

Appendix E7

Open Pit – Mine Maintenance Facility

Memo

From: Jesse Aarsen
Date: April 09, 2010
Re: KSM – Mine Maintenance Facility

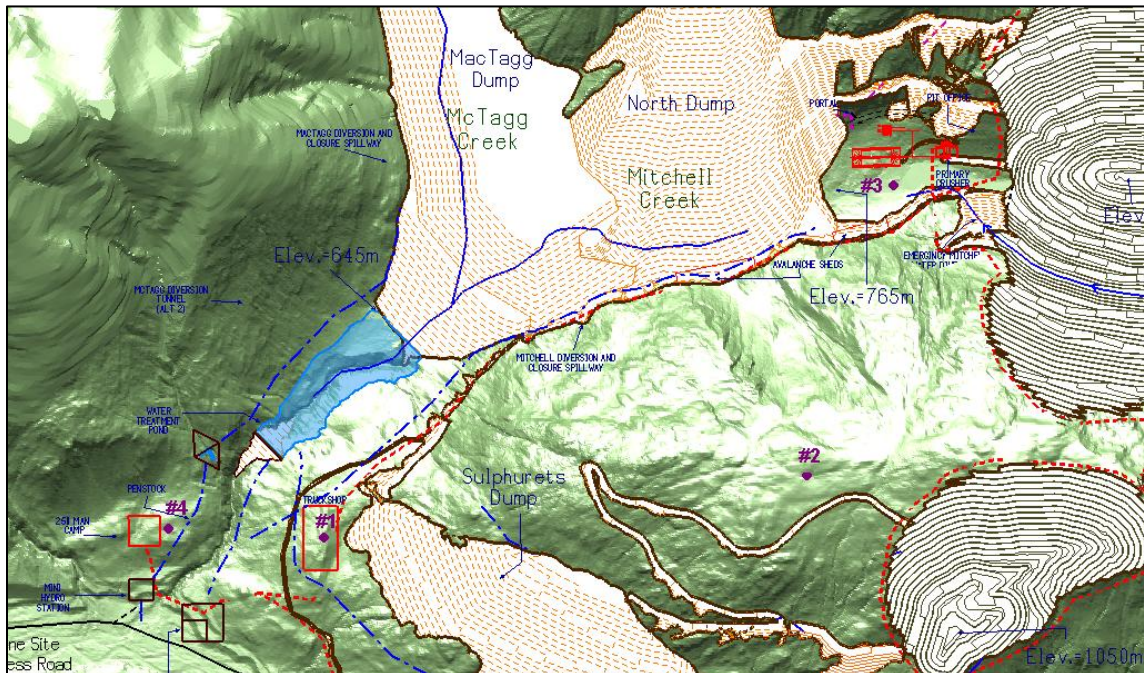
1. INTRODUCTION

This file note describes the design basis and the preferred site selection of the KSM Mine Maintenance Facility (including technical department offices) and is based on the 2009 KSM Preliminary Economic Assessment (PEA).

2. MAINTENANCE FACILITY LOCATION

The figure below shows four potential Mine Maintenance Facility locations for the KSM mine site that have been evaluated.

Figure 1 - Maintenance Facility Potential Locations



The advantages and disadvantages of each location are discussed below:

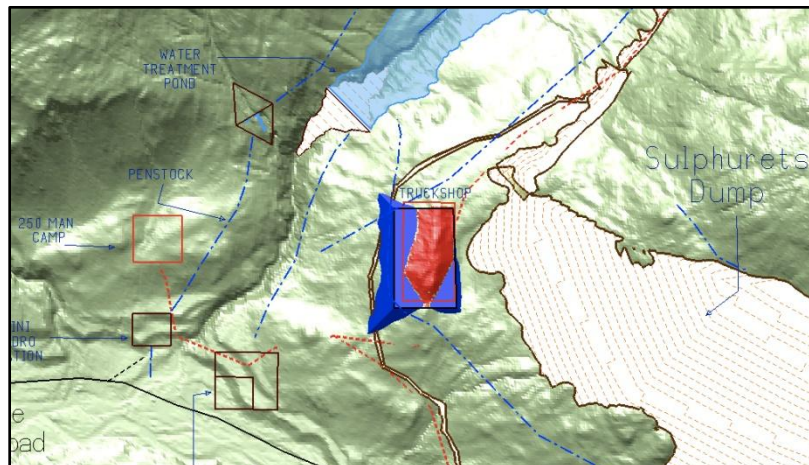
Table 1 – Location Selection advantages and disadvantages

