within a set of prescribed limits consistent with the NPDES permit. The sludge thickener rake is operated normally on. The rate of sludge wasting, and sludge recycle is determined by the sludge density, sludge volume index and by the accumulation of sludge in the thickener as observed by the operator from sample ports in the thickener.
Reclaimed Water Tank or	Designed to provide an accumulation point for treated water. Water can be redirected to discharge or recycle to the mill from this component. Control criteria is the water demand from the	The reclaimed water can be recycled to the mill by activation of 1 or two recycle pumps by the operator as requested by mill operators. Water in excess of mill demand is discharged by

Clean Water Sump (auxiliary CPP only)	mill. Control means are recirculation pumps and valves. The clean water sump provides an equivalent function for the auxiliary CPP.	gravity overflow weir to the Pond 6/ Pit 5 site for discharge or further treatment.

3.3.5.2 Start-up and Normal Operations

The following sequence is a checklist of procedures to enable the process wastewater systems at the 920 site. Both the main and auxiliary treatment plants are from the same manufacturer, and are configured similarly. There are differences in some reagents used and the input and output sources, however the procedure below provides a generalized procedure for both plants. References to the manufacturers and suppliers O&M manuals are made when specific information in the detail O&M section is in place to provide step-by-step instructions. The general normal condition start-up procedure follows:

MAIN 920 CPP

1)Coordinate startup time, expected influent flow rates, overflow proportion, recycle loop proportion, and mill reagent use with mill operations personnel. Coordinate overflow routing and possible subsequent secondary treatment with Pond 6/Pit 5 treatment facilities personnel. Confirm that all electrical panels and all MCC are enabled (not locked out), and that all pumps, valves, and other controls are available for operation (not locked out).

2)Confirm chemical supply bins and tanks adequately filled to commence operation, including:
- -Peroxide
- -Coagulant (ferric sulfate/ferric chloride)
- -Slaked lime supply from mill silo/slaker
- -Sulfuric Acid
- -Polymer

3)Clean and calibrate influent and effluent pH meters with minimum 2 point calibration per manufactures instructions. Clean and calibrate effluent turbidity meter per manufacturers instructions.

4) Manually close 8" butterfly valves (2) following reclaimed water loop pumps.

5) Manually open 8" gate valves (2) between the rapid mix tank and Densadeg unit.

7)Close all 1/2" sample port valves in Densideg unit.

8)Close Densideg drain/blowdown valve.

9)Close rapid mix tank drain/blowdown valve.

10) Open 6" valve at process influent line from PLC panel to start influent flow.

11)Confirm influent flow into treatment plant at flow meter FE-1 and visually at the rapid mix tank.

12) Enable automatic feed of lime/acid and pH control loop from PLC panel.

13)Enable feed of coagulant from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.

14)Enable feed system for peroxide from PLC panel (if required by mill), adjust/confirm feed rate to standard predetermined initial rate.

15)Enable polymer feed system from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.

16)Fill rapid mix tank to impeller submergence, start rapid mix tank agitator at PLC and confirm operation.

17)Fill Densideg unit to impeller submergence. Start agitator at PLC and confirm operation.
18) Start thickener rake at PLC and confirm operation.
19)Start sludge recycle pump at PLC to recycle at 100%. Configure sludge blowdown pump and valves to 0% blowdown.
20) Check pump readiness at reclaim water loop by hand switching to confirm function. Configure PLC auto control pump system for reclaimed water tank to provide 100% recycle to mill (zero overflow to discharge), or provide for overflow to be routed to Tank 6 rather than discharge at Pond 6/Pit 5 site.
21)Observe pH adjustment control loop to confirm pH adjust to prescribed limits (typically 8.5 to 9.0).
22)Observe precipitate coagulation and flocculation to confirm adequate particle agglomeration. Confirm adequate settling at clarifier overflow weir, and at effluent turbidity meter.
23)Confirm proper reclaim water loop pump cycling and reclaim water tank level sensor operation/control.
24)Monitor sludge blanket level in Densideg unit via periodic sample extraction at 1/2" sample ports. Upon attaining the manufacturers recommended sludge blanket level, commence reduction of sludge recycle in 10% increments, and increase the sludge blowdown by 10% increments, until sludge blanket is at equilibrium, and effluent clarification is maintained.
25)Reduce effluent recycle via pump and valve controls to flow rate prescribed by mill. Confirm overflow meeting required operational parameters (NPDES limits) and discharge to overflow pipeline for direct discharge at NPDES point 002.

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence with nominal recycle is as follows:

-Follow startup procedure to bring plant to full function

-Route all overflow directly to discharge at NPDES point 002 via the Pond 6/Pit 5 pipeline to the existing secondary treatment pump station.

-Periodically monitor treatment reagent storage tank levels and feed pump function.

-Periodically monitor sludge settling rate with standard sludge settling test.

-Monitor influent and effluent pH values, and effluent turbidity.

-Monitor sludge blanket level in thickener via sample ports.

Normal operation procedures and checklists are provided by the treatment plant manufacturer and associated components manufactures. An operators daily log and checklist for incorporation into the MIMS database will be maintained by completion of the following daily system checklist form and log forms.

920 MAIN PROCESS WASTEWATER TREATMENT SYSTEM
DAILY CHECKLIST

DATE:

OPERATIONS:	QUANTITY/STATUS	INITIAL
1) Record coagulant storage tank volume level	_______	_______
2) Record acid storage tank volume level	_______	_______
3) Record peroxide storage tank volume level	_______	_______
4) Record polymer storage tank volume level	_______	_______
5) Confirm PLC operation	_______	_______
6) Confirm mix tank mixer operation	_______	_______
7) Confirm flocculation mixer operation	_______	_______
8) Confirm sludge rake operation	_______	_______
9) Confirm sludge recycle pump function	_______	_______
10) Confirm sludge blowdown pump function	_______	_______
11) Observe reclaim water tank condition, fluctuation and cycling.	_______	_______
12) Conduct floc settling test	_______	_______
13) Conduct sludge volume index test	_______	_______
14) Record cumulative flow of influent	_______	_______
15) Record instantaneous flow of influent	_______	_______
16) Record cumulative flow of overflow	_______	_______
17) Record instantaneous flow of overflow	_______	_______
18) Record cumulative flow of recycle	_______	_______
19) Record instantaneous flow of recycle	_______	_______
20) Confirm coagulant pump operation	_______	_______
21) Confirm acid pump function	_______	_______
22) Confirm slake lime availability	_______	_______
23) Confirm polymer blend and feed function	_______	_______
24) Test floor sump pump function	_______	_______
25) Confirm function of rapid mix pH monitor	_______	_______
26) Confirm function of effluent pH monitor	_______	_______
27) Confirm function of effluent turb. monitor	_______	_______
28) Conduct safety walk around and inspection	_______	_______
29) Other items:______________________ ________________________________ ________________________________	_______	_______

Comments and General Observations:____

3.3.5.3 Abnormal Operations and Emergency Conditions

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined below along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge concerning the system is the most sure way of preparing for an abnormal operational condition should it occur. The examples are broad, and are intended as a general corrections methods. Detailed troubleshooting, abnormal function conditions, and alternative operations methods are generally included with the manufacturers operations and maintenance manuals for the specific component or subsystem. For water treatment facilities abnormal operation is generally caused by one of two main failures 1) electro-mechanical failure, 2) process failure. These are addressed separately below. Some types of failure create emergency conditions which require special actions beyond trouble shooting and mitigative measures. These are also discussed below.

Electro-Mechanical Failure

Pump failure

Failure modes:

1) Pump not operating when called for

-Check MCC ON and HAND-OFF-AUTO switches
-Check control signal and switching to control circuit
-Check power to panels and breakers
-Check motor starter or heater trip
-Check motor for failure (short circuit "burned up")
-Check for impeller jamb or obstruction.

2) Pump not producing rated output
3) Pump running, but not pumping
-Check inlet and outlet pressures
-Check for closed valves
-Check for prime if appropriate
-Check for intake obstructions
-Check for shaft key stripping or break

-Check for impeller wear, volute wear etc.
-Check for adequate fluid supply on suction side
-Check for bearing overheating/binding
-Check Manufacturers O&M information (Appendix___)

Pipe Failure

Failure modes:

1) Leaking at joint, union, flange or other fitting
-Check joint, union or flange bolt tightness
-Check gasket or pipe joint compound
-Check for stripped threads or warped flange

2) Leaking at wall of pipe
-Check for stress crack
-Check for corrosion hole
-Check for puncture hole

3) Partial or total plugging
-Check for closed valves
-Check for debris
-Check for scale, precipitate or other buildup

Valve Failure

Failure modes:

1) Valve won't open or close
-Check for obstruction
-Check for broken valve stem
-Check for stripped threads or worm gears
-Check servo-motor or air motor for function

2) Valve won,t stop flow, seal incomplete
-Check for obstruction
-Check for broken gasket/seal

3) Valve leaks from valve stem
-Check valve stem nut tightness
-Check valve stem packing or gasket
-Check valve stem for excessive wear

Controller Failure

-Operate system in manual or HAND mode until problem resolved. Recalibrate according to manufacturers recommendations, operations criteria, set points etc. Place system in service and observe operation. Obtain technical assistance from on-site via work order or from manufacturer.

Motor Failure

-Check power on or MCC on status
-Check electrical panel supply or breakers status

-Check drive jamming or shaft rotation
-Check for short circuit or windings burn.

Sensor Failure
-Clean and calibrate sensor according to manufacturers instructions
-Check sensor output signal

Process Failure

Elevated or Depressed pH
-Check acid or lime supply
-Check pH sensor for function and calibration
-Check chemical feed pump and controller
-Check influent untreated water quality for abnormal characteristics

Slug Inflow
-Reduce influent feed rate
-Increase sludge blowdown rate
-Monitor effluent pH, turbidity
-Prepare to increase reclaimed water recycle to 100% if necessary to prevent non-compliance discharge

Solids Washout
-Recycle 100% of reclaimed water to mill or send to secondary treatment at the Pond 6/Pit 5 site
-Check coagulant feed
-Check polymer feed
-Check influent flow rate
-Increase sludge blowdown
-Reduce influent flow rate if possible

Dissolved Metals Washout
-Check effluent pH and rapid mix tank pH, adjust as needed
-Check coagulant feed, increase ferric feed rate
-Reduce influent flow rate

Component Scaling and Fouling
-Remove scale from components where scale is a problem
-Sample scale material and send for analysis
-Lime-excessive lime addition, may wish to supplement neutralization with a sodium based agent such as NaOH
-Gypsum-excessive recirculation through mill

-Soft scale (slime) from overdosing with polymer
-Wash down
-Adjust polymer feed rate

Emergency Conditions

Chemical Spill
-Evacuate and isolate the building and spill area
-Contact the mine spill prevention and control team
-Execute SPCC plan

Chemical/Electrical Fire
-If appropriate, use local equipment to extinguish
-Contact mine fire crew

Vessel or Piping Rupture
-Shut down plant and close influent supply pipe valve.
-Notify mill operators

Uncontrolled Discharge
-Shut down plant and close influent supply pipe valve.
-Notify mill operators
-Notify Pond 6/Pit 5 operators

3.3.6 CONTROL

Local Control

The 920 systems are partially local control systems. PLC systems located at or near the treatment plants provide automated control for most plant subsystems. Each electrical unit has an additional control circuit lockout if located remote from the MCC or PLC. Control system lockouts are for emergency cut-off of equipment, not for day to day switching or scheduled maintenance lockout. Use MCC lockouts only when performing maintenance.

Pumps have run time meters that allow monitoring of service time and scheduling of maintenance. The second level of local control are level switches and low or high level alarms or shutoffs. These are provided for the reclaimed water tank, effluent pH, and effluent turbidity.

Subsystem Control

The 920 systems have several sub-system process loop controllers between chemical feed pumps and the process water. These systems include:

-Influent flow rate (flow control valve) loop to influent flow meter
-Control loops for pH and lime/acid addition

-Control loops for pH and Turbidity in effluent monitoring
-Control loop for sludge blowdown cycling

System Control/Interfaces

The 920 systems have programmable logic controllers (PLC's) for overall system control integrating information from level indicators, alarms, subsystem control loops.

3.3.7 MAINTENANCE

3.3.7.1 Short-Term

The Operations and Maintenance checklist should be executed for maintenance items. The manufacturers recommended O&M schedule should take precedence over the short term monitoring schedule outlined on the checklist.

SHORT TERM MAINTENANCE CHECKLIST
920 PROCESS WATER PRIMARY WATER TREATMENT PLANT

DATE:_______

DAILY ITEMS:	**INITIAL**
1) Clean and calibrate pH probes	_______
2) Clean and calibrate turbidity monitor	_______
3) Observe influent flow meter and effluent flow meters flow balance.	_______

WEEKLY ITEMS:	
1) Grease all fittings	_______
2) Check all drives (gear box oil, belts)	_______
3) Check all pipe, valves, hoses, and vessel penetrations for leaks/damage	_______
4) Check all valve for function (open-close)	_______
5) Check all pumps for function (startup normally off pumps)	_______
6) Clean and flush clarifier tubes	
7) Other items:____	

____

MONTHLY ITEMS:	
1) Check motor bearings and pump bearing for oil/grease	_______
2) Check motors and drives for alignment and vibration	_______
3) Check all alarms and auto shut downs for function	_______
4) Observe all coatings, paint and lining systems for integrity	_______
5) Clean all sensor probes/level probes/pressure sensors etc.	_______
6) Other items:____	

____

ANNUAL OR SEMI-ANNUAL ITEMS:	
1) Change oil and grease per MFR's recommendations	_______
2) Check interconnecting piping for scale or corrosion	_______
3) Check/replace chemical feed pump diaphragms	_______
4) Inspect mixer shafts, bearings, and impellers	_______
5) Empty tankage and inspect for wear, coating condition, scale etc.	_______
6) Other items:____	

____

Comments/Findings:____
____
____

3.3.7.1 Long-Term

Long term maintenance items will be conducted according to specific equipment manufacturers recommendations or in accordance with the findings developed for the detailed MIMS record system.

Long term maintenance items include:

- -Scheduled rebuilds based upon hours of service or other service units
- -Replacement of linings, coatings, or other material protective measures
- -Replacement of high wear equipment such a pump bearings, packing, motor bearings, drive bearings, pump volutes, pump impellers, pump stators or rotors.
- -Replacement of items subject to chemical corrosion or breakdown such as hoses, tubing, chemical storage tank valves etc.

3.4 SEWAGE 920 SYSTEM

3.4.1 PURPOSE OF SYSTEM

The domestic sewage system at the 920 mill site is in place to collect, treat, and route treated water to export to Tank TK-06 for additional treatment and discharge. The treated water is combined with stormwater in DB-02.

3.4.2 SYSTEM DESCRIPTION

The domestic sewage system at the 920 mill site is depicted in **Figures 3.4-1 (Shop drawings from the supplier).** The P&ID, **Figure 3.4-2 (from supplier)** illustrates the overall water system components, controls, and interfaces (piping and control).

Sewage is collected from rest rooms, the dry (showers) and sinks in lunch rooms. Sewage is routed to the reconditioned secondary treatment system, a fixed media, rotating biological contractor (RBC). Effluent from the aerobic treatment portion of the unit is routed through a clarifier and a tablet hypochlorinator. Disinfected effluent is piped along with storm flow to DB-02.

Sludge from the aerobic treatment unit is pumped to an aerobic sludge holding tank. Sludge in the holding tank is mixed and aerated awaiting disposal. Some digestion of the solids occurs in the holding tank. Submersible pumps are used to mix and transfer solids. Solids are transferred to the on-site dewatering system for tailings backfill or to tanks for shipment to Juneau for disposal at CBJ treatment facilities. A dedicated solids dewatering press is under study.

Key features of the domestic sewage system include:

•Rehabilitated secondary treatment unit (RBC)
•Rehabilitated tablet disinfection system
•Solids storage system

Control of the sewage system is largely automated and passive. Flow routing of sewage is by gravity. Rotating biological contractors run continuously. Sludge transfer pumps and sludge aeration are on timers or can be controlled by hand switches. disinfection is automatic and in proportion to flow (more flow results in more contact with chlorine tablets).