Location	Site	Advantages	Disadvantages
1	General Arrangement Location (from PEA)	-large enough area -close to main dumping area -good foundation	-below Sulphurets dump (down slope risk)
2	Top of Sulphurets ridge	-largest area available (good view of all the pits) -good foundation	-remote location -requires Sulphurets access to be built ahead of schedule -windy location (will cause problems with snow drifting) -inclement working conditions -poor visibility for access during storms
3	Primary crusher area in Mitchell	-closest to the majority of the mining (Mitchell pit)	-poor foundation (clays in the valley bottom) -not large enough to build truck shop (based on dimensions outlined below) -adds to congestion in the 'plant' area
4	250 man camp area	-good foundation -relatively central location for all the pits	-small area -may overlap with 250 man camp -access to pits and dumps is longer and more difficult than location #1

Based on the above comparison, Locations #2, #3 and #4 have been eliminated from further analysis primarily due to their disadvantages.

The estimated dimensions of a pad that can be built in location #1 is 250m x400 m. A pad this size will require 790 kBCM of cut and 839 kBCM of fill. The elevation of this pad is 734 m. Figure 2 shows the cut (red solid), fill (blue solid) and pad outline (black line).

Figure 2 - Cut and Fill for Location #1



The total dimensions of the truck shop facility are 200m x 50m and are shown in the attached drawing titled “Maintenance Facilities LAYOUT.pdf”.

The recommended shop sizing includes 8 service bays, 1 welding bay and 3 wash bays. This will accommodate the fleet for the first 22 years of the PEA production plan. Expansion beyond 22 years may require a light vehicle shop and a separate wash bay to allow for expanded heavy equipment use of the existing shop space. The Mine Maintenance Facility will also include a machine shop area, tool storage area, mine muster area, warehouse and office complex. A separate tire bay facility will be required with an exterior heated pad to accommodate at least two trucks and a tire manipulator. Pad area should be 30m x 30m.

Detailed determination of the amount of bays required is shown in the attached appendix.

3. HEAVY EQUIPMENT SHOP

Every bay in the heavy equipment shop should be designed for the servicing and repair of the heavy end-dump haul trucks. The truck bays are designed to accommodate the equivalent of a Cat 797B or equivalent sized haul truck.

The bays are arranged so that the trucks entering from each side will be lined up in a nose to nose configuration inside the building, to optimize utilities and shop efficiency. A 5m corridor separates the bays for pedestrian and forklift traffic from the warehouse.

The main roll-up doors are sized to provide adequate clearance on the sides and the top of the operating width of the largest trucks. The door width provides 1.87m clearance on each side of the Cat 797B or equivalent sized haul truck. The door height provides 1.26 m clearance above the truck canopy. Rubber doors are recommended as they are more likely to stand up to potential damage caused by material rolling out of truck boxes or equipment inadvertently contacting the doors, than the lower cost alternative of rubberized fabric rollup doors.

The width of the heavy equipment bays will provide sufficient clear space between haul trucks parked in adjacent bays to permit maneuvering service equipment such as stair platforms, and wheel dollies and to provide adequate space for tool cabinets and major component lay down. Removal of tires, wheel motors, large components and truck boxes will require coordination and planning of work activity in adjacent bays.

The headroom required for an overhead crane governs the building interior height. The overhead crane hook height is based on providing sufficient clearance to accommodate the largest heavy haul trucks with the dump body in the raised position. A minimum crane hook clearance of 17 m from the floor is the current specification.

The heavy equipment shops are arranged to facilitate the efficient movement of parts into the bays from the warehouse area. The 5 m spine through the center of the shop permits forklifts from the warehouse to deliver large components to the shop bays.

Adequate area is required for storage of large tools such as stair platforms, large jacks, wheel dollies, slings and cables etc. Keeping the tools in a dedicated area promotes safety and good housekeeping in the shop by keeping aisles and work areas clear, as the area between the bays is needed as work space for support equipment and parts lay down. A central storage area will make it easier to track tools, allowing for regular inspection and maintenance. Storage of tools in a central location increases productivity by elimination of lost time spent searching for tools around the shop.

A secured mechanics tool box storage area is required to provide an area for tradesmen to store personal tools while they are on days off. The area should provide good access from shop floor; mechanics must be able to roll tool boxes easily from storage area to bays. The arrangement should provide access to the tool boxes while they are in storage. The area needs to be accessible to an outside bay door so mechanics can load their tool boxes on a truck if required. Future expansion of the shop will require additional storage located closer to future shop additions or an annex attached to the outside of the proposed space.

The heavy equipment shops are separated from the welding bays to reduce welding fumes and smoke by a relocate-able steel wall, designed to permit overhead crane travel between the heavy duty shops and the welding bays.

Heavy Equipment Shop Functional Requirements:

- Anvil top floor or similar
- Floor strength based on unloaded weight of heaviest unit (haul truck – approx 625 tonnes)
- Shop floors flat, will be maintained dry (no drainage sump)
- Heated apron, angle iron reinforced leading edge
- Heated door entrance
- Rubber roll-up shop doors
- Man doors between shop doors, window on shop man door to see what is in front of door
- Fluid and tube delivery systems; one tube reel between two bays with adequate number on hose reels. Lubes and fluids to be recommended by the OEM after the truck fleet has been selected but at a minimum would include:
 - Engine oil
 - Hydraulic fluid
 - Transmission fluid
 - Gear oil
 - Synthetic gear oil
 - High volume/low pressure grease

- Glycol
- Evacuation hose (two)
- Compressed air
- Bulk windshield washer fluid
- Air hose reels located at each end of the bay, with shutoff valves at supply outlet
- Two compressed air powered fluid evacuation pump systems, enclosed in acoustic enclosures, for each tube rack (note: equipment must be ordered with suitable fittings for use with quick evacuation system)
- Electrical power cord reels
- 600 amp welder outlets every second bay
- Shop piped for bulk oxygen/acetylene supply or MAPP gas
- GFI outlets for portable power tools
- Air compressor: comes with receiver and dryer, isolation valves and shutoff valves as required
- Back up compressor systems
- Provide one rough service computer workstation every four bays
- Natural gas fired unit heaters at each roll up door
- Makeup air heaters
- Ventilation air discharges at high and low levels to remove diesel fumes to meet appropriate specifications and standards for air exchange
- Gas detection systems
- Acoustic damping systems on ventilation system
- High bay lighting, task specific lighting, mid-height lighting on columns with separate controls, provision for low-level lighting (outlets)
- Shop lighting attached to underside of crane bridges
- Easy access to free pick items area on the shop floor – ear plugs, safety glasses, fasteners
- Large shop equipment storage area (forklifts, floor sweeper, wheel dollies, super jacks, transmission dollies, stands, etc). Approximate area required = 160 m²
- Secure mechanics tool box storage area to accommodate approximately 45" x 60" wide tool boxes; minimum area approximately 180 m². Rollup door to exterior, 2-ton jib crane to unload tool boxes from pickups
- Easy access to tool crib and shop foreman's office
- Bird bath wash located between shops and parts book and lunch room areas
- Utilize mezzanine above tool storage area as much as possible to house services
- Storage for full/empty gas cylinders (nitrogen, argon, propane, oxygen, acetylene for field) outside in ventilated racks
- Adequate space and access to waste disposal (domestic, shop waste, metal, fluids)
- Design outside aprons so water drains away from bay doors; floor height 2m above center of yard to accommodate drainage after road elevation increases due to crushed rock and gravel placement.
- Cranes:

- Four by 50-ton cranes; two bridges on each side of shop, travel parallel to center aisle, capable of operating in synchronized mode
- One auxiliary 25-ton crane on each main crane beam

4. MACHINE SHOP

The Machine Shop is intended to provide shop space for large lathes required for machining of heavy equipment components.

The function of the Machine Shop is to provide rapid response on equipment repairs where replacement parts or a component is not readily available, or minor machining extends the life of a component until a parried replacement is scheduled. The intent of this scaled down repair facility is for emergency and routine repairs to maintain equipment availability and not as a remanufacturing or rebuild centre. The space should be large enough to house the tools listed below and provide a safe work space:

- Two lathes
- Radial drill
- Band saw
- Vertical mill
- Heavy duty turret mill
- Cutoff saw

While it is advantageous for the machine shop to be located next to the mechanical bays, ideally this space is located adjacent to the welding bay.