3.4.3 COMPONENTS OF SYSTEM

Components and sub-components of the 920 sewage system include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

A-Collection sewers (pipes)
B-RBC secondary aeration system
    -RBC and drive
C-Clarifier
    -Submersible waste sludge pump
    -Submersible return sludge pump
D-Solids holding tank
    -Submersible mixing pumps
    -Aerators and blower
F-General components
    -Electrical and control interfaces
    -Lighting system
    -General (applies to the component system)
        -Maintenance items
    -Pipe and valves

3.4.4 INTERFACES WITH OTHER SYSTEMS

The interfaces with other site systems is by piping. Water for the mill domestic waste generators is piped to the treatment unit. Treated effluent is piped to DB-02.

A critical interface with the domestic sewage system occurs at the fixtures that generate the wastewater. It is critical that these fixtures be in working order and that flows are controlled within reasonable ranges to reduce load on the sewage system.

3.4.5 OPERATIONS

3.4.5.1 Process Design Criteria and Indicators

The 920 sewage system design criteria and operational indicators are tabulated in **Table 3.4-1**.

Table 3.4-1 Sewage 920 - Design/Control Criteria		
COMPONENT	**DESIGN/CONTROL CRITERIA**	**COMMENTS/INSTRUCTIONS**
Primary Clarifier	9,600 gallon holding cell before RBC cell	
	Mixed with 4 submersible pumps to keep sludge form "caking" or settling	Sludge wasted to holding tank by submersible pump (time clock controlled). Waste before solids reach 10,000 mg/l TSS (approximately 300 gpd)
RBC Secondary Treatment Unit	12,000 gpd (8.3 gpm) average daily flow capacity.	
	40 pounds per day BOD and 20 lb/day TSS influent load	
Clarifier	400 to 1,200 gpm/square foot flow range at average and peak flows	
	Return and waste sludge capacity of 2 times theoretical load	Sludge returned to RBC cell by submersible pump (time clock controlled)
Chlorinator	40 gpm capacity	
	6 to 12 day supply of tablets	
	Flow proportional dosage (passive)	
Solids Holding	1-month capacity (1,200 pounds solids at 1% solids)[8,800 gallons from 920 site, 1,170 gallons from Hawk Inlet]	Note: The holding tank may receive solids form the Hawk Inlet sewage treatment facility
	Heating, 2, 2,400-watt immersion heaters	Winter operation only
	Aeration, 1, 5 hp blower	

NOTE: See **Appendix B** for detail information from manufacturers and suppliers.

3.4.5.2 Start-up and Normal Operation

Start-up and normal operation discussions assume that the system is in full operational status and all systems are fully maintained and functioning.

Start-up

The following sequence is a checklist of procedures to enable the domestic sewage system at the 920 site. References to the manufacturer's and supplier's O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions. The general start-up procedure follows:

1)Confirm condition of sewer pipes and treatment units.
2)Route all flows to the treatment unit.
4)Motor control center and lock-out verification
 -MCC and lock-outs at "on" status
3)Allow the unit to fill and start the RBC unit drive. NOTE: upon the very first start-up or after the system has been down long enough to result in damage to the aerobic growths on the RBC disks, a month-long (or more) accumulation period will be required to obtain regrowth on the RBC media. Sewage should be routed through the RBC unit and all solids should be returned to the RBC cell until at least a quarter inch growth layer is in place on the RBC disk.
4)Check pump and blower readiness (test pump each by hand-switching). Blower will not be needed until waste sludge is in the holding tank.
 -Open valves
 -Confirm rotation and flow.
5)Check controllers
 -Level switches in solids holding tank
 -Over pressure blow-off on blower
-Pump timers (return sludge and waste sludge). Waste sludge will not be needed until unit is fully operational (1-month normally)
 -Pump on-off controllers
6)Start-up pumps and controls
 -Switch pumps to on, one at a time to check operation
 -Switch all off
 -Switch all pumps to auto in sequence (allow time for pump to come to speed before switching another)
 -Confirm operation
 -Observe operation
  -Pumps, valves, leaks, level control
  -Adequate water depth in treatment unit to adequately cover the RBC disks
  -Confirm that pumps cycle at proper levels

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence is as follows:

- •Route sewage flow to the RBC treatment unit
- •Operate the primary clarifier mixers to keep sludge mixed
- •Operate the RBC drive continuously
- •Return all sludge from secondary clarifier (adjust pump timer so return sludge contains solids, not effluent. Likely 5 minutes of pumping every hour or less). The pump time must be determined by experience.
- •Waste solid from the primary clarifier when additional solids start to carry over to the clarifier or when the solids in the RBC cell reaches over 3000 mg/l TSS. This will likely require sludge wasting for an hour, twice weekly at a rate of approximately 25 gpm. The wasting rate must be determined by experience.
- •Operate the aerator in the holding tank when waste sludge is present. Adjust blower pressure for sludge depth if necessary.
- •Attempt to decant water from holding tank to treatment influent weekly by shutting off aeration for 3-hours and siphoning or pumping "clear" water off holding tank.
- •Clean the clarifier weirs daily (brush or wash down)
- •Service the tablet chlorinator weekly (remove debris and add tablets so it i always 50 to 75 % of tablet capacity).
- •Observe outlet water quality daily

Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database:

SEWAGE TREATMENT SYSTEM 920 OPERATION CHECKLIST:

Date:_______

OPERATIONS:Initial and Date

1) Observe waste sources, sewer pipes, and treatment units for debris, plugging, damage, freezing, or unusual conditions_____
2)Confirm proper pump and blower operation _____
3)Confirm proper sludge return and wasting (TSS or sludge levels)_____
4)Observe treatment unit condition (scum, growth, controls, operation)_____
5)Clean clarifier weirs _____
6)Valves, piping issues (leaks, valve operation)_____
7)Confirm heater operation if needed_____
8)Check chlorinator (clean and add tablets as needed) _____
9)Determine if sludge must be removed from holding tank (removal mode yet to be determined) _____
9)Safety Inspections weekly_____
10)Other items:________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____
____
__
Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _____________________________
Follow-Up by MIMS; Date and Responsible Party:_________________________

3.4.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, hydraulic or organic overloading, or failure to operate or maintain the system during normal day-to-day operations. Examples of such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, processes, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and the details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Sewage Collection Conveyance Failure

Failures or plugging of sewers or excess flow from sources can result in site contamination (back-ups in sewers) and treatment loading problems. High flows can wash out the biological treatment processes. Excess organic loading can use up oxygen supplied to the treatment organisms, killing or damaging the biological treatment process.

It is necessary that any failures or overloads from the collection and conveyance system be remedied as soon as possible to minimize biological process upset. Repair pipes or sources such as toilets or sinks. Organic overloads from spills or "disposal" into sewers must be controlled. The biological treatment system is small and the growth that performs the treatment is fragile.

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- Pump not operating when called for
- Pump not producing the rated output or not pumping

The return sludge and waste sludge pumps are the critical pumps and must be checked daily and repaired upon notice of a problem. Depending on the characteristic of the failure mode, the following checklist should be followed:

<u>Pump Not Running:</u>

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary. Pumps are all removable submersibles and can be readily removed, maintained, or replaced with a spare pump (suggest keeping at least 2 spare pumps in stock).

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached or functional where the valve will no longer operate, but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Valve failure may allow for scheduled valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. Most controls in this system are on-off. The sludge return and wasting pumps controllers have timers that require system experience to set the desired run time and sequences. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations, design criteria, and field developed set points (timers)
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Sludge Holding Tank High Level or Potential Overflow

If the sludge holding tank reaches a high level, sludge must be removed from the system. Sludge may be metered into the mine backfill dewatering thickening and dewatering system or transferred in specially built tanks to the CBJ treatment plant.

3.4.6 CONTROL

The sewage treatment system is locally controlled. Piping, valves, timers, and MCC lockouts form the basis of control. Each electrical unit has an additional control circuit lockout if located remote from the MCC. Control circuit lockouts are for emergency cut-off of equipment, NOT for day-to-day switching nor for official maintenance lockout. For safety, always **use MCC lockouts** when performing maintenance.

Control Interfaces:

- •No automated control circuits are included in the design with the exception of timed pump sequencing and cycles for the return and waste sludge pumps as follows:
  - •Increase return sludge if solids accumulate in the clarifier hopper.
  - •Change the waste sludge pump time to maintain no more than 10,000 mg/l TSS in the primary clarifier mix tank.
- •Other controls are initiated by operators as a result of observations as follows:
  - •Turn one or more of the mixing pumps off if the primary clarifier cell over mixes and causes solids carry over to the clarifier.
  - •Settle solids and decant water from the sludge holding tank as levels approach full.
  - •Withdraw solids from the holding tank if the solids will not settle more than 1 foot in 3 hours after the aerator is shut off.
- •Alarm functions include:
  - •Pump failure alarm (notifies the CCS)

3.4.7 MAINTENANCE

3.4.7.1 Short-Term

See the Operation Checklist (**Section 3.4.5.2**) for day-to-day maintenance items. In addition, the following short-term maintenance activities are needed:

SHORT-TERM MAINTENANCE CHECKLIST - SEWAGE SYSTEM 920:

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1) Grease all fittings _____
2)Check all drives _____
3)Check all pipes and valves for leaks/damage _____

Monthly Items:

1)Check for sewer or treatment plant leaks, damage, and debris_____
2)Check motor operating vibrations (motors, drives, bearings)_____
3)Check the RBC drive, disks, and disk shaft/attachments _____

Annual or Semi-annual Items:

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check for sludge accumulation (remove as necessary) _____
3)Clean and inspect electrical and I&C panels and elements _____
4)Other items:_________________________

____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____
__

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________

Follow-Up by MIMS; Date and Responsible Party:__________________________

3.4.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled pump rebuilds based on hours of service (track hours)
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.5 WATER SITE D/23

3.5.1 PURPOSE OF SYSTEM

Water site D/23 has two primary purposes. One is to receive water from area 23 drainage and from stormwater pumps PP-09 and PP-10 at Pond A and pump to tank TK-6 for further treatment and ultimate discharge. The other is to collect run-off in Pond D and from site D curtain drains, and pump it to the freshwater head tank at the mill for recycle.

3.5.2 SYSTEMS DESCRIPTION

The system is depicted in **Figures 3.5-1** through **3.5-3 (600-17-209, 700-35-202, 600-17-208)**, and consists of components and functions as described below. the P&ID, **Figure 3.5-4 (600-17-200)**, illustrates the overall water system components controls and interfaces (piping and control).

The following describes normal operations. As indicated, there are a number of bypass and intertie valves available for maintenance and operation during various failure modes.

Pond D collects surface runoff from area D. Effluent from Pond D and from curtain drain collection systems is collected at the underdrain sump and pumped to a standpipe containing adjustable-speed caisson pump PP-37, which recycles water to the fresh water head tank at the mill. A solenoid valve on the underdrain sump pump discharge is opened to drain the pipe when the pumps are turned off to prevent freezing.

If the standpipe overflows for any reason, the overflow will flow into wet well 23 with pumps PP-24 and PP-25, as described below.

Pond 23 can receive stormwater runoff from area 23, mill reclaim tank overflow, storm water from pumps PP-09 and PP-10 in Pond A,and mixed well/stormwater from degritting basin DB-02. These flows are further treated in DB-03 prior to Pond 23. The pond is decanted to wet well 23 and pumps PP-24 and PP-25. This decant flows through a caisson containing the standpipe with pump PP-37 enroute to wet well 23 in order to divert overflow from the standpipe to wet well 23. Wetwell 23 also collects water from Pond 23 underdrain pump PP-23, which is used to dewater Pond 23.

Pumps PP-24 and PP-25 export to tank TK-06 at the dry tailings Pond 6 area for equalization before additional treatment. Export flow is monitored by FE/FT-____.

3.5.3 COMPONENTS OF SYSTEM

Components and sub-components of the 920 stormwater system include the following MIMS standard numbered items (see **Appendix A and B**) for MIMS and detailed component information):

Note: Add MIMS number for each item later.

Pond D Subsystem

- Pond D
- Site 23 curtain drain collectors
- Site D curtain drain
- Underdrain sump
- Pump PP-21
- Pump Pp-22
- Solenoid value SOV
- Caisson (wetwell)
- Standpipe
- Pump PP-37
- Pressure indication PI
- Pipes
- Valves
- Pressure indicator PI
- Overflow from Pond D

Pond 23 Subsystem

- Site ditches/pipes
- Degritting basin DB-03
- Splash box

- Pond 23 sediment berm, decant structure, and underdrain
- Underdrain sump
- Pump P-23
- Wet well No. 23
- Pump PP-24
- Pump PP-25
- Pressure indicator PI
- Flow element and transmitter FE/FT
- Pipes
- Valves
- Ditch
- Pump station building

3.5.4 INTERFACES WITH OTHER SYSTEMS

Piping interfaces are as follows:

-Reclaim tank TK-85 overflow
-(Capped) makeup water line from water supply pump house
-Effluent from stormwater 920 system
-Discharge line to process stormwater system at Pond 6 and on to outfall at Hawk Inlet
-Discharge line to Tank TK-06
-Discharge to tank TK-28 at the mill

Upon failure of any pump, the pump is automatically disabled and an alarm signal is sent to the CCS (Central Control System).

Adjustable speed pump PP-37 pumps to the fresh water head tank at the mill. It receives on-off control and an analog speed command from the level controller in its caisson (wetwell).
The effluent flow from pumps PP-24 and PP-25 is monitored and the flow signal is sent to the process water treatment plant and to the CCS.

3.5.5 OPERATIONS

3.5.5.1 Process Design Criteria and Indicators

Water Site D/23 design criteria and operational indicators are tabulated in Table 3.5-1.

Table 3.5-1 Water Site D/23-Design/Control Criteria

COMPONENT	DESIGN/CONTROL	COMMENTS/INSTRUCTION

	CRITERIA	S
Pond D	Capacity ____ acre-feet	Receives area D surface runoff.
Underdrain Sump (Pond D)	Capacity _____ gallons	Receives Pond D water, Site D curtain drainage, and water from Site 23 curtain drains.
Pond D pumps PP-21 and PP-22	2 each, ___hp, ___gpm units operate in lead-standby to control sump level	
Solenoid valve SOV	Opens when pumps not running to drain discharge line (freeze protection)	
Caisson and Standpipe	Caisson capacity ____ gallons Standpipe capacity ___ gallons Operating range ___ feet	Standpipe is in caisson. Pump PP-37 is in standpipe.
Caisson Pump PP-37	Adjustable speed, ___hp, zero to ___ gpm	Receives on/off and speed control to maintain level in its wetwell
Degritting Basin DB-03	Removes grit from stormwater received from pumps PP-09 and PP-10, Site 23 and DB-02	
Pond 23	Capacity ___ acre feet Underdrain to ______ pond for sediment removal	Receives flow from degritting basin DB-03 and from area 23 drainage
Underdrain Sump (Pond 23)	Capacity ___ gallons	
Underdrain Pump PP-23	--- hp --- gpm	Used to dewater Pond 23
Wet Well 23	Capacity ___ gallons	
Wet well pumps PP-24 and PP-25	2 each ____ hp, ____ gpm Units operate in lead-lag to maintain level in wetwell	Export water to tank 06 for equalization, treatment and discharge

NOTE: See **Appendix B** for detailed manufacturers and supplier component of system information.

3.5.5.2 Start-up and Normal Operation

Start-up and normal operation discussions assume that the system is in full operational status and all systems are fully maintained and functioning.

Start-up

The following sequence is a checklist of procedures to enable the water system at site D/23. References to the manufacturer's and supplier's O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions. This system is being upgraded. Portions have been in operation for some time. The following startup procedure is written as though from a cold start with no pumps operating.