Machine Shop Functional Requirements

- Requires outside access doors to load/unload components (at a minimum, boom truck access)
- Similar lighting and ventilation as truck shops
- Overhead door access to corridor to permit components to be delivered to/from the warehouse

5. WELDING BAY

Consideration has been given to outsourcing welding, however an onsite welding bay may be required due to concerns about the issues involved in transporting large components such as truck boxes and shovel buckets along the highway to a contract welding shop. These components can weigh up to 90 tons and are extremely large and difficult to transport due to logistical issues including width and weight restrictions. These items require scheduling of large cranes to load and unload both at the origin and destination and permits and escorts on public highways. With other mines being proposed in the area, a heavy equipment service centre may be built by a service provider. If this happens within the right time frame it may be possible to eliminate the onsite welding bay.

The welding bay is needed within 3 years of start-up as shovel bucket components will require rebuild within 24 to 36 months of start-up.

A dedicated welding shop can be achieved by attaching the welding bays to the heavy equipment shop. The primary justification for recommending a dedicated welding bay is the potential health and safety issues created by welding. To mitigate the impact of the welding function on the workforce the recommended design calls for a wall between the welding bay and heavy equipment shops to reduce noise, fumes and light flashes from the welding bay.

Because of the significant cost of providing dedicated crane coverage, the wall extends only high enough to allow sharing of the heavy equipment shop crane.

6. HEAVY EQUIPMENT WASH BAYS

The Heavy Equipment wash bays are required to clean heavy mine equipment prior to service, inspection and repair. They are intended to handle the Cat 797B or equivalent sized haul truck as well as all heavy support equipment (graders, dozers etc.)

The wash bays will be equipped with a steel floor plate, with doors of sufficient height to accommodate the Cat 797B or equivalent sized trucks. Effective drainage of the area surrounding the wash bays is paramount to minimize ice build up during travel to the shops after cleaning.

The Heavy Equipment wash bay, waste water sump should be equipped with a three compartment sump configured to intercept solids and oil with a recycle water compartment. The initial compartment receives water and solids directly from the wash bay floor. The solids are retained in this sump and the water overflows into an adjacent oil interceptor sump. The solids sump is designed with a ramp access to facilitate manual cleanout with a backhoe or a front end loader. The second sump, the oil interceptor sump causes the water to underflow a weir trapping oils on the surface which are to be manually skimmed and removed. The third sump serves as a recycle sump with wash water drawn off the sump and distributed to the wash monitors in the wash bay. The recycle sump receives a regulated volume of clean water to maintain a preset mixture of clean and recycled water based on an optimal wash water blend.

Make up water will be fed to the grey water sump. Roof drains from the wash bay and possibly other buildings will be routed to the grey water sump to supplement the make up water with melt and rainwater.

An alternative arrangement to be assessed in the detail design phase is to pump sludge to a sediment pond outside the bays.

For safety, the wash bays must all be equipped for restricted personnel access via locking doors and a visual notification system actuated from outside the wash bay so the operator inside can be notified if necessary.

The wash bay requirements were based on cold water wash, as sufficient warm water wash history is unavailable. It is estimated wash time could be reduced by up to half by a warm water wash. The estimates are based on recent discussions with operating mines and vendors. It

should be noted that wash durations reflect the TOTAL elapsed time in the bay, which includes time needed for repair of electrical components that are at times damaged due to the high pressure wash.

Functional Requirements

- Designed to accommodate Cat 797B or equivalent sized haul truck with box in raised position
- Due to time involved in cleaning, permanent high volume monitors should be installed, with capability for robotic operations in the future
- Monitors located for maximum effectiveness on selected equipment
- Monitors and lighting should be best in class to facilitate faster and more thorough cleaning
- Steel floor plates to allow large tracked vehicles to drive in
- Steel apron
- Heated apron, door entrance and portion of interior floor slab
- Rollup rubber doors
- Locking doors with visual notification system from outside
- Locking man doors
- Two high pressure Hotsy units for detailed/final cleaning
- High volume utility water supply to allow spot cleaning
- High intensity lighting
- Adequate storage tank for cleaner (Citriclean/Biosol)
- Ventilation system configured to remove high moisture levels; rooftop exhaust fan with makeup air unit supply. Air input is discharged to the floor level and exhaust air removed at ceiling.
- Heating – separate combustion natural gas fired makeup air unit heaters discharging to lower building level at doors and occupied zones
- Mud and sludge from wash pumped into settlement pond
- Ramp access to settlement sump for cleanup by small loader
- Drainage away from shop yard
- Lockers for wash bay attendants
-

Design Specifications:

- 360 gpm monitors operating at 185 psi with a 3” nozzle opening
- Detail design should determine required water capacity for multiple nozzles operating simultaneously if robotic system used
- Adequate storage for cleaner (minimum 8,000 L) but could size to optimize deliveries with large tanker trucks

7. LIGHT VEHICLE BAY

A light vehicle shop design should be included with the facility as the mine site is remote. Another option is to construct a shop on site and outsource operation of the shop to a third party.

These bays are required for the service and repair of severe application mine vehicles and critical light vehicles, which includes supervisors' vehicles, crew buses and service vehicles

Due to the severe application and specialization needed to identify and repair the type of damage that occurs in the mine application, this is a critical function. A specialized skill set is required to ensure safe and lasting repairs on these types of vehicles in this application. The mine vehicles are prone to frequent failures, which experienced mechanics may repair in hours, as opposed to up to a week if repaired off site. The time required to coordinate a tow truck to service centers could add at least two days to each repair due to delivery time. Supervisory and service vehicles are critical to safe mine operation, therefore a quick return from service and repair is essential.

Vehicle hoists can be situated at angle parking within a standard sized truck bay and relocated to a new shop when expansion is required.

8. MINE WAREHOUSE

The role of the Mine Warehouse facility is to provide storage and distribution of materials and parts used in maintenance and operations. The role of this facility would also include packing and shipping of materials for repair and remanufacturing.

The Warehouse function will also be responsible for collection, storage and shipping of waste material including hazardous waste from the mine operations and maintenance complex to the central site hazardous waste handling facility.

The Mine Warehouse will also house the tool crib and a hose shop.

The Mine Warehouse facility is sized based on dimensions of similar facilities in BC. Actual capacity will need to be determined with a procurement group input and will be influenced by the services that will be provided in the local area in the future. The exact dimensions may be flexible to allow integration with rest of facility.

If expansion of the operation takes place, consideration should be given to providing or expanding satellite warehouse and using the Mine Warehouse as a receiving and distribution center.

Design Considerations:

Design needs to accommodate expected inventory for mine operations and maintenance and should accommodate the following:

- Receiving access/docks, leveller dock at each door
- Shipping area
- Storage racks

- Offices
- Lunch room
- Lockers for storage of outdoor gear
- Outside storage racks in secure area in yard
- Walk up parts wicket
- Parts books
- Motion actuated rollup door into central spine of facility
- Warehouse parking for site delivery vehicles and visitors
- Full/empty gas bottle storage
- Hazardous materials holding area
- Batter disposal area
- Used oil filter disposal area
- Cardboard compactor and bailer
- Connected to heavy equipment shop to provide ready access for forklifts and parts trolleys to deliver parts to equipment bays
- Same lighting specifications as truck shops
- Pressurized ventilation system
- Filtered makeup air
- Approximate area required is 1,200 m².

Final functional specification of the warehouse and hazardous material transfer and storage facility should be supplied by the procurement group.

9. TOOLBOX STORAGE AREA

A secured mechanics tool box storage area is required to provide an area for tradesmen to store personal tools while they are on days off. The area should provide good access from shop floor; mechanics must be able to roll tool boxes easily from storage area to bays. The arrangement should provide access to the tool boxes while they are in storage. The area needs to be accessible to an outside bay door so mechanics can load their tool boxes on a truck if required.

10.MINE OPERATIONS MUSTER AREA

This area provides a central marshalling area for mine operations crews where each individual will receive an equipment and crew bus assignment prior to beginning each shift. Because it is the only area where the entire operations crew is in one place during the shift, it also serves as an area for announcements, updates and events such as production milestone celebrations.