1) Confirm condition of ponds, ditches, culverts, and other hydraulic system components. Maintain as needed.
2) Confirm that there is water in Pond D and in the Pond D underdrain sump.
3) Check setup status for pumps PP-21, PP-22, PP,23, and PP-37:

- Discharge valves open
- HOA switches to OFF
- Power on to MCC
- Lockouts ON

4) Confirm that fresh water head tank at mill can receive water.
5) Operate pumps individually, manually. Turn each HOA switch to ON, then to OFF. For pump PP-37, manually vary speed over the range 50 to 100 percent. Confirm correct motor rotation and that flow is attained. Check solenoid valve on discharge of pumps PP-21 and PP-22. Confirm that valve closes when either pump is operating and opens when both pumps are off to drain down the discharge pipe (freeze protection).
6) Confirm that the level controller at the fresh water head tank is ready and operating. For pumps PP-21, PP-22, and PP-37 turn HOA switches to AUTO.
7) Confirm that pumps PP-21 and PP-22 cycle to maintain level in the underdrain sump, and that the solenoid valve on the discharge line closes when either pump is on and opens when both pumps are off.
8) Confirm that pump PP-37 cycles on and off and changes speed as commanded by the level controller at the fresh water head tank (when PP-37 is slowed or stopped, the standpipe will overflow, and the water will flow to wet well no. 23 to be pumped by pumps PP-24 and PP-25).
9) Observe and inspect pipes, valves, and pumps for leaks or noisy operation.
10) Confirm setup status of pumps PP-24 and PP-25:

- Discharge valves open
- HOA switches OFF
- Power on to MCC
- Lockouts ON

11) Confirm that there is water in Pond 23 and underdrain sump 23, and that pump PP-09 or PP-10 is ready to operate and other mill site water sources to Pond 23 are operational.

12) Confirm that tank TK-06 can receive water and that the export pipeline is operational.
13) Operate pumps PP-24 and PP-25 individually, manually, Turn each HOA switch to ON, then to OFF. Confirm correct motor rotation and that flow is attained. Confirm operation of the flow transmitter on the pump discharge header, and that the flow signal is received at the process water treatment plant and at the CCS.
14) For pumps PP-24 and PP-25, turn HOA switches to AUTO.
15) Confirm that the pumps cycle to maintain level range in wet well no. 23 (and therefore in Pond 23).
16) Observe and inspect pipes, valves, and pumps for leaks or noisy operation.
17) Confirm proper operation of lockout switches. For each pump, while running turn lockout switch to OFF, then back to ON. Confirm that pump stops, then starts again.

Normal Operation

Normal operation assumes no failures or breaks. Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database.

WATER SITE D/23 OPERATION CHECKLIST:

Date:________

OPERATIONS:Initial and Date

1) Observe ditches, culverts, pipes, Pond A, and drops for debris, plugging, damage or erosion conditions_____

2)Observe proper flow from pond D to underdrain sump and observe sump condition (debris, level elements)_____

3)Observe proper operation and sequencing of pond D pumps PP-21 and PP-22 and discharge solenoid valve SOV___.______

4)Observe proper sequencing and speed control of pump PP-37 as commanded by the level controller at the fresh water head tank._____

5)Observe degritting basin DB-03 level and grit accumulation. _____

6)Observe proper flow to pond 23 and wet well 23, and observe wet well condition (debris, level elements).______

7)Observe proper operation and sequencing of pumps PP-24 and PP-25 and associated Pond 23 level.______

8)Observe signal output of discharge flow transmitter FE/FT_____

9)Perform safety inspections weekly. _

10)Other items:__________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ________________________________

Follow-Up by MIMS; Date and Responsible Party:___________________________

3.5.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- Pump not operating when called for
- Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

Pump Not Running:

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached, or functional where the valve will no longer operate but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Depending on location and failure mode, valve failure may allow scheduling of valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations and design criteria set points
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Tank Overflow or Low Level

1)Check tank valve positions
2)Check control set points (adjust as necessary)
3)Check control elements such as LIC, LE, and LT for proper operation, power, and signal
4)Check supply system and pipes for leaks if tank is low

Low Flow In Greens Creek

In the event annual cold weather conditions limit flow in Greens Creek to less than 4.0 cfs, an alarm will be signaled and maximum water recycle procedures implemented in the mill. Fresh water supply system operations should be modified as follows:

1)Shut down 2 of the supply pumps to limit withdrawal to 250 gpm
2)Confirm the mill is in the maximum recycle mode of operation (250 gpm maximum demand)
3)Monitor tank level to determine if additional throttling of demand is necessary

3.5.6 CONTROL

Pond D pumps PP-21 and PP-22 are operated automatically in lead-standby control to maintain level in the underdrain sump (and, therefore, in Pond D). The solenoid valve on the pump discharge header opens to drain the discharge pipe back into the sump when the pumps are not running (for freeze protection).

Adjustable speed pump PP-37 pumps to the fresh water head tank at the mill. It receives on-off control and an analog speed command from the level controller in its caisson (wetwell).

Underdrain pump PP-23 ;is controlled manually and is used to dewater Pond 23.

Wet well No. 23 pumps PP-24 and PP-25 are operated automatically in lead-lag control to maintain level in wet well No. 23 (and, therefore, in Pond 23).

Pumps PP-24 and PP-25 pump to tank TK-06. In the event of high level at tank TK-06, an alarm will be initiated and the operator must take appropriate action. There is no interlocking with pumps PP-24 and PP-25, but tank 6 has an automatic overflow to Pond 6 to control unexpected surges inflow.

The pump discharge flow signal is sent to the process water treatment plant and to the CCS.

3.5.7 MAINTENANCE

3.5.7.1 Short-term

See the Operation Checklist (**Section 3.5.5.2**) for day-to-day maintenance items. In addition, the following tabulated short-term maintenance activities are needed.

SHORT-TERM MAINTENANCE CHECKLIST - WATER SITE D/23:

Date:_________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1) Grease all fittings _____
2) Check all drives (gear, belts) _____
3) Check all pipes and valves for leaks/damage _____

Monthly Items:

1) Check motor operating vibrations (motors, drives, bearings)_____
2) Observe lining/coating systems_____

Annual or Semi-annual Items:

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Clean and inspect electrical and I&C panels and elements_____
3) Other items:__________________________

____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ________________________________
Follow-Up by MIMS; Date and Responsible Party:____________________________

3.5.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the chlorine pump)

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.6 PROCESS AND STORMWATER - POND 6

3.6.1 PURPOSE OF SYSTEM

The primary purpose of this system is to serve as a ballast reservoir for water collected from a number of sources and either pump the water to the process water system (System, 7, **Section 3.7**) for treatment or to route treated water to the outfall at Hawk Inlet. In addition, the system provides emergency storage in Pond 6 and dry tailings underdrain collection and pumping to treatment.

3.6.2 SYSTEM DESCRIPTION

The system is depicted in **Figures 3.6-1** through **3.5-4 (350-35-201, 350-35-202, 600-17-212, 350-10-202)**. the P&ID, **Figure 3.6-4 (600-17-204)**, illustrates the overall water system components controls and interfaces (piping and control).

Surge tank TK-06 has been added to this system to act in place of Pond 6, which previously served as a collection point and flow equalization storage. Any runoff collected in Pond 6 is now pumped to the surge tank.

Surge tank TK-06 collects water from a number of sources, including stormwater from 920, process water from 920, water from Site D/23, storm and process water from Hawk Inlet, and runoff and underdrain water form the Pond 6/dry tailings site. In addition, water treated to discharge quality by the 920 process treatment units is routed through the Pond 6 area and can be routed directly to the outfall or to additional treatment. From Tank 6, water can be pumped for treatment to the Pond 6/Pit 5 process water system for further treatment. Treated water is metered to the process outfall in Hawk Inlet through the Pond 6 area and system.

pH of the water in the surge tank (Tank 6) is controlled, and pH and flow of the water metered to the outfall at Hawk Inlet is monitored and recorded.

Other elements of the system include a truck wash near Tank 6 which drains into Pond 6, barge pump PP-40 to dewater Pond 6, and a wet well to collect water from the dry tailings pile and underdrains from where it is pumped to Tank TK-06.

3.6.3 COMPONENTS OF SYSTEM

Components and sub-components of the Process And Stormwater - Pond 6 system include the following MIMS standard numbered items (see **Appendices A and B** for MIMS and detailed component information):

Note: Add MIMS number for each item later.

A-Surge Tank TK-06
- -Tank level monitoring LE/LI/LIT/LI-9042
- -Tank pH control system
- -Primary treatment pumps PP-38/39
- -Pressure indicator PI-
- -Truck wash pump PP-55

B-Truck wash system/building

C-Pond 6
- -Barge pump PP-40
- -Dry tailings curtain drains and underdrains
- -Wet well no. 2
- -Pumps PP-27/28
- -Pressure indicator PI-
- -Pump PP-58 (future)
- -Wet well and standpipe

D-Secondary Pump Station
- -Secondary treatment pumps PP-41/42
- -Pressure indicator PI-

E-NPDES sample station
- -NPDES Monitoring Building
- -Sample pump
- -pH monitoring AE/AIT/AIR-9200
- -pH monitoring AE/AIT/AIR-9201
- -Flow monitoring FE/FT/FIR-9202

F-Miscellaneous Systems
- -Tank inlet flow monitoring FE/FIT/FI-9040
- -Broken pipe alarm FY/FDAH-9040

-Tank inlet flow monitoring FE/FIT/FI-9041
-Broken pipe alarm FY/FDAH-9041
-Pipes
-Valves
G-Tailings underdrain storage system
-Tank (future)
-Pump PP-59 (future)
-Level monitoring LE/LT-

3.6.4 INTERFACES WITH OTHER SYSTEMS

Piping Interfaces

Piping interfaces are listed below and are shown on **Figure _**.

- Stormwater from the process and stormwater system at Hawk Inlet
- Reclaim tank overflow
- Pumped water from wet well 23 at water site D/23
- Effluent from the tailings filter plant at the process water system in the pond 6 area (for routing to the outfall at Hawk Inlet)
- Effluent from tailings filter plant (to tank TK-06)
- Treated water to diffuser at Hawk Inlet outfall
- Pumped water to rapid mix tank (from pumps PP-41/42)
- Pumped water to rapid mix tank (from pumps PP-38/39)
- Pumped water to tailings filter plant (from pumps PP-41/42) (this path not normally used)
- (Future) pumped water to (future) tailings seepage tank (from future pump PP-58)

Control Interfaces

Upon failure of any automatically controlled pump, the pump is automatically disabled and an alarm signal is sent to the CCS (Central Control System).

Upon occurrence of broken pipe alarms (PDAH-9040 or PDAH-9041) a BROKEN PIPE alarm signal is sent to CCS.

3.6.5 OPERATIONS

3.6.5.1 Process Design Criteria And Indicators

Process And Stormwater Pond 6 system design criteria and operational indicators are tabulated in **Table 3.6-1**.

Table 3.6-1 Process And Stormwater Pond 6 Design/Control Criteria		
COMPONENT	**DESIGN/CONTROL CRITERIA**	**COMMENTS/INSTRUCTIONS**
Surge tank TK-06	Capacity 1.1 million gallons	
LI-9043	Level indicator range 0-__ feet	
LE/LIT/LI-9043	Level monitor and indicator range 0-__ feet	
?? tank pH control system	??	
Truck wash		
Pond 6	Not normally used Receives overflows and incidental runoff	
Pump PP-40	__hp,__gpm	Used to dewater pond 6
Dry tailings curtain drain and underdrains		
Wet well no. 2	capacity __ gal.	
Pumps PP-27/28	2 each,__hp, __gpm operate in lead-standby to control level in wet well no. 2	
Pressure indicator PI-__	range 0-__ psi	
Pump PP-58 (future)	__ hp, __gpm	
Pumps PP-38/39	2 each, __hp, __gpm (control????)	These pump to the rapid mix tank
Pressure	range 0-__ psi	

Table 3.6-1 Process And Stormwater Pond 6 Design/Control Criteria		
indicator PI-__	with diaphragm isolator	
Pump PP-55	__hp, __gpm	Supplies water to truck wash
Wet well and standpipe	Capacity __ gallons	Contains standpipe and pumps PP-41/42
Pumps PP-41/42	2 each, __hp, __gpm operate in lead- standby to control level in sump	These pump to secondary treatment-overflow routed through standpipe to Hawk Inlet outfall
Pressure indicator PI-__	Range 0-__ psi	Monitors effluent header of pumps PP-41/42
NPDES pH monitoring AE/AIT/AIR-9200 and AE/AIT/AIR-9201	Range -__to +__ pH units	Monitors discharge to Hawk Inlet outfall
NPDES flow monitoring FE/FT/FIR-9202	Range 0-__ gpm	Monitors flow to Hawk Inlet outfall
FE/FIT/FI-9040	Range 0-__ gpm	Monitors flow to tank TK-06 from wet well no. 23 at water Site D/23
Broken pipe alarm FY/FDAH-9040		
FE/FIT/FI-9041	Range 0-__ gpm	Monitors flow to tank TK-06 from reclaim tank TK-85 overflow at process water 920 system
Broken pipe alarm FY/FDAH-9041		

Note: See **Appendix B** for detailed system component information from manufacturers and suppliers.

3.6.5.2 Startup And Normal Operation

Startup and normal operations descriptions assume that the system is in full operational status and all systems are fully maintained and functioning.

Startup

The following sequence is a checklist of procedures to enable the Process and Stormwater - Pond 6 system. References to the manufacturers' and suppliers' O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions. This system is being upgraded, and portions of the system have been in operation for some time. The following startup procedure is written as though from a cold start with no pumps operating.

1)Confirm condition of ponds, culverts, and other hydraulic system components. Maintain as needed.
2)Confirm that there is water in tank TK-06, in wet well no. 2, and in the wet well containing pumps PP-41/42.
3)Check setup status for pumps PP-27, -28, -38, -39, -40, -41, -42, -55, and -58:
-Discharge valves open
-HOA switches to OFF
-Power on to MCC
-Lockouts ON
4)Confirm that the Hawk Inlet diffuser is available to receive water.
5)Confirm that rapid mix tank TK-72 is available to receive water.
6)Operate pumps individually, by hand. Turn each HOA switch to ON, then to OFF. Confirm correct motor rotation and that flow is attained. For pumps PP-27 and PP-28, confirm that solenoid valve SOV-9045 on the discharge header closes when a pump is turned on and opens when the pump stops. For pumps PP-38 and PP-39, vary pump speed by hand over the range 50 to 100 percent.
7)Confirm that level controls in wet well no. 2 are operable, and turn HOA switches for pumps PP-27 and PP-28 to AUTO. Confirm that the pumps cycle to maintain level in the wet well, and that the discharge pressure indicator reads pressure.
8)**???How are these controlled?**
Operate primary treatment pumps PP-38 and PP-39. Confirm that the pumps operate correctly and that the discharge pressure indicator reads pressure.
9)Operate truck wash pump PP-55. Confirm that the pump operates correctly.
???Is this automatically controlled?

10)Confirm that level controls are operable in the wet well containing pumps PP-42 and PP-42, and turn the HOA switches for these pumps to AUTO. Confirm that the pumps cycle to maintain level in the wet well,and that the discharge pressure indicator reads pressure.
11)Turn HOA switches to OFF for pumps PP-41 and PP-42 and allow water to overflow into the standpipe and to the Hawk Inlet outfall. Confirm that the pH and flow instrumentation on the outfall line operates correctly. Turn the HOA switches back to AUTO.
12)Confirm proper operation of flow monitoring instrumentation on inlets to tank TK-06: FE/FIT/FI-9040 and FE/FIT/FI-9041.
13)Disconnect the local inputs and confirm operation of broken pipe alarms FDAH-9040 and FDAH-9041. Confirm that these alarm signals are transmitted to the CCS.
14)Observe and inspect pipes, valves, and pumps for leaks or noisy operation.
15)Confirm proper operation of lockout switches. For each pump, while running turn lockout switch to OFF, then back to ON. Confirm that the pump stops, then starts again.

At this time the system should be operating normally.

Normal Operation

Normal operation assumes no failures or breaks. Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database.

PROCESS AND STORMWATER - POND 6 OPERATION CHECKLIST:

Date:________

OPERATIONS (daily unless noted):Initial and Date

1)Observe culverts, pipes, Pond 6, and drops for debris, plugging, damage, or erosion conditions.
2)Observe proper operation of level instrumentation (loop 9042) on tank TK-06.
3)Observe proper operation of flow instrumentation into tank TK-06(loops 9040 and 9041).
4)Observe proper operation of pH control system.
???????????????????????????LET'S DISCUSS!
5)Observe level and grit accumulation in Pond 6 and in truck wash channels
6)Observe proper operation of pumps PP-27/28, solenoid valve SOV-9045, and associated level controls in wet well no. 2.
7)Observe proper operation of pumps PP-38/39 and discharge pressure indicator.
???????How are these controlled?
8)Observe proper operation and sequencing of pumps PP-41/42, discharge level indicator, and associated level controls in wet well.
9)Observe operation of NPDES sample station in NPDES monitoring building (pH loops 9200 and 9201 and flow loop 9202).
10)Perform safety inspections weekly.

9)Other items:__________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____

Safety Issues:____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________
Follow-Up by MIMS; Date and Responsible Party:__________________________

3.6.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- •Pump not operating when called for
- •Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

Pump Not Running:

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached, or functional where the valve will no longer operate but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Depending on location and failure mode, valve failure may allow scheduling of valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations and design criteria set points
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Tank Overflow or Low Level

1)Check tank valve positions
2)Check control set points (adjust as necessary)
3)Check control elements such as LIC, LE, and LT for proper operation, power, and signal
4)Check supply system and pipes for leaks if tank is low

3.6.6 CONTROL

Pumps PP-27/28 are operated automatically in lead-standby control to maintain level in wet well No. 2, which collects water from the dry tailings underdrains.

Pump PP-40 is operated by hand as required to dewater pond 6.

Pumps PP-38/39 **coordinate with treatment controls**to pump to the rapid mix tank.

Pump PP-55 is turned on by hand or by a truck actuated switch when the truck wash is in use.

Pumps PP-41/42 are operated automatically in lead-standby control to maintain level in their wet well. Overflow in this wet well is automatically routed via the standpipe to the outfall at Hawk Inlet if pumps fail.

Upon failure of any automatically-controlled pump, the pump is automatically disabled and an alarm signal is sent to the CCS (Central Control System).

Upon occurrence of a broken pipe alarm, the alarm signal is sent to the CCS (loops 9040 and 9041).

Flow rate (loop 9202) and pH (loops 9200 and 9201) are monitored and recorded on the discharge to the Hawk Inlet outfall.

Incoming flow rates are monitored and indicated on two inlets to tank TK-06. These flow rates are also compared with upstream flow rates to generate local broken pipe alarms, which are then transmitted to the CCS.

3.6.7 MAINTENANCE

3.6.7.1 Short Term

Perform short-term maintenance according to the following short-term maintenance check list.

<u>SHORT-TERM MAINTENANCE CHECKLIST - PROCESS AND STORMWATER POND 6:</u>

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

<u>Weekly Items:Initial and Date</u>

1) Grease all fittings _____
2) Check all drives _____
3) Check all pipes and valves for leaks/damage _____

<u>Monthly Items:</u>

1) Check for pond condition and wetwell damage and debris_____
2) Check motor operating vibrations (motors, drives, bearings)_____
3) Observe lining/coating systems_____
4) Check degritting channels at truck wash and grit accumulation in Pond 6 (remove as necessary) _____

<u>Annual or Semi-annual Items:</u>

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check sediment accumulation (remove as necessary) ______
3) Clean and inspect electrical and I&C panels and elements _____
4) Other items:__________________________
____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.6.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled pump rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the sample pump or chem feeders)

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.7 PROCESS WASTEWATER POND 6/PIT 5 SYSTEMS

3.7.1 PURPOSE OF SYSTEM

The process water system at the Pond 6/Pit 5 site is to collect, treat, and discharge wastewater generated from the tailings disposal site, site 23, site D, Hawk Inlet concentrate storage area/loadout and other process or mine ore/tailings contact water.

3.7.2 SYSTEM DESCRIPTION

The treatment systems at the Pond 6/Pit 5 site consist of a Chemical Precipitation Plant (CPP) and a Filtration Plant (FP). Both treatment systems will be addressed here, but separated by subheadings where appropriate. The process and contact water chemical treatment system at the Pit 5 is depicted in **Figures 3.7-1 through 3.7-3 (600-10-205, 206, 207)**. The system consists of components and functions described below. The P&ID's, **Figures 3.7-4 and 3.7-5 (600-17-202, 600-17-203)** illustrate the wastewater system components, controls, and interfaces (piping and control). The system is configured and designed to provide maximum flexibility in treatment and distribution of water directly to discharge or to filtration and then discharge. The filtration plant is depicted in **Figures 3.7-6 and 3.7-7 (Coffman drawings)**. The system consists of components and functions described below. The filtration plant P& ID's, **Figure 3.7-8 and 3.7-9 (Coffman drawing 160-17-M2)** illustrate the system components, controls and interfaces.

Process or contact wastewater is generated from stormwater runoff collected from the 920 stormwater system, site 23 runoff and seepage collection system, site D runoff and seepage collection system, and from seepage, underdrain pumping, and surface runoff contact water at the tailings disposal site. The Pit 5 treatment systems may also be used to treat mill water on a second pass from the 920 treatment plants, or as first pass treatment in the event the 920 plants must be temporarily removed from service.

Process and contact water to be treated at Pit 5 is routed to Tank 6 as a central accumulation and blending point for wastewater redistribution. From Tank 6, wastewater can be routed via pipelines to the CPP, routed directly to the FP, or discharged to NPDES discharge point 002. In the event that flows are received at the Pond 6/Pit 5 facilities in excess of the treatment capacity, 23 acre-feet of overflow storage and surge capacity are available in Pond 6. Overflow accumulation in Pond 6 can be pumped back to tank 6 for distribution to the treatment facilities and discharge. **Figure 1-3 (100-10-202)** presents the general site process and stormwater balance flow sheet, which illustrates the primary and optional routing and handling of runoff contact water and process wastewater.

Key features of the Pond 6/Pit 5 wastewater treatment systems include:
•Options for chemical treatment, filtration, or both
•Increased wastewater treatment and wastewater surge/storage capacity
•Increased wastewater handling flexibility
•Provide backup treatment and handling systems for mill/concentrator treatment plants

Control of the process wastewater system is partially automated, but requires operator monitoring and execution of operations and maintenance procedures to maintain operation within prescribed compliance parameters. Operations of the systems require operator communications with the 920 treatment plant operators and the mill/concentrator operations personnel.

3.7.3 COMPONENTS OF SYSTEM

Components and sub-components of the Pond 6/Pit 5 wastewater systems include the following MIMS standard numbered items (see Appendix A and B for MIMS and detailed component information):

Chemical Precipitation Plant (800 gpm rated capacity)

A. Process wastewater influent handling
-Tank 6/Pond 6, contact water pipeline, mill pipeline
-Flow control valves
-Flow meter/controllers
B. Lime feed and storage
-Silo and slaker
-pH sensor and controller
-Pipes
-Flow control valve
C. Coagulant feed and storage
-Coagulant (ferric iron solution) storage tank
-Chemical feed pumps (2)
-Motor
-Diaphragm
-Check valves
-Plant influent flow sensor and controller

-Pipes
-Safety/hazards

D. Flocculent feed and storage
-Polymer container/storage
-Polymer blender
-Motor
-Flow meter
-Polymer feed pump
-Motor
-Diaphragm
-Check valves

E. Mix tank/reactor
-Mixer motor
-Pipes
-Baffles
-Valve
-Mixer blades/shaft
-Tankage

F. Flocculator/clarifier/thickener
-Pipes
-Mixer motor
-Mixer paddles
-Valves
-Sludge pumps (2 - blowdown and recycle)
-Motor
-Impeller
-Sludge rake motor
-Clarifier modules (tube settlers)
-Sample ports
-Tankage

G.Sludge handling and disposal
-Sludge holding tank
-Sludge filter press
-Sludge filter press feed pump
-Sludge filtrate transfer pump
-Sludge filtrate tank
-Sludge cake disposal truck
-Air compressor
-Pipes
-Valves

H. Effluent handling
-pH sensor/alarm

-Turbidity sensor/alarm
-Level sensor/alarm
-Pipes
-Valves
-Tankage
-Pumps (2 - filtration plant)

I. Control Systems
-PLC/SCADA equipment

Filtration Plant (1,600 gpm rated capacity)

A. Process wastewater influent handling
-Tank 6/Pond 6, contact water pipeline, mill pipeline
-Flow control valves
-Secondary pump station pumps
-Secondary pump station wet well
-Secondary pump station building
-Flow meter/controllers

B. Acid feed and storage
-Tote bin
-pH sensor and controller
-Pipes
-Flow control valve

C. Coagulant feed and storage
-Coagulant (ferric iron solution) storage tank
-Chemical feed pumps (2)
-Motor
-Check valves
-Plant influent flow sensor and controller
-Pipes
-Safety/hazards

D. Flocculent feed and storage
-Polymer container/storage
-Polymer blender
-Motor
-Flow meter
-Polymer feed pump
-Motor
-Diaphragm
-Check valves

E. Mixer
-Static mixer

-Pipes
F. Flocculation tank
-Pipes
-Tank
-Baffles
-Valves
G. Filters
-Filter tanks
-Surface wash
-Media
-Piping (plastic and steel)
-Valves
-Compressor (pneumatics)
-PLC
-Analog backwash controller
-Differential pressure sub-system
-Sight glasses
G. Backwash tank and pumps
-Backwash holding tank
-Backwash pumps
-Pipes
-Valves
H. Effluent handling
-pH sensor/alarm
-Turbidity sensor/alarm
-Level sensor/alarm
-Pipes
-Valves
-Tankage
I. Control Systems
-PLC/SCADA equipment

3.7.4 INTERFACES BETWEEN SYSTEMS

The interfaces between systems is by piping and controls. There are three main interfaces of the CPP and FP with each other and other systems. These systems are: 1) CPP interface with the FP, 2) Pond 6 and Tank 6, 3) 920 CPP's. Both the CPP and FP communicate with the Tank 6 accumulation tank through level sensors. As water is accumulated the plant operators must start-up or adjust the CPP and/or FP accordingly. CPP effluent is piped to the FP facilities for further treatment or by-pass to direct discharge if NPDES standards are met without filtration. The quality of the CPP effluent water is measured by sensors at effluent standpipe. The effluent standpipe can receive water from the 920 CPP's and from the Pond 6/Pit 5 CPP's,

Interfaces with other site systems consists of piping, valves, and operator communications. A listing of the principal interfaces is provided below:

Piping interfaces:

- -8" wastewater pipe from Tank 6/Pond 6 to the CPP and FP.
- -2" treated water pipe from the filtration plant to the polymer blending system.
- -10" treated effluent pipe to Pond 6/Pit 5 and to secondary treatment pump station.
- -12" backwash pipe from filter plant to Tank 6

Control Interfaces:

- -Low level/high level at effluent standpipe
- -Low level/high level at Tank 6

Other Interfaces:

- -Truck haulage of sludge cake for disposal

3.7.5 OPERATIONS

3.7.5.1 Process Design Criteria and Indicators

The Pond 6/Pit 5 CPP design criteria and operational indicators are tabulated in **Table 3.7-1**. The Pond 6/Pit 5 FP design criteria and operational indicators are tabulated in **Table 3.7-2.** The two treatment facilities serve different purposes and incorporate different processes, therefore both require different operations and maintenance specifications.

Table 3.7.1 Pond 6/Pit 5 CCP - Design/Control Criteria

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS
Rapid Mix Tank	Designed to ensure complete mixing of reagents added immediately up-stream in the influent piping. The reagents include a coagulant, a peroxide oxidation agent, lime for pH elevation, or acid for pH depression. Control criteria are pH, dissolved metals, and suspended solids concentrations.	Mix tank mixer normally on at all times. Following treatment with reagents water should exhibit a particular color and solids character. The pH sensor/indicator/controller must be within prescribed range, typically 8.5 to 9.0 for NPDES discharge.
Flocculator/Reactor	Designed to receive precipitated and suspended solids from the rapid mix tank. Polymer is added to increase particle size and optimize settling. Control criteria are particle size and flocculation of particles, and settling rate.	Flocculator/Reactor agitator normally on at all times to optimize particle contact and flocculation. Judgement of particle size is visual, assessment of flocculation is visual, and the settling rate is periodically determined by the operator conducting defined procedure settling tests.
Clarifier/Sludge Thickener (Densadeg Unit)	Designed to provide complete solid-liquid separation. Clarifier receives outflow directly from the flocculator - reactor as this is an integrated portion of the system. Control criteria for the clarifier are effluent pH, dissolved metals, and suspended solids concentrations as measured in the reclaimed water tank. Control criteria for the sludge is the sludge volume index or sludge density. Control means are alteration of sludge recycle rate, alteration of total influent rate, alteration of upstream component operations.	The clarifier is a passive system dependent upon flow rate and the adequacy of upstream component performance. pH, suspended solids, and dissolved metals must normally be maintained within a set of prescribed limits consistent with the NPDES permit. The sludge thickener rake is operated normally on. The rate of sludge wasting, and sludge recycle is determined by the sludge density, sludge volume index and by the accumulation of sludge in the thickener as observed by the operator from sample ports in the thickener.
Sludge Storage Tank	Designed to provide sufficient volume to hold blowdown sludge from the clarifier/thickener until	Sludge is pumped from the clarifier to this tank. Tank level sensors provide information for activating a sludge

	sufficient volume is available to load and operate the sludge filter presses.	pressing cycle.
Sludge Filter Press	Designed to press sludge to a relatively high solids low volume product to assist with disposal	Sludge is pumped from the sludge holding tank to the filter press. The solids are pressed/filtered to a high solids content cake. Filtrate (liquid) is collected in a filtrate sump tank and is pumped back to the clarifier/thickener influent line. This process must be performed periodically depending on sludge production rate and sludge storage tank status.
Effluent Standpipe	Designed to provide an accumulation point for treated water. Water can be redirected to discharge or recycle for re-treatment, or routed to filtration. Control criteria is the effluent water quality. Control means are pumps and valves.	The effluent can be recycled to Tank 6 by activation of 1 or two recycle pumps and associated valves further CPP treatment, filtration, or discharge to NPDES point 002.

Table 3.7-2 Filter Plant - Design/Control Criteria

COMPONENT	DEIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS
Secondary Pump Station	Design as a backup system. Normally, previously untreated process water will proceed through the chemical treatment system and then to the filtration system. In the event that filtration alone will sufficiently treat the process water, the secondary pump station can route water to the filters. System capacity is 1800 gpm (variable rate)	The secondary pump station can act as a backup for the Tank 6 pumps if/when Tank 6 is bypassed. The effluent standpipe in the secondary pump station wet well automatically separates treated from untreated water. During extreme flow conditions, the standpipe may act as an overflow.
Chemical Addition	Acid or sodium hydroxide can be added to adjust ph to the optimum level for chemical precipitation and for floculation. The range of control is more than pH 6 to pH 9. Polymer can be added proportional to flow before the statix mix/flocculation systems.	pH control is automated.
Mixing/Flocculatio n	Mixing and flocculation are passive proceses. A static mixer and baffled flocculation tank are provided. The flocculation tank detention time is approximately 5 minutes at 600 gpm.	Floor space is provided for expansion of the flocculation system if needed.
Filtration	Three multi-media sand filters are provided. The design filter rate is 600 gpm per filter at 3 gpm/ft^2.	
Backwash	Backwash initiation is either manually started or by differential pressure across the filters. Backwash of one filter at a time (sequentially) is provided at 12 gpm/ft^2).	Backwash water is stored in the backwash tank to be avaialble when needed. Backwash water is routed to Tank 6 for treatment in the chemical treatment unit and dewatering.