Functional Requirements

- Area to accommodate approximately 150 people peak for shift change
- Wicket for crew assignments and mine operations clerk office

- External access vestibule with double doors adequately spaced to minimize heat loss during winter shift change
- Outdoor covered canopy for bus wait area
- Electronic billboard for employee information
- Employee computer access kiosks
- Pre-shift meeting room (200 people) with dividers
- Mine operations supervisors and trainers offices located adjacent
- Mine operations training room configured for classroom, computer and equipment simulator training
- Access to supervisors and trainers offices
- Mine access and permit wicket nearby

Tire Shop and Pad

The Tire Shop will be used for replacing tires and rims on Cat 797B or equivalent sized haul trucks. It will also serve as a base for tire management for support equipment and the light vehicle fleet.

The dedicated shop is recommended for safety and efficiency reasons. Large tires require removal of the tires and rims at high pressures (90 psi). The dedicated shop and pad is recommended due to potential safety issues associated with doing tire work in the heavy equipment shop with a higher level of activity and more people in the area. Space for lay down is required in the winter months for warming at least 2 tires prior to installation. Emergency tire changes in the shop will take up to one day longer during the winter as tires require time to thaw. A standalone tire shop is recommended as this function is generally outsourced to a tire supplier, therefore a dedicated shop is highly recommended should this option be exercised. The shop should be large enough to accommodate a warming area for two large hauler tires, support equipment tire changing area and a heated pad large enough to accommodate 2 heavy hauler trucks. By utilizing a heated pad several safety and efficiency gains can be achieved. Icing of the outdoor pad is dangerous and requires time to clear before use. By utilizing a heated pad workers can stay out longer in inclement weather and finally the extra pad size can be used as an overflow area for mechanical maintenance by simply installing temporary hoarding around the specific work during in winter months.

Maintenance Complex - Yard Area

Consideration needs to be given to the design and layout of the yard area due to the impact the yard has on safety, efficiency of shift changes and materials and equipment used in the maintenance function.

Purpose

- Allow for the safe and efficient flow of traffic between shop areas
- Parking areas for equipment including down line and ready lines for all shops

- Offloading area (ramps) for heavy support equipment
- Light vehicle parking – visitors
- Storage for used/scrapped tires
- Pallet racks for component storage
- Equipment salvage yard (bone yard)
- Cold steel storage
- Secured outdoor storage
- Crew marshalling areas (incorporating bus turnaround areas)

Sufficient allowance has been made on maintenance facility pad area for the maintenance complex yard area.

Bulk Lube Storage

The facility will provide an unloading facility, storage and loading for distribution of lubricants and fluids for use in mine equipment and various shops. It will be operated by the warehouse. The Bulk Lube Facility will house the larger bulk storage tanks for new lubricants and glycol inside with the pumps located on the floor beside the associated tanks. Lubes and glycol are located inside the building to minimize the risk of contaminating the products instorage and to maintain them at a temperature suitable for pumping to the Mine Maintenance Complex. Storage space for lube cubes and drums of specialty tubes, solvents, etc is required. The Bulk Lube Facility is attached to the Mine Operations Complex to minimize the distance products need to be pumped and to avoid long runs of underground piping that could be damaged by yard traffic. The requirements for a fire wall will need to be addressed.

Functional Requirements

Approximately 50,000 L storage tanks required for fluids and engine oil for various types of engines:

- Hydraulic fluid
- Transmission fluid
- Gear oil
- Open gear lube
- Grease
- Waste oil
- Waste glycol
- Bulk windshield washer fluid
- Other lubes and fluids as required by equipment OEMs
- 25,000 L tank required for degreaser/detergent
- Cone bottom shaped tanks required to distribute shovel open gear lube through bulk dispenser
- Should be located close to HE shop and provide ease of access to delivery trucks
- Explosion proof gas fired infrared heaters
- Needs adequate heating for winter conditions to ensure fluid flow