3.7.5.2 Start-up and Normal Operations

The following sequence is a checklist of procedures to enable the process wastewater systems at the Pond 6/Pit 5 site. References to the manufacturers and suppliers O&M manuals are made when specific information in the detail O&M section is in place to provide step-by-step instructions. The general normal condition start-up procedure follows:

Pond 6/Pit 5 CPP

1) Coordinate startup time, expected influent flow rates, with all plant operations personnel. Coordinate overflow routing and possible subsequent secondary treatment at filter plant. Confirm that all electrical panels and all MCC are enabled (not locked out), and that all pumps, valves, and other controls are available for operation (not locked out).
2) Confirm chemical supply bins and tanks adequately filled to commence operation, including:
   -Coagulant (ferric sulfate/ferric chloride)
   -Slaked lime supply from mill silo/slaker
   -Polymer
3) Clean and calibrate influent and effluent pH meters with minimum 2 point calibration per manufactures instructions. Clean and calibrate effluent turbidity meter per manufacturers instructions.
4) Manually close 8" butterfly valves (2) following effluent standpipe pumps.
5) Manually open 8" gate valves (2) between the rapid mix tank and Densadeg unit.
6) Manually open 8" butterfly valves at Tank 6 primary treatment pump station.
7) Close all 1/2" sample port valves in Densadeg unit.
8) Close Densadeg drain/blowdown valve.
9) Close rapid mix tank drain/blowdown valve.
10) Open 6" valve at process influent line from PLC panel to start influent flow.
11) Confirm influent flow into treatment plant at flow meter FE-1 and visually at the rapid mix tank.
12) Enable automatic feed of lime and pH control loop from PLC panel.
13) Enable feed of coagulant from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.
14) Enable polymer feed system from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.
15) Fill rapid mix tank to impeller submergence, start rapid mix tank agitator at PLC and confirm operation.
16) Fill Densideg unit to impeller submergence. Start agitator at PLC and confirm operation.
17) Start thickener rake at PLC and confirm operation.
18) Start sludge recycle pump at PLC to recycle at 100%. Configure sludge blowdown pump and valves to 0% blowdown.
19) Check pump readiness at reclaim water loop by hand switching to confirm function. Configure PLC auto control pump system to provide 100% treatment capacity (zero overflow of Tank 6).
20) Observe pH adjustment control loop to confirm pH adjust to prescribed limits (typically 8.5 to 9.0).

21)Observe precipitate coagulation and flocculation to confirm adequate particle agglomeration. Confirm adequate settling at clarifier overflow weir, and at effluent turbidity meter.
22)Confirm proper pump cycling and Tank 6 level sensor operation/control.
23)Monitor sludge blanket level in Densadeg unit via periodic sample extraction at 1/2" sample ports. Upon attaining the manufacturers recommended sludge blanket level, commence reduction of sludge recycle in 10% increments, and increase the sludge blowdown by 10% increments, until sludge blanket is at equilibrium, and effluent clarification is maintained.
24)Reduce effluent recycle via pump and valve controls to flow rate prescribed by mill. Confirm overflow meeting required operational parameters (NPDES limits) and discharge to overflow pipeline for direct discharge at NPDES point 002.

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence with nominal recycle is as follows:

-Follow startup procedure to bring plant to full function
-Route all effluent directly to discharge at NPDES point 002
-Periodically monitor treatment reagent storage tank levels and feed pump function.
-Periodically monitor sludge settling rate with standard sludge settling test.
-Monitor influent and effluent pH values, and effluent turbidity.
-Monitor sludge blanket level in thickener via sample ports.
-Monitor sludge levels in sludge storage tank and cycle sludge presses as required.

Normal operation procedures and checklists are provided by the treatment plant manufacturer and associated components manufactures. An operators daily log and checklist for incorporation into the MIMS database will be maintained by completion of the following daily system checklist form and log forms.

POND 6/PIT 5 CHEMICAL PRECIPITATION TREATMENT SYSTEM
DAILY CHECKLIST

DATE:____________

OPERATIONS:	QUANTITY/STATUS	INITIAL
1) Record coagulant storage tank volume level	_______	_______
2) Record polymer storage tank volume level	_______	_______
3) Record lime silo volume level	_______	_______
4) Confirm PLC operation	_______	_______
5) Confirm mix tank mixer operation	_______	_______
6) Confirm flocculation mixer operation	_______	_______
7) Confirm sludge rake operation	_______	_______
8) Confirm sludge recycle pump function	_______	_______
9) Confirm sludge blowdown pump function	_______	_______
10) Observe and record sludge hold tank level	_______	_______
11) Observe and record filtrate tank level/status	_______	_______
12) Observe effluent standpipe condition, fluctuation and cycling.	_______	_______
13) Conduct floc settling test	_______	_______
14) Conduct sludge volume index test	_______	_______
15) Record cumulative flow of influent	_______	_______
16) Record instantaneous flow of influent	_______	_______
17) Record cumulative flow of effluent	_______	_______
18) Record instantaneous flow of effluent	_______	_______
19) Confirm coagulant pump operation	_______	_______
20) Confirm lime slaker operation	_______	_______
21) Confirm polymer blend and feed function	_______	_______
22) Test floor sump pump function	_______	_______
23) Confirm function of rapid mix pH monitor	_______	_______
24) Confirm function of effluent pH monitor	_______	_______
25) Confirm function of effluent turb. monitor	_______	_______
26) Conduct safety walk around and inspection	_______	_______
27) Other items:______________________ ________________________________ ________________________________	_______	_______

Comments and General Observations:____
____
____
____

Pond 6/Pit 5 Filtration Plant

1)Determine if the filtration plant should be operated in series, operated whthout the CCP, or not operated (i.e., filtration not needed for water quality). Operation in normal series filtration is as follows:
2)Coordinate startup time, expected influent flow rates, with all plant operations personnel. Coordinate overflow routing and secondary treatment at filter plant with CCP operation or flow from Pond 23 or 920. Confirm that all electrical panels and all MCC are enabled (not locked out), and that all pumps, valves, and other controls are available for operation (not locked out).
3)Confirm chemical supply bins and tanks adequately filled to commence operation, including:
 -Acid
 -Coagulant (ferric sulfate/ferric chloride)
 -Sodium Hydroxide
 -Polymer
4)Clean and calibrate influent and effluent pH meters with minimum 2 point calibration per manufactures instructions. Clean and calibrate effluent turbidity meter per manufacturers instructions.
5) Manually close valves (2) from secondary pumps (PP-41 and 42).
6) Manually open valves (2) from CCP filter feed pumps (PP-30 and 31).
Or adjust the valve operation depending on other operating modes.
7)Enable all filter valves (PLC)
8)Open the valves on feep pipes to static mixer and flocculator.
9)Close rapid mix tank drain/blowdown valve.
10) Open filter control valve on process influent line from the PLC panel and enable feed pumps to start influent flow.
11)Confirm influent flow into treatment plant at flow meter XXXXX.
12) Enable automatic feed of acid for the pH control loop from PLC panel.
13)Enable feed of acid feed from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.
14)Enable polymer feed system from PLC panel, adjust/confirm feed rate to standard predetermined initial rate.
15) Check supply and backwash pump readiness by hand switching to confirm function. Configure PLC auto control pump system for feed and backwash pumps to facilitate 100% feed rate.
20)Observe pH adjustment control loop to confirm pH adjust to prescribed limits (typically 8.5 to 9.0).
21)Observe precipitate coagulation and flocculation to confirm adequate particle agglomeration for proper filtration. Confirm adequate filtration at effluent turbidity meter.
22)Confirm proper pump cycling and Tank 6 level sensor operation/control.
23)Monitor headloss across filter beds. Upon attaining the manufacturers recommended differential pressure, commence backwashing or confirm that the PLC initiales and times the backwash sequence according to manufacturer's recommendations.
24)Confirm treated effluent meeting required operational parameters (NPDES limits) and discharge to outfall pipeline at secondary pump station for direct discharge at NPDES point 002.

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence with nominal recycle is as follows:

- -Follow startup procedure to bring plant to full function
- -Route all effluent directly to discharge at NPDES point 002 (there is the option to recycle if effluent does not meet standards)
- -Periodically monitor treatment reagent storage tank levels and feed pump function.
- -Periodically monitor backwash need (i.e., differential headloss).
- -Monitor influent and effluent pH values, and effluent turbidity.
- -Monitor accumulatio of backwash water in backwash tank.

Normal operation procedures and checklists are provided by the treatment plant manufacturer and associated components manufactures. An operators daily log and checklist for incorporation into the MIMS database will be maintained by completion of the following daily system checklist form and log forms.

POND 6/PIT 5 FILTRATION TREATMENT SYSTEM
DAILY CHECKLIST

DATE:____________

OPERATIONS:	QUANTITY/STATUS	INITIAL
1) Record acid storage tank volume level	________	________
2) Record polymer storage tank volume level	________	________
3) Record backwash tank volume level	________	________
4) Confirm PLC operation	________	________
5) Confirm feed pump operation	________	________
6) Confirm backwash pump operation	________	________
7) Confirm surface wash operation	________	________
8) Confirm pH and turbidity functions	_______	________
9) Conduct floculation and settling test	________	________
10) Record cumulative flow of influent	________	________
11) Record instantaneous flow of influent	________	________
12) Record cumulative flow of effluent	________	________
13) Record instantaneous flow of effluent	________	________
14) Confirm acid pump operation	________	________
15) Confirm polymer slaker operation	________	________
16) Confirm polymer blend and feed function	________	________
17) Test floor sump pump function	________	________
18) Confirm function of pH monitor	________	________
19) Confirm function of effluent turb. monitor	________	________
20) Conduct safety walk around and inspection	________	________
21) Other items:________________________		
____		
____	________	________

Comments and General Observations:____
____
____
____

3.7.5.3 Abnormal Operations and Emergency Conditions

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined below along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge concerning the system is the most sure way of preparing for an abnormal operational condition should it occur. The examples are broad, and are intended as a general corrections methods. Detailed troubleshooting, abnormal function conditions, and alternative operations methods are generally included with the manufacturers operations and maintenance manuals for the specific component or subsystem. For water treatment facilities abnormal operation is generally caused by one of two main failures 1) electro-mechanical failure, 2) process failure. These are addressed separately below. Some types of failure create emergency conditions which require special actions beyond trouble shooting and mitigative measures. These are also discussed below.

Electro-Mechanical Failure

Pump failure

Failure modes:

1) Pump not operating when called for
-Check MCC ON and HAND-OFF-AUTO switches
-Check control signal and switching to control circuit
-Check power to panels and breakers
-Check motor starter or heater trip
-Check motor for failure (short circuit "burned up")
-Check for impeller jamb or obstruction.
2) Pump not producing rated output
3) Pump running, but not pumping
-Check inlet and outlet pressures
-Check for closed valves
-Check for prime if appropriate
-Check for intake obstructions
-Check for shaft key stripping or break
-Check for impeller wear, volute wear etc.
-Check for adequate fluid supply on suction side
-Check for bearing overheating/binding
-Check Manufacturers O&M information (Appendix___)

Pipe Failure

Failure modes:

1) Leaking at joint, union, flange or other fitting
-Check joint, union or flange bolt tightness
-Check gasket or pipe joint compound
-Check for stripped threads or warped flange

2) Leaking at wall of pipe
-Check for stress crack
-Check for corrosion hole
-Check for puncture hole
3) Partial or total plugging
-Check for closed valves
-Check for debris
-Check for scale, precipitate or other buildup

Valve Failure

Failure modes:

1) Valve won't open or close
-Check for obstruction
-Check for broken valve stem
-Check for stripped threads or worm gears
-Check servo-motor or air motor for function
2_) Valve won,t stop flow, seal incomplete
-Check for obstruction
-Check for broken gasket/seal
3) Valve leaks from valve stem
-Check valve stem nut tightness
-Check valve stem packing or gasket
-Check valve stem for excessive wear

Controller Failure

-Operate system in manual or HAND mode until problem resolved. Recalibrate according to manufacturers recommendations, operations criteria, set points etc. Place system is service and observe operation. Obtain technical assistance from on-site via work order or from manufacturer.

Motor Failure

-Check power on or MCC on status
-Check electrical panel supply or breakers status
-Check drive jamming or shaft rotation
-Check for short circuit or windings burn

Sensor Failure

-Clean and calibrate sensor according to manufacturers instructions
-Check sensor output signal

Process Failure

Elevated or Depressed pH

-Check acid or lime supply
-Check pH sensor for function and calibration
-Check chemical feed pump and controller
-Check influent untreated water quality for abnormal characteristics

Slug Inflow
-Reduce influent feed rate
-Increase sludge blowdown rate
-Monitor effluent pH, turbidity
-Prepare to increase reclaimed water recycle to 100% if necessary to prevent non-compliance discharge

Solids Washout
-Recycle 100% of treated water to Tank 6 for retreatment or send primary treated effluent to secondary treatment
-Check acid feed
-Check polymer feed
-Check influent flow rate
-Increase backwashing
-Reduce influent flow rate if possible

Dissolved Metals Washout
-Check effluent pH and rapid mix pH, adjust as needed
-Check coagulant feed, increase ferric feed rate
-Reduce influent flow rate

Component Scaling and Fouling
-Remove scale from components where scale is a problem
-Sample scale material and send for analysis
-Lime-excessive lime addition, may wish to supplement neutralization with a sodium based agent such as NaOH
-Gypsum-excessive recycle in mill may be the cause
-Soft scale from overdosing with polymer should be washed down and polymer feed rate examined for adjustment

Emergency Conditions

Chemical Spill
-Evacuate and isolate the building and spill area
-Contact the mine spill prevention and control team
-Execute SPCC plan
Chemical/Electrical Fire
-If appropriate, use local equipment to extinguish

-Contact mine fire crew
Vessel or Piping Rupture
-Shut down plant and close influent supply pipe valve
Uncontrolled Discharge
-Shut down plant and close influent supply pipe valve

In all emergency events, be ready to recycle water to other treatment systems, to curtail water transport form all storage facilities up stream from effluent treatment facilities, or to curtail operations.

3.7.6 CONTROL

Local Control

The Pond 6/Pit 5 CPP and FP systems are partially local control systems. Piping, valves, MCC, and PLC systems located at or near the treatment plants provide automated control for most plant subsystems. Each electrical unit has an additional control circuit lockout if located remote from the MCC or PLC control system lockouts are for emergency cut-off of equipment, not for day to day switching or scheduled maintenance lockout. Use MCC lockouts only when performing maintenance.

Pumps have run time meters that allow monitoring of service time and scheduling of maintenance. The second level of local control are level switches and low or high level alarms or shutoffs. These are provided for the reclaimed water tank, effluent pH, and effluent turbidity. The sludge filter press has a local control panel only.

Subsystem Control

The Pond 6/Pit 5 wastewater treatment systems have several sub-system process loop controllers between chemical feed pumps and the process water. These systems include:

-Influent flow rate (flow control valve) loop to influent flow meter
-Control loops for pH and lime/acid addition
-Control loops for pH and Turbidity in effluent monitoring
-Control loop for sludge blowdown and backwash cycling

3.7.6.3 System Control/Interfaces

The Pond 6/Pit 5 systems have programmable logic controllers (PLC's) for overall system control integrating information from level indicators, alarms, subsystem control loops.

3.7.7 MAINTENANCE

3.7.7.1 Short-Term

The Operations and Maintenance checklist should be executed for maintenance items. The manufacturers recommended O&M schedule should take precedence over the short term monitoring schedule outlined on the checklist.

SHORT TERM MAINTENANCE CHECKLIST
POND 6/PIT 5 SYSTEM

DATE:_______

DAILY ITEMS: INITIAL

1) Clean and calibrate pH probes ________
2) Clean and calibrate turbidity monitor ________
3) Observe influent flow meter and effluent flow meters flow balance. ________
4) Review backwash needs

WEEKLY ITEMS:

1) Grease all fittings ________
2) Check all drives (gear box oil, belts) ________
3) Check all pipe, valves, hoses, and vessel penetrations for leaks/damage ________
4) Check all valve for function (open-close) ________
5) Check all pumps for function (startup normally off pumps) ________
6) Clean and flush clarifier tubes
7) Other items:____

____

MONTHLY ITEMS:

1) Check motor bearings and pump bearing for oil/grease ________
2) Check motors and drives for alignment and vibration ________
3) Check all alarms and auto shut downs for function ________
4) Observe all coatings, paint and lining systems for integrity ________
5) Clean all sensor probes/level probes/pressure sensors etc. ________
6) Other items:____

____

ANNUAL OR SEMI-ANNUAL ITEMS:

1) Change oil and grease per MFR's recommendations ________
2) Check interconnecting piping for scale or corrosion ________
3) Check/replace chemical feed pump diaphragms ________
4) Inspect mixer shafts, bearings, and impellers ________
5) Empty tankage and inspect for wear, coating condition, scale etc. ________
6) Confirm condition of media ________
7) Other items:____

____

Comments/Findings:____

3.7.8.1 Long-Term

Long term maintenance items will be conducted according to specific equipment manufacturers recommendations or in accordance with the findings developed for the detailed MIMS record system.

Long term maintenance items include:
- -Scheduled rebuilds based upon hours of service or other service units
- -Replacement of linings, coatings, or other material protective measures
- -Replacement of high wear equipment such a pump bearings, packing, motor bearings, drive bearings, pump volutes, pump impellers, pump stators or rotors.
- -Replacement of items subject to chemical corrosion or breakdown such as hoses, tubing, chemical storage tank valves etc.

3.8 FRESH WATER-HAWK INLET

3.8.1 PURPOSE OF SYSTEM

This system draws water from Cannery Creek and provides chlorinated and filtered potable water for the Hawk Inlet area and washdown water for the Hawk Inlet wheel wash and degritting basin DB-04.

3.8.2 SYSTEM DESCRIPTION

The system is depicted in **Figures 3.8-1 and 3.8-2**. The P&ID, **Figure 3.8-3 (600-17-204)**, illustrates the overall system components, controls, and interfaces (piping and control).

Refer to the P&ID. The following describes normal operation. Some bypass and intertie valves are available for maintenance and operation during failure modes.

Water is drawn from Cannery Creek by potable water pump PP-61 and washdown water pump PP-61A. An inlet screen is in place to trap large debris prior to pumping. Pump PP-61 is controlled by level controls in potable water tank TK-08. The water is chlorinated and filtered in-route to the tank. The chlorine injection pump runs whenever pump PP-61 runs, and the tank provides chlorination contact time as well as storage. The filter is passive and is backwashed using hand-operated valves.

Pump PP-61A pumps to washdown tank TK-05 and is controlled by level controls in the tank. Washdown water is distributed to the concentrate storage area and to the Hawk Inlet wheel wash facility.

3.8.3 COMPONENTS OF THE SYSTEM

Components and sub-components of Fresh Water - Hawk Inlet System include the following MIMS standard numbered items (see **Appendices A and B** for MIMS and detailed component information.

A-Potable Water Sub-system
- -Inlet screen
- -Pump PP-61
- -Chlorinator and injection pump
- -Filter
- -Potable water tank TK-08
- -Level controller LE/LC-

B-Washdown Water System
- -Pump PP-61A
- -Washdown water tank TK-05
- -Level controller LE/LC-

3.8.4 INTERFACES WITH OTHER SYSTEMS

Piping Interfaces

The system receives water from Cannery Creek and delivers potable water to the Hawk Inlet area, washdown water to the concentrate storage area and the Hawk Inlet wheel wash facility, and backwash water to degritting basin DB-04. Interfaces include:
- -Domestic water to the Hawk Inlet area
- -Unfiltered fresh water to concentrate storage
- -Wahsdown water to the Hawk Inlet wheel wash facility
- -Filter backwash water to degritting basin DB-04

Control Interfaces

Upon failure of water pump PP-61 or PP-61A, an alarm is initiated and sent to the CCS (central control system).

3.8.5 OPERATION

3.8.5.1 PROCESS DESIGN CRITERIA AND INDICATORS

TABLE 3.8-1 FRESH WATER - HAWK INLET - DESIGN/CONTROL CRITERIA		
COMPONENT	**DESIGN/CONTROL CRITERIA**	**COMMENTS/INSTRUCTIONS**
Pump PP-61 (potable water)	___ Hp, ___ gpm, Controls level in Water Tank TK-08	
Chlorinator and	___Hp, ___mg/l maximum dosage	Injection pump runs when Pump

Injector Pump		PP-61 runs
Filter	20 gpm maximum capacity	Manually backwashed as pressure drop across filter increases
Tank TK-08	______gallon capacity	
Pump PP-61A	___Hp, ___gpm, Controls level in Tank TK-05	
Tank TK-05	_____gallon capacity	

NOTES: See **Appendix B** for detail information from Manufacturers and Suppliers.

3.8.5.2 Startup and Normal Operation

Description of startup and normal operation assumes that the system is in full operational status and all systems are fully maintained and functioning.

Startup

Following are procedures to start up the system. This system is being upgraded; portions have been in operation for some time. The startup procedure is written as though from a cold start with no pumps operating.

1)Confirm condition of ponds, ditches, culverts, and other hydraulic system components. Maintain as needed.
2)Confirm that there is adequate water in Cannery Creek to supply the system.
3)Check setup status for pumps PP-61 and PP-61A:
  -Discharge valves open
  -HOA switches to OFF
  -Lockouts ON
  -Power on to MCC
4)Confirm that tanks TK-05 and TK-08 can receive water, and level controls are operable.
5)Confirm that chlorinator and injection pump are ready to operate.
6)Confirm that filter is ready to operate and that valves are set up for forward flow.
7)Operate water pumps individually, by hand. Turn each HOA switch to ON, then to OFF. Confirm correct motor rotation and that flow is attained. Confirm that chlorine injection pump runs when potable water pump PP-61 is running.
8)For potable water pump PP-61, turn HOA switch to AUTO. Confirm that the pump cycles to maintain level in tank TK-08, and that chlorine injection pump runs when the water pump is running.

9) For washdown pump PP-61A, turn HOA switch to AUTO. Confirm that pump cycles to maintain level in tank TK-05.
10) Observe and inspect the filter, pipes, valves,and pumps for leaks or noisy operation.
11) Confirm proper operation of lockout switches for pumps PP-61 and PP-61A. For each pump, while running, turn lockout switch to OFF, then back to ON. Confirm that pump stops, then starts again.

At this time the Fresh Water-Hawk Inlet system should be operating normally.

Normal Operation

Normal operation assumes no failures or breaks. The normal operation checklist is shown on the following page. It should be maintained daily, except where noted otherwise, and compiled monthly for incorporation into the MIMS database.

FRESH WATER SYSTEM - HAWK INLET OPERATION CHECKLIST:

Date:________

OPERATIONS:Initial and Date

1) Observe intake for debris, plugging and flood damage _____
2)Confirm creek flow with staff gage _____
3)Observe proper operation of potable water pump PP-61_____
4)Confirm tank level controller operation and sequencing_____
5)Observe proper operation of chlorination and filter _____
6)Observe intake and treated water quality daily _____
7)Observe proper operation of wash water pump PP-61A_____
8)Confirm tank level controller operation and sequencing _____
9)Valves, piping issues (leaks, valve operation)_____
10)Check controls and alarms_____
11)Safety Inspections weekly_____
10)Other items:__________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.8.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Intake Screen Restricted

The intake screen in Cannery Creek may become obstructed by fine organic and inorganic material that accumulates during flood conditions or during long-term operation. The inlet effectively screens debris. Pump damage may occur due to cavitation or air entrainment in the pump suctions if the screen becomes clogged. Observe and clean the inlet at least twice weekly.

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- Pump not operating when called for
- Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

Pump Not Running:

1) Check power to breakers, panels, and motor starters
2) Check control signal and switching to control circuit
3) Check MCC, HAND-OFF-AUTO switches for proper setting
4) Check motor starter for failure or heater trip
5) Check motor for failure (heater or short circuit)
6) Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1) Check inlet and outlet pressures
2) Check for closed valves
3) Check prime if appropriate
4) Check for intake obstructions

5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached or functional where the valve will no longer operate, but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Depending on location and failure mode, valve failure may allow scheduling of valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations and design criteria set points
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Tank Overflow or Low Level

1)Check tank valve positions
2)Check control set points (adjust as necessary)
3)Check control elements in tanks for proper operation, power, and signal
4)Check supply system and pipes for leaks if tank is low

Low Flow In Cannery Creek

In the event annual cold weather conditions limit flow in Cannery Creek to less than the demand on the system, the supply will be inadequate and the storage tanks will empty. Maximum water use reduction procedures should be implemented. Fresh water supply system operations should be modified as follows:

1)Conserve water at use points or eliminate uses
2)Monitor tank level to determine if additional throttling of demand is necessary

3.8.6 CONTROL

Potable water pump PP-61 is controlled by level controls in potable water tank TK-08. The chlorine injector pump is slaved to the water pump. There are no alarms or monitoring associated with the chlorinator. The filter is backwashed by means of hand-operated valves. Potable water tank TK-08 contains level controls and provides chlorine contact time as well as water storage.

Washdown water pump PP-61A is controlled by level controls in washdown tank TK-05.

3.8.7 MAINTENANCE

3.8.7.1 SHORT TERM

Perform short-term maintenance according to the following short-term maintenance checklist.

SHORT-TERM MAINTENANCE CHECKLIST - FRESH WATER - HAWK INLET:

Date:_________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1)Check inlet for debris or plugging (clean as needed) _____
2) Grease all fittings _____
3)Check all drives _____
4)Check all pipes and valves for leaks/damage _____

Monthly Items:
1)Check for filter media in backwash flow _____
2)Check hypochlorite in chlorinator (add as needed) _____
3)Check motor operating vibrations (motors, drives, bearings)_____
4)Observe lining/coating systems_____

Annual or Semi-annual Items:
1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check filter media (depth and condition)_____
3)Clean and inspect electrical and I&C panels and elements _____
4)Other items:__________________________
____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.8.7.2 Long Term

Long-term maintenance includes:

- •Scheduled rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the chlorine pump)

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.9 STORMWATER AND PROCESS WATER - HAWK INLET

3.9.1 PURPOSE OF SYSTEM

The purpose of the system is to degrit drainage, wash down, and other water from a number of sources in the Hawk Inlet area and pump the water to Tank TK-06 at the Process and Stormwater Pond 6 area (see **Section 3.7**).

3.9.2 SYSTEM DESCRIPTION

The system is depicted in **Figures 3.9-1 through 3.9-3 (800-10-202, 600-15-203, xxxx TRUCK WASH)**. The P&ID, **Figure 3.9-4 (600-17-204)**, illustrates the overall system components, controls, and interfaces (piping and control).

Refer to the P&ID. The following describes normal operation. Water is received at degritting basin DB-04 from the following sources:

- -Upper site drainage
- -Lower site drainage
- -Hawk Inlet wheel wash facility
- -Potable filter backwash water
- -Stormwater and washdown from concentrate storage and shiploader

This water is degritted and flows by gravity to the stormwater wet well (integral to the wheel wash building), from where it is pumped to Tank TK-06 by suction pump PP-44 and export pump PP-43. Pump flow is monitored and a flow signal is sent to the CCS (central control system) and to the process water treatment plant.

In the event of high flows to degritting basin DB-04 (greater than ten-year flood), the basin will overflow into the overflow impoundment basin. After the period of high flows, the basin is dewatered using impoundment pump PP-36, which is controlled by hand switch.

3.9.3 COMPONENTS OF SYSTEM

Components and sub-components of the Hawk Inlet Process and Stormwater system include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

A-Ditches and culverts for site drainage
  -Erosion control (road base and rip-rap)
  -Pipes (CMP)
  -Drop inlets
  -Drop structures
B-Degritting Basin DB-04
  -Inlets
    -Ramp
    -Pipes
  -Grit settling chamber(s)
    -Rail guards
    -Overflow weirs
C-Impoundment
  -Pump PP-36
D-Pump Station
  -Wetwell
  -Suction pump PP-44
  -Export pump PP-43
  -Level element and controller LE/LC-
  -Flow indicating totalizer FIQ-

3.9.4 INTERFACES WITH OTHER SYSTEMS

Piping Interfaces

Piping coming in to the system consists of stormwater and wash down from concentrate storage and shiploader, backwash water from the potable water filter, and site drainage. The single pipe leaving the system is the export line to Tank TK-06. Piping interfaces include:
  -Overflow from concentrate storage/shiploader
  -Filter backwash water from Fresh Water-Hawk Inlet system
  -Washdown water from head tank TK-05
  -Pumped effluent from surge tank TK-06

Control Interfaces

Upon failure of suction pump PP-44 or export pump PP-43, an alarm is initiated and sent to CCS.

Export flow is monitored, and the flow signal is sent to the CCS and to the process water treatment plant.

3.9.5 OPERATIONS

3.9.5.1 Process Design Criteria and Indicators

Stormwater and Process Water - Hawk Inlet design criteria and operational indicators are tabulated in **Table 3.9-1**.

Table 3.9-1 STORMWATER AND PROCESS WATER - HAWK INLET - DESIGN/CONTROL CRITERIA

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS
Degritting Basin DB-04	Remove grit from stormwater, wheel wash, and other sources	
Overflow to Impound Basin	_______ gallon storage capacity	Receives overflow from DB-04 during peak storm events
Impoundment Pump PP-36	___Hp, ___gpm	Used to dewater impoundment basin
Stormwater Wet Well	______ gallon capacity	Receives water form degritting basin and pump PP-36
Suction Pump PP-44	___Hp, ___gpm	Provides suction pressure to export pump PP-43
Export Pump PP-43	___Hp, ___gpm Pumps PP-44 and PP-43 operate together to control level in the stormwater wet well	Pumps to Tank TK-06

<u>NOTES:</u> See **Appendix B** for detail information from Manufacturers and Suppliers.

3.9.5.2 STARTUP AND NORMAL OPERATION

Description of startup and normal operation assumes that the system is in full operational status and all systems are fully maintained and functioning.

Startup

Following are procedures to start up the system. This system is being upgraded; portions have been in operation for some time. The startup procedure is written as though from a cold start with no pumps operating.

1) Confirm condition of ponds, ditches, culverts, and other hydraulic system components. Maintain as needed.
2) Confirm that water is available at the stormwater wet well so that pumps PP-43 and PP-44 can be operated.
3) Confirm that tank TK-06 is available to receive water.
4) Check setup status for pumps PP-43 and PP-44:
   - -Discharge valve open
   - -HOA switches to OFF
   - -Lockouts ON
   - -Power on to MCC

NOTE: DO NOT RUN EXPORT PUMP PP-43 UNLESS SUCTION PUMP PP-44 IS RUNNING.

5) Operate suction pump PP-44 by hand. Turn HOA switch to ON, then to OFF. Confirm correct motor rotation. Then turn HOA switch to ON and leave running.
6) For suction pump PP-44, turn lockout switch to OFF, then back to ON. Confirm that pump stops, then starts again.
7) Operate export pump PP-43 by hand. Turn HOA switch to ON, then to OFF. Confirm correct motor rotation and that flow is attained.
8) For both pumps, turn HOA switches to AUTO. Confirm that export pump PP-43 cycles to maintain level in the stormwater wet well, and confirm that suction pump PP-44 always runs when the export pump is running.
9) When the export pump is running, confirm that flow element/transmitter FE/FIT__ and flow indicating totalizer FIQ-__ are operating, and that the flow signal is being received at the CCS and at the process water treatment plant.
10) While export pump PP-43 is running, turn its lockout switch to OFF, then back to ON. Confirm that pump stops, then starts again.
11) Check operation of impoundment pump PP-36. If water is available, start the pump and confirm correct motor rotation and that flow is attained. If water is not available, just bump the motor and confirm correct motor rotation.

At this time, the Stormwater-Hawk Inlet system should be operating normally.

Normal Operation

Normal operation assumes no failures or breaks. The normal operation checklist is shown on the following page. It should be maintained daily, except where noted otherwise, and compiled monthly for incorporation into the MIMS database.

STORMWATER AND PROCESS WATER - HAWK INLET OPERATION CHECKLIST:

Date:________

OPERATIONS:Initial and Date

1) Observe ditches, culverts, pipes, impoundment pond, and drops for debris, plugging, damage or erosion conditions _____
2)Observe degritting basin level and grit accumulation_____
3)Confirm proper operation of pumps PP-44 and PP-43 to maintain proper level range in the wet well _____
4)Observe wetwell condition (debris, controls, operation)_____
5)Confirm that suction pump PP-44 always runs when export pump PP-43 is running _____
6)Valves, piping issues (leaks, valve operation)_____
7)Check controls and alarms (FIQ- , and FE/FT-)_____
8)Safety Inspections weekly_____
9)Other items:__________________________
____

Comments:____
____
____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.9.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, or a condition that is not a part of normal day-to-day operations. Such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and the details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- •Pump not operating when called for
- •Pump not producing the rated output or not pumping

Depending on the characteristic of the failure mode, the following checklist should be followed:

<u>Pump Not Running:</u>

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)
6)Check for mechanical obstruction blocking pump operation

<u>Pump Running, Not Producing:</u>

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary.

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached or functional where the valve will no longer operate, but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Valve failure may allow for scheduled valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations and design criteria set points
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

3.9.6 CONTROL

Impoundment pump PP-36 is controlled by hand.

Suction pump PP-44 and export pump PP-43 run together, and are controlled by level controls in the stormwater wet well.

Export flow is monitored and totalized by FE/FT-__ and FIQ-__, and the flow signal is sent to the CCS and the process water treatment plant.

3.9.7 MAINTENANCE

3.9.7.1 Short Term

Perform short-term maintenance according to the following short-term maintenance check list.

SHORT-TERM MAINTENANCE CHECKLIST - STORMWATER AND PROCESS WATER - HAWK INLET:

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date
1) Grease all fittings _____
2)Check all drives and controls _____
3)Check all pipes and valves for leaks/damage _____

Monthly Items:
1)Check for pond and wetwell damage and debris _____
2)Check motor operating vibrations (motors, drives, bearings)_____
3)Observe lining/coating systems_____
4)Check degritting basin sediment accumulation (remove as necessary) _____

Annual or Semi-annual Items:
1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check sediment pond accumulation (remove as necessary)______
3)Clean and inspect electrical and I&C panels and elements _____
4)Other items:__________________________
____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.9.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled pump rebuilds based on hours of service
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment (possibly the chlorine pump)
- •Replacement of Pond A liner

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.10 SEWAGE SYSTEM HAWK INLET

3.10.1 PURPOSE OF SYSTEM

The domestic sewage system at the Hawk Inlet site is in place to collect, treat, and route treated domestic wastewater to the ocean outfall (NPDES 001).

3.10.2 SYSTEM DESCRIPTION

The domestic sewage system at Hawk Inlet is depicted in **Figures 3.10-1 and 3.10-2 (MFR's drawings)** consists of the following components and functions as described. The P&ID, **Figure 3.10-3 (MFR's drawings)** illustrates the overall water system components, controls, and interfaces (piping and control).

Sewage is collected from rest rooms, showers, sinks, and the kitchen at the Cannery Building. Sewage is routed under the bunk house and office/kitchen buildings to a wetwell pump station. A duplex sewage pumping system transfers the sewage to a secondary treatment system using a sequencing batch reactor (SBR)(batch extended aeration with batch clarifier for sludge return and wasting).

Effluent form the batch clarifier is pumped to outfall 001 near the Hawk Inlet buildings.

Sludge from the aerobic treatment unit is stored in the aeration cell for up to 25 days (solids concentration will then exceed recommended TSS concentration under normal conditions). Excess solids are either transferred to the 920 sludge holding tank or to the CBJ treatment system for treatment and disposal. A dedicated solids dewatering press is under study.

Key features of the domestic sewage system include:

- •Collection system
- •Sewage lift station
- •Secondary treatment unit (SBR)
- •Solids transfer system

Control of the sewage system is largely automated and passive. Flow routing of sewage is by gravity and pumping. The SBR system runs continuously. Effluent transfer pumps and sludge transfer pumps are timer controlled (programmable logic controller(PLC)) or can be controlled by hand switches.

3.10.3 COMPONENTS OF SYSTEM

Components and sub-components of the Hawk Inlet domestic sewage system include the following MIMS standard numbered items (see **Appendix A and B** for MIMS and detailed component information):

A-Collection sewers (pipes)
B-SBR secondary system
  -SBR and blower/aerators
  -Submersible waste sludge pump
  -Submersible transfer pump
C-Clarifier
  -Submersible return sludge pump
  -Submersible Effluent pump
D-Outfall 001 to Hawk Inlet
E-General components
  -Electrical and control interfaces
  -Lighting system
  -Tank heaters
  -General (applies to the component system)
    -Maintenance items
  -Pipe and valves

3.10.4 INTERFACES WITH OTHER SYSTEMS

The interfaces with other site systems is by piping. Water for the domestic waste generators is piped to the pump station and pumped to the treatment unit. Treated effluent is pumped to outfall 001.

A critical interface with the domestic sewage system occurs at the fixtures that generate the wastewater. It is critical that these fixtures be in working order and that flows are controlled within reasonable ranges to reduce load on the sewage system.

3.10.5 OPERATIONS

3.10.5.1 Process Design Criteria and Indicators

The Hawk Inlet sewage system design criteria and operational indicators are tabulated in **Table 3.10-1**.

Table 3.10-1 Hawk Inlet Sewage System - Design/Control Criteria

COMPONENT	DESIGN/CONTROL CRITERIA	COMMENTS/INSTRUCTIONS

Sewage Lift Station	12,00 gallon wetwell. Was an interim treatment unit and has	The wetwell can be used as a flow

	aeration capability	equalization tank.

	2 submersible sewage pumps to transfer flow to treatment	Aeration can be used to limit settling in the wetwell.

SBR Secondary Treatment Unit	30,000 gpd (21 gpm) average daily flow capacity	

	60 pounds per day BOD and 30 lb/day TSS influent load	

Clarifier	Batch. Sludge and effluent pumped by timer controlled submersibles	

Return sludge capacity of 2 times theoretical load	Sludge returned to SBR cell by submersible pump (timer controlled)

Solids Handling	20-day capacity (600 pounds solids at 1% solids) stored in the mixed	Note: The holding tank at 920 may receive solids form the Hawk Inlet sewage treatment facility. Optional

	liquor aeration solids	disposal at CBJ treatment plant

Heating, 2, 2,400-watt immersion heaters	Winter operation only

	Aeration, 1, 7.5 hp blower	

NOTE: See **Appendix B** for detail information from manufacturers and suppliers.

3.10.5.2 Start-up and Normal Operation

Start-up and normal operation discussion assumes that the system is in full operational status and all systems are fully maintained and functioning.

Start-up

The following sequence is a checklist of procedures to enable the domestic sewage system at the Hawk Inlet site. References to the manufacturer's and supplier's O&M manuals are made when specific information in the detail O&M Section is in place to provide step-by-step instructions. The general start-up procedure follows:

1)Confirm condition of sewer pipes and treatment units
2)Route all flows to the sewage lift station
3)Motor control center and lock-out verification
-MCC and lock-outs at "on" status
4)Aerate the lift station wetwell for 20 minutes before starting sewage pumps
5)Switch pump HOA switch to ON individually to check pump operation. Then switch both pumps to AUTO to initiate pumping to the SBR
6)Check pump and blower readiness (test pump each by hand-switching)
-Open valves
-Confirm flow
7)Check controller and level switches
-Level switches in aeration and clarifier cells
-Over pressure blow-off on blower
-Pump timers (return sludge and waste sludge). Waste sludge will not be needed until unit is fully operational (1-month normally)
-Pump on-off controllers
8)Start-up pumps and controls
-Switch pumps to ON, one at a time to check operation
-Switch all OFF
-Switch all pumps to AUTO in sequence (allow time for pump to come to speed before switching another
-Confirm operation
-Observe operation
-Pumps, valves, leaks, level control
-Adequate water depth in treatment unit to adequately cover the RBC disks
-Confirm that pumps cycle at proper levels

9)Allow the SBR unit to fill to at least a quarter full and start the aeration system. NOTE: upon the very first start-up or after the system has been down long enough to result in damage to the aerobic growth in the SBR aeration cell, a month-long (or more) accumulation period will be required to obtain regrowth on the SBR active bio-solids. Sewage should be routed through the SBR unit until full. Normal SBR sequences can them be started where a portion of the aeration cell contents are pumped in batches to the clarifier. All solids should be returned to the SBR cell until at least a 2,000 mg/l TSS concentration is obtained in the aeration cell.

Normal Operation

Normal operation assumes no failures or breaks. The normal operating sequence is as follows:

- Route sewage flow to the SBR treatment unit
- Operate the sewage lift station
- Operate the SBR functions continuously
- Return all sludge from clarifier.
- Waste solid from the aeration cell when solids in the SBR cell reaches over 6,000 mg/l TSS. This will likely require sludge wasting of 600 gallons every 2-weeks. The wasting rate must be determined by experience.
- Check the lift station and SBR weekly for required cleaning (brush or wash down)
- Observe outlet water quality daily

Normal operation procedures are summarized on the following operation checklist that is to be maintained daily and compiled monthly for incorporation into the MIMS database:

HAWK INLET SEWAGE TREATMENT SYSTEM OPERATION CHECKLIST:

Date:________

OPERATIONS:Initial and Date

1) Observe waste sources, sewer pipes, and treatment units for debris, plugging, damage, freezing, or unusual conditions_____
2) Confirm lift station condition and operation _____
3) Confirm proper pump and blower operation _____
4) Confirm proper sludge return and wasting (TSS or sludge levels)_____
5) Observe treatment unit condition (scum, growth, controls, operation)_____
6) Clean-up as needed _____
7) Valves, piping issues (leaks, valve operation)_____
8) Confirm heater operation if needed_____
9) Determine if sludge must be removed from aeration tank (removal mode yet to be determined) _____
10) Safety Inspections weekly_____
11) Other items:__________________________

____

Comments:____

____

____

MAINTENANCE ITEMS:

Findings or Shortcomings: ____

____

____

____

Safety Issues:____

____

____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): ________________________________
Follow-Up by MIMS; Date and Responsible Party:____________________________

3.10.5.3 Abnormal Operation

Abnormal operation or maintenance activities will normally be a result of a failure, a break, hydraulic or organic overloading, or failure to operate or maintain the system during normal day-to-day operations. Examples of such conditions are outlined along with step-by-step methods of addressing the issues. An O&M document cannot cover all potential issues. Experience and knowledge of the system, components, processes, and the P&ID's is the only sure method of preparing for any condition that may occur. The examples here provide a broad exposure to O&M functions of the systems and components. Refer to the P&ID's and the details in **Appendix B** for more information. Specific abnormal O&M situations and appropriate procedures follow:

Sewage Collection Conveyance Failure

Failures or plugging of sewers or excess flow from sources can result in site contamination (back-ups in sewers) and treatment loading problems. High flows can wash out the biological treatment processes. Excess organic loading can use up oxygen supplied to the treatment organisms, killing or damaging the biological treatment process.

It is necessary that any failures or overloads from the collection and conveyance system be remedied as soon as possible to minimize biological process upset. Repair pipes or sources such as toilets or sinks. Organic overloads from spills or "disposal" into sewers must be controlled. The biological treatment system is small and the growth that performs the treatment is fragile.

Pump Failure

Pumps may fail electrically or mechanically, or control functions may fail. Either event can result in one of the following failure modes:

- •Pump not operating when called for
- •Pump not producing the rated output or not pumping

The return sludge and waste sludge pumps are the critical pumps and must be checked daily and repaired upon notice of a problem. Depending on the characteristic of the failure mode, the following checklist should be followed:

Pump Not Running:

1)Check power to breakers, panels, and motor starters
2)Check control signal and switching to control circuit
3)Check MCC, HAND-OFF-AUTO switches for proper setting
4)Check motor starter for failure or heater trip
5)Check motor for failure (heater or short circuit)

6)Check for mechanical obstruction blocking pump operation

Pump Running, Not Producing:

1)Check inlet and outlet pressures
2)Check for closed valves
3)Check prime if appropriate
4)Check for intake obstructions
5)Check for shaft key stripping or shaft break
6)Check for wear of impellers etc.
7)Check Manufacturer's O&M information (**Appendix B**)

Repair the cause of the pumping failure or the failed pump as necessary. Pumps are all removable submersibles and can be readily removed, maintained, or replaced with a spare pump (suggest keeping at least 2 spare pumps in stock).

Valve Failure

Valve failure can be catastrophic where the integrity of the line is breached or functional where the valve will no longer operate, but may allow the pipe to function. Total breaches will normally require system shut-down and repair of damage. Valve failure may allow for scheduled valve maintenance or replacement.

Control Failure

Control failure may allow hand-switch operation while the controller or primary elements are serviced, recalibrated, or replaced. Most controls in this system are on-off. The sludge return and wasting pumps controllers have timers that require system experience to set the desired run time and sequences. After the system operation has been checked and a probable cause identified, the following procedure is suggested:

1)Recalibrate according to manufacturer's recommendations, design criteria, and field developed set points (timers)
2)Place system in service and observe operation
3)If control failure persists, prepare a Work Order for I&C technical maintenance
4)Determine and implement the best method of keeping the system on line or providing the needed service during maintenance

Sludge Solids in Excess

If the sludge quantity in the aeration cell reaches a high concentration (<6,000 mg/l), sludge must be removed from the system. Sludge may be thickened in the aeration cell or clarifier and transferred in specially built tanks to the CBJ treatment plant or to the solids holding tank at the 920 site.

3.10.6 CONTROL

The sewage treatment system is locally controlled. Piping, valves, timers, and MCC lockouts form the basis of control. Each electrical unit has an additional control circuit lockout if located remote from the MCC. Control circuit lockouts are for emergency cut-off of equipment, NOT for day-to-day switching nor for official maintenance lockout. For safety, always **use MCC lockouts** when performing maintenance.

Control Interfaces:

- No automated control circuits are included in the design with the exception of timed pump sequencing and cycles for the system pumps and aeration blower as follows:
  - Lift station pumps are lead-lag, controlled by level in the wetwell
  - Batch sequences are controlled by PLC time settings that start and stop the aerator and transfer pumps
- Other controls are initiated by operators as a result of observations as follows:
  - Start and stop the lift station blower as needed to mix solids in the wetwell
  - Turn on the tank heaters if needed
- Alarm functions include:
  - Pump failure alarm (notifies the CCS)

3.10.7MAINTENANCE

3.10.7.1 Short-Term

See the Operation Checklist (**Section 3.10.5.2**) for day-to-day maintenance items. In addition, the following short-term maintenance activities are needed:

SHORT-TERM MAINTENANCE CHECKLIST - HAWK INLET SEWAGE SYSTEM:

Date:________ (Complete and file with MIMS clerk **weekly**. Notify MIMS of needed maintenance **daily**)

Weekly Items:Initial and Date

1) Grease all fittings _____
2) Check all drives _____
3) Check all pipes and valves for leaks/damage _____

Monthly Items:

1) Check for sewer or treatment plant leaks, damage, and debris_____
2) Check motor operating vibrations (motors, drives, bearings)_____
3) Check the SBR programmable controller settings _____

Annual or Semi-annual Items:

1) Change all oils/grease semi-annually or per MFR's recommendations)_____
2) Check for sludge accumulation (remove as necessary) ______
3) Clean and inspect electrical and I&C panels and elements _____
4) Other items:___________________________

____

Comments:____
____
____

Findings or Shortcomings: ____
____
____
____

Safety Issues:____
____
____

A work order shall be prepared for all maintenance and safety items noted. See **Appendix A** MIMS procedures. Work Order Number(s): _______________________________
Follow-Up by MIMS; Date and Responsible Party:___________________________

3.10.7.2 Long-Term

Long-term maintenance includes:

- •Scheduled pump rebuilds based on hours of service (track hours)
- •Replacement of linings and coatings (paint systems)
- •Replacement of high wear equipment

Such long-term maintenance shall be in accordance with the Manufacturer's recommendations or in accordance with the findings developed from the detailed MIMS record system. For example, the MIMS system will provide statistical maintenance information on all systems and components upon which to base repair or replacement decisions. The MIMS data along with O&M staff experience and analysis will formulate the long-term maintenance schedule.

3.11 MISCELLANEOUS WATER SYSTEMS

Miscellaneous water systems include items that do not necessarily have electrical, instrumentation, or controls associated with the operation or maintenance of the system and are generally less complex than the 11 basic water systems on the Mine site. The miscellaneous systems require observation and maintenance and are thus included in this O&M discussion.

3.11.1 PIPELINES

Water conveyance pipelines carry fresh, treated, and untreated water around the site. Pipelines are buried in some instances, partially buried as in the case of the export pipes form the 920 Mill site to Tank 6, or exposed in buildings or in a few instances outside. Buried pipelines are by definition located below the theoretical frost depth and generally do not require special O&M procedures. Partially buried pipelines are periodically exposed along the pipe run or are buried in the frost zone (frost zone at Greens Creek is between 2.5 and 3.5 feet). Each set of pipeline conditions have different features that result in different operational and maintenance practices.

General Pipeline Guidance

To evaluate pipeline performance and obtain an indication of pipeline condition, pipeline flow and headloss characteristics can be recorded periodically. Pipes may become plugged or partially plugged with debris, can have collapsed sections, can be severely corroded, or can be air-bound. These and other causes will result in deterioration of pipeline performance.

It is suggested that, flow characteristics of all pipelines be confirmed annually or biannually. If flow capacity is lower than theoretical values or headloss is higher, causes should be investigated. In many cases, pipe flow and head conditions can be evaluated using existing meters or gages. Records of flow and head can be reviewed to determine indications of changes over time. Care must be taken to be certain that the measuring devices are properly calibrated.

If flow or pressure gages are not available on the pipe being reviewed, one or more of the following methods may be used to measure or estimate the characteristics:

- Portable gages and flow meters (clamp-on flow meters are available)
- Measurement of flow upon exit from the pipe by tank filling rate, stop watch and bucket, or portable flow meter.
- Pump pressure, amperage draw, and pump curve analysis.

Some of the causes for pipeline capacity degradation can be determined in the following manner:

- Video inspection
- Observation of a portion of the pipeline (remove and inspect a sample)
- Observation of air in pipeline inlet, outlet, or in the pipe high points
- Pigging or rodding the line
- Measurement of freezing conditions
- Changes in characteristics of fluid flowing in the pipeline (solids content, viscosity,...)

Remediation of pipeline capacity issues may take some of the following measures:

- Detailed O&M staff or Consultant study
- Pipeline replacement
- Pigging or rodding (clean-out)
- Freeze protection
- Proper air release or control of air entering the pipeline
- Pipe slope adjustment (for gravity pipes or air-bound pipes)
- Adjustment of changes in characteristics of material flowing in the pipe (too viscous, too high a solids content, corrosive nature...)
- Change the pipe material to be compatible (if corrosion is an issue)

Most of the causes and remediation features are self explanatory. The air-binding issue is more problematic. Air binding in a pipeline can rob most of the capacity and add significantly to the headloss. Air can be introduced into the pipeline at pumps (sucking air into the pump suction), by dissolved gasses in the liquid (gas coming out of solution as pressure drops), or at air-vacuum valves as flow in the pipe is shut off or turned on.

Pipelines must have proper air-vacuum release valves (i.e., Apco S-140c or equal) and air sources to the pipe must be controlled (i.e., adequate submergence on pump suctions). The proper air-vacuum valves are combination valves that release air upon start-up and allow vacuum to be broken (air enters the pipe) on shut-down so the pipe does not collapse. In addition, the air-vac valves MUST allow air that may accumulate during pipeline operation to be released continuously (hence, the Combination Air-Vac valve designation).

Combination air-vac valves must be kept from freezing and must be checked periodically to see that the floats and orifices in the release mechanism is operable and has not plugged with debris. The valves may require insulated housing with heat sinks from the pipeline to transfer as much heat as possible to prevent freezing (a design detail). Valve operation should be checked monthly or more frequently to assure proper operation (may require dismantling the valve to clean orifices).

An indication of adequate valve operation can be determined by logging the head loss in the pipeline (pressure on the upper end). Increasing headloss over time indicates the probability of increasing air binding. By logging the pressure at various points along the pipeline during full flow, the most serious air binding may be located or at least the worst areas identified.

3.11.2 ROADS

Road O&M is critical not only to transportation, but to stormwater quality. The procedures and materials used for road surfacing and grading have an impact on runoff water quality and sediment load to roadside ditches.

Road surfacing material must be durable crushed rock that will not weather excessively, limiting release of sediment and will not release soluble constituents to runoff water. As the road surface becomes dominated by fines (due to surfacing break-down), additional durable material should be placed.

Grading of the road surface should be scheduled to avoid heavy rainfall-runoff periods and to allow the surface to compact before the next rainfall. In southeast Alaska, grading between rainfall events may not always be possible. However, major rainfall events should be avoided to limit erosion.

Road runoff water quality is monitored as part of the stormwater monitoring program. Sediment from roads is also monitored at key points.

Culvert and ditch maintenance is key to proper road O&M. See subsequent sections.

3.11.3 BRIDGES

Bridges are maintained to contain the sediment and to divert runoff from direct stream influences. Bridges are being upgraded to increase side-board containment. Bridge decks are being fitted with filter fabric under the wearing surface to control sediment escape to the streams. Bridges drain water from decks to adjacent treatment ponds (Mine 920 bridge) or to adjacent ditches. Ditches route runoff to the streams or to adjacent overland vegetative filter areas.

See the Structural Investigation of Access/Haul Road Bridges (M3, 1995) for more detail.

3.11.4 DITCHES

Road-side ditches must be cleaned periodically to maintain the flow routing and capacity of the original design. Ditch cleaning should be done during dry periods (no rain). Check the design plans for proper flow routing, slopes, and ditch cross-section.

Care must be taken when cleaning ditches since the export pipelines may parallel the ditch in many places. Pipeline breaks or damage are to be avoided.

3.11.5 CULVERTS

Road-side culverts must be kept clear of debris to maintain flow capacity. The culvert outlet configuration is critical to control of erosion. Culvert outlets must be adequately rip-rapped to limit erosion or discharge into a flat-sloping area that will spread the flow and dissipate energy sufficiently to control erosion.

Culverts should be diverted from direct discharge to area streams whenever possible to land-spreading areas that will filter the flow. Best Management Practices (BMP's) should be used where discharge control is not possible. See the Stormwater Pollution Prevention Plan for suggested BMP's such as straw bales, silt fences, silt catchments, and others.

3.11.6 ROOF DRAINAGE

Roof drainage from site buildings may be routed directly off site unless it comes into contact with ore. The Mill building drains should likely be routed to treatment (and are so directed). Other Project building drains should be maintained regularly, but could be routed directly to off-site runoff.

3.12GENERAL WATER SYSTEM O&M FUNCTIONS

3.12.2 HOUSEKEEPING

Good housekeeping practices are encouraged and emphasized throughout the Greens Creek mining project site for reasons of health, safety, morale, and environmental awareness.

Sufficient solid waste containers are made available throughout the site to accommodate cleanup of debris. Regular maintenance activities are not considered complete until cleanup has been accomplished. Building floor washdowns are routinely conducted to provide clean, safe, walking surfaces. Floor sweeping and washdown within the mill building will route any reagents and process materials to appropriate sump pumps. Regular inspections are performed by supervisors and managers. Good housekeeping practices will be promoted by posters, suggestion boxes, bulletin boards, slogans, employee publications, and other techniques.

Cleaning chemicals and spill absorption materials will be stocked in appropriate locations throughout the site to facilitate efficient cleanup of the site. All areas of the project will have sufficient access to brooms, mops, buckets, shovels, cleaning agents, and absorption materials to implement good housekeeping standards and to immediately mitigate any spills and/or spill debris.

3.12.4 TRAINING

Employees will be required to attend several training programs at the Green Creek Mine Site. Specific training on the O&M Document will be conducted. Employees will be trained on the overall O&M Document and on specific areas of the site's operation and maintenance, for which they will be responsible. Refresher courses on the operations and maintenance of the facility will be conducted quarterly to ensure that employees are kept informed of any new or different procedures and/or equipment at the facility.

Maintenance supervisors and administrative personnel will also be required to attend a two-day training session on the maintenance and related modules of MIMS. Refer to Appendix A for an outline of the training. Refreshers on the MIMS will be provided as needed.

Employee training approved by the Mine Safety and Health Administration (MSHA) will be conducted annually (40 hours initially for underground employees, 24 hours initially for surface employees, and 8 hours annual refresher courses for all employees). Training will include inexperienced and experienced personnel in all levels of responsibility. The training program is designed to provide a complete understanding of the processes and materials with which they are working, the safety hazards, the practices for preventing discharges, and the procedures for responding properly and rapidly to toxic and hazardous materials. Spill drills will be conducted on a semi-annual basis.

Specific job training is also provided prior to starting a particular job or new position to ensure that employees not only understand the particular job and process operation, but also to help them to understand potential discharge problems. In addition, employees working in an area where hazardous chemicals may be present will be notified in writing of the chemicals present and will be provided with appropriate material safety data sheets (MSDS) (Greens Creek Mining Company "Right to Know").

Records of the initial and refresher training courses for all employees are maintained at the manager's office. These records include the dates, instructors, subject matter, and lesson plans of the training sessions.

3.12.5 RECORD KEEPING

The MIMS provides record keeping for material management, maintenance, operations and accounting. Refer to **Appendix A** for specific details on the MIMS. The following summarizes the record keeping capabilities of the MIMS.

MIMS stores information on all equipment at the facility and maintains a history of maintenance records. All equipment at the plant is recorded in the MIMS including equipment costs, and equipment history. Records on equipment history include date of purchase, costs of operation and maintenance, historical and future preventive maintenance tasks, work orders on equipment, conditions of equipment, and predicted life of equipment or components.

MIMS records , accumulates and reports any type of performance parameter on equipment. Operating statistics can identify parameters to be used to drive preventative maintenance scheduling (i.e., operating hours, meter hours, miles, tons, etc), and can identify downtime and reasons (downtime analysis). The MIMS also monitors predefined caution, warning or danger levels and can trigger a maintenance job. It can interface with existing equipment condition monitoring devices such as vibration analyzers.

MIMS creates schedules of maintenance tasks that need to be performed on specific equipment and components. Work orders are generated by MIMS that identifies work to be done, priority, special requirements and resource needs. The work orders also include details such as parts needed, labor estimates and job instructions.

3.12.6 INSPECTIONS

Visual inspections of all operating areas and equipment will be conducted daily. The frequency of the inspections is based on the types of chemicals, construction materials, age and utilization of equipment, and systems design of the project.

Supervisory maintenance personnel or members of the environmental engineering staff will monitor project operation and physical condition of vessels, containers, pipelines, systems, embankments, drainage, ditches, sediment and holding ponds, vehicles, and mechanical equipment such as pumps, valves, lines, and flanges.

Material storage areas will be inspected for evidence of, or the potential for, significant discharges. Storage areas will be inspected for leaks, durability, damage, and corrosion of containers; for deterioration of foundation or supports; and for closure of drain valves in containment facilities.

Areas of loading and unloading will be inspected during transfer of materials. The condition of equipment such as forklifts, trucks, and conveyor systems will be inspected. In the case of fuel transfer, inspections will ensure that the transfer is complete prior to disconnecting any lines.

Security of containers on forklifts and/or trucks will be inspected prior to loading, unloading or transfer of material storage containers.

In plant transfer and material handling areas in the mill building will include the visual inspection of reagent storage containers, tanks, pipelines, pumps, valves, seals, and fittings. Daily inspections will be conducted by specified maintenance personnel and by operations personnel.

Visual inspections, water quality sampling, and groundwater monitoring will be conducted at the tailings facility. This will ensure that overflows are minimized, water quality standards are met, and that seepage into groundwater is not excessive.

Runoff and collection systems throughout the entire Greens Creek facility will be inspected. Ditches, pipes, settling and holding ponds will be inspected regularly to ensure that no process material is discharging directly into any creeks or water bodies. Diked areas and overflow structures will also be inspected to ensure the integrity of the runoff collection system.

Records of inspections, results of inspections, and actions taken will be recorded on the preventive maintenance computer program, MIMS. Project facilities and equipment will be documented in the program. Inspection procedures, time intervals between inspections for each facility or element, results of inspections, follow-up procedures, and foremen assigned to certain inspections will be included in the program. Weekly printouts describing inspection activities to be carried out that week will be distributed to foremen. As inspections are completed, records of dates completed, results, and activities will be entered into the MIMS program.

3.12.7DATA ANALYSIS

MIMS records the results from oil sampling and analyses and can provide information on trace elements analyses over time and conditions. The statistical module in the system can identify abnormalities in trace elements and in oil consumption. Refer to Appendix A for specific details on the MIMS.

4.0 DETAILED SYSTEMS/COMPONENT O&M

The narrative O&M sections (1 - 3), outline the basics of operations and maintenance of the Greens Creek Mine Water Systems. Detailed information on specific components of the water systems is needed by the shift operators and maintenance staff to facilitate rapid and correct responses to operation or maintenance needs. Manufacturer's information and recommendations regarding operation and maintenance of specific systems and components of the systems are needed.

For example, detail information on how to service a simple hand-operated valve requires the following:

- •Catalogue information (model, drawing, list of parts, materials, ...)
- •Spare parts list
- •Operational suggestions
- •Maintenance suggestions
- •Name, address, phone and FAX numbers of the supplier, manufacturer, and contact person (several sources are preferred)

To facilitate availability of such detailed information, a series of working files have been compiled. These files, designated **Appendix B,** are located separately in file cabinets since the file fills more than 2 drawers of a legal size cabinet. Working copies are available at the Mill, the Pond 6/Pit 5 Control room, and at the Hawk Inlet engineering office. A secure, complete file is also kept at the MIMS office in the Administration Office at the 920 site.

The working and secure files are organized as follows:

- •Filed in Systems as numbered in the O&M document (Systems 1 - 13)

- •Information is bound in the file folders or in booklets in the file

- •Individual component and sub-component files numbered by O&M Section, equipment tag number, and design drawing sheet Dale and Steve, let's talk about this one!! The equipment number might be 03,TK-06,600-17-200 (i.e., system#, tag#, drawing#). At least this way one could find things! It would be initially tedious! But how else will you be able to reference the O&M Section or the drawing sheet? Let's discuss!!

- •In the individual file folder, the file contains the following as appropriate:
    - -Loop description (I&C control description)
    - -Manufacturer's, supplier's, or other appropriate names, addresses (including courier delivery address), phone numbers (including FAX)
    - -Catalogue cut (complete)
    - -Specific O&M instructions
    - -Lubrication schedule

-Maintenance schedule
 -Spare parts list
 -Other information

Some information will not be available or necessary for all equipment items (i.e., a small gate valve will not have a lubrication schedule or specific O&M instructions from the manufacturer). However, the new 920 process water treatment facility will have all the listed information.

The working copy file is intended to be used as follows:

- Operations or maintenance staff will be able to look at the file and obtain needed information

- Staff will be encouraged to copy information if they need field copies. Otherwise, a check-out system is necessary to safeguard the completeness and integrity of the file.

- The working copies will be compared to the secure copy annually as the entire file is updated with new or replacement equipment information.

The detailed information is intended as a supplement to this O&M document. Refer to the file designated **Appendix B** for the detailed information outlined.

REFERENCES

M3 Engineering and Technology Corp., Recommissioning Design Drawings, 1995-1996.

M3 Engineering and Technology Corp., Structural Investigation of Access/Haul Road Bridges, 1995.

Coffman Engineers, Inc., Design Drawings (Pond 6/Pit 5), 1993.

KGCMC, Design Drawings (Site 23), 1994.

KGCMC, Stormwater Pollution Prevention Plan for Construction Activities (SWPPP), 1995.

KGCMC, Stormwater Pollution Prevention Plan (SWPPP), 1996.

KGCMC, Spill Prevention and Countermeasures Control Plan (SPCC), 1995 update.

KGCMC, Safety, Health, and Environmental Action Program (SHEAP), 1995.

KGCMC, NPDES Application and Supplemental Background Information Report, 1995.

KGCMC, QAPP Monitoring Plan for NPDES, 1996.

KGCMC, Fresh Water Monitoring Plan, 1993 update.

KGCMC, MIMS for Maintenance Foreman and General Foeman, 1995 (see **Appendix A**).

KGCMC, General Plan of Operations (GPO), 1995.

KGCMC, Annual Plan Update, 1996 and subsequent years.

OTT Engineering Inc., Utilities at Hawk Inlet (water, sewage), 1986.

Burford Concrete Products, Sewage Treatment/Pump Station at Hawk Inlet, 1986.

ATS Inc., Drawings, Sewater Treatment at Hawk Inlet, 1989.

ATS Inc., Drawings, Sewage Treatment at 920, 1996.

Confirm the dates and titles of references!