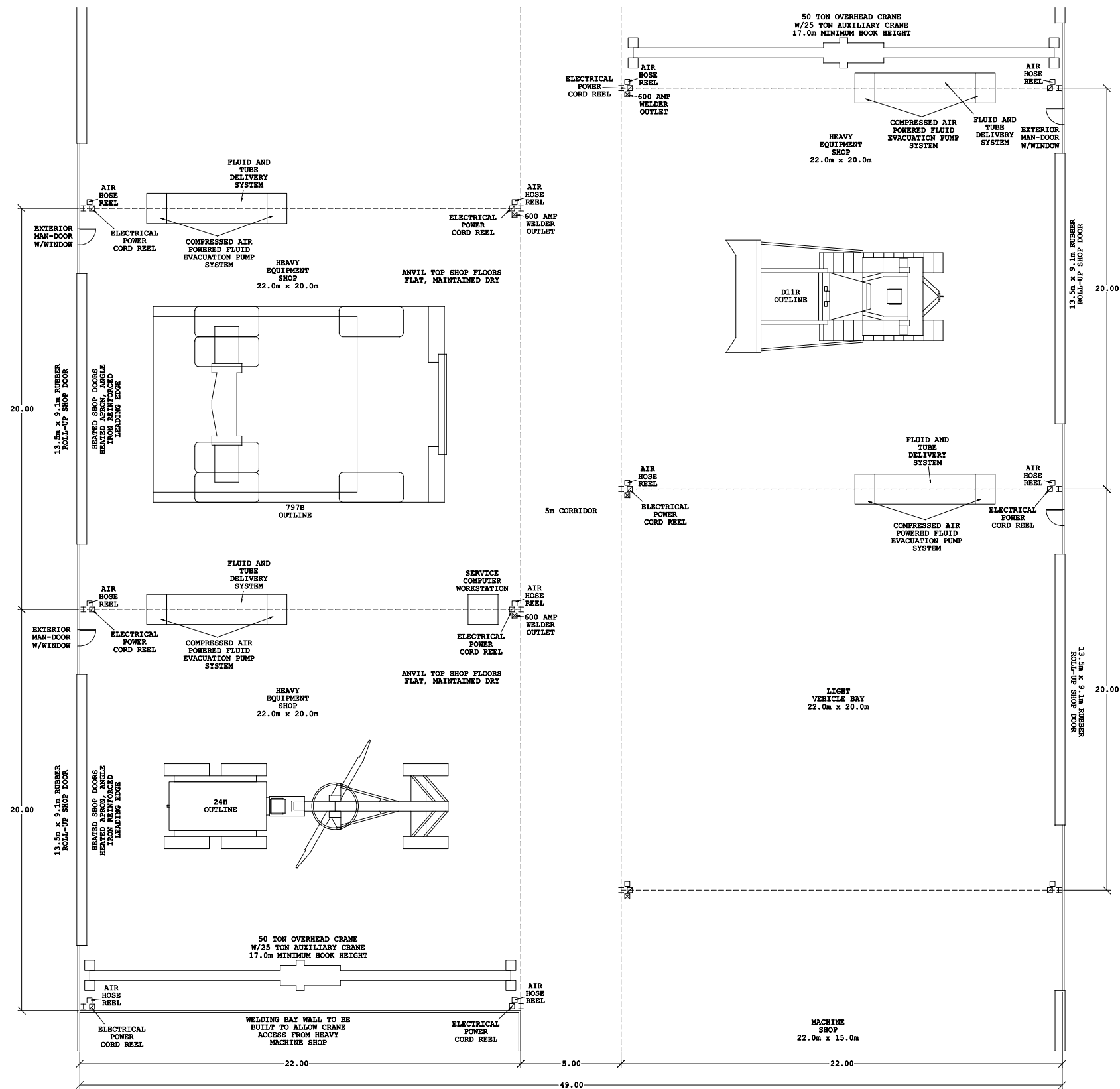
- Attached vestibule and service room
- Additional storage space for drums and cubes (1m x 1m x 1m) of specialty lubes, solvents, etc.
- Tanks need to be sized to accommodate tankers and lead times
- Indoor storage for containerized product
- Enclosed truck warming and unloading bay
- Overhead crane for handling lube cubes
- Pump area (loading area for tube trucks, shovel crew trucks)

Dimensions

The dimensions of the bulk lube storage area are approximately 25m x 29m. 3-ton overhead crane is needed in the tube delivery bay. Sufficient allowance has been made on maintenance facility pad area for the bulk lube storage.

List of Drawings:

- <Maintenance Facilities LAYOUT.pdf>
- <Maintenance Facilities HEAVY MACHINE SHOP.pdf>
- <Maintenance Facilities WASH BAY.pdf>



MOOSE MOUNTAIN TECHNICAL SERVICES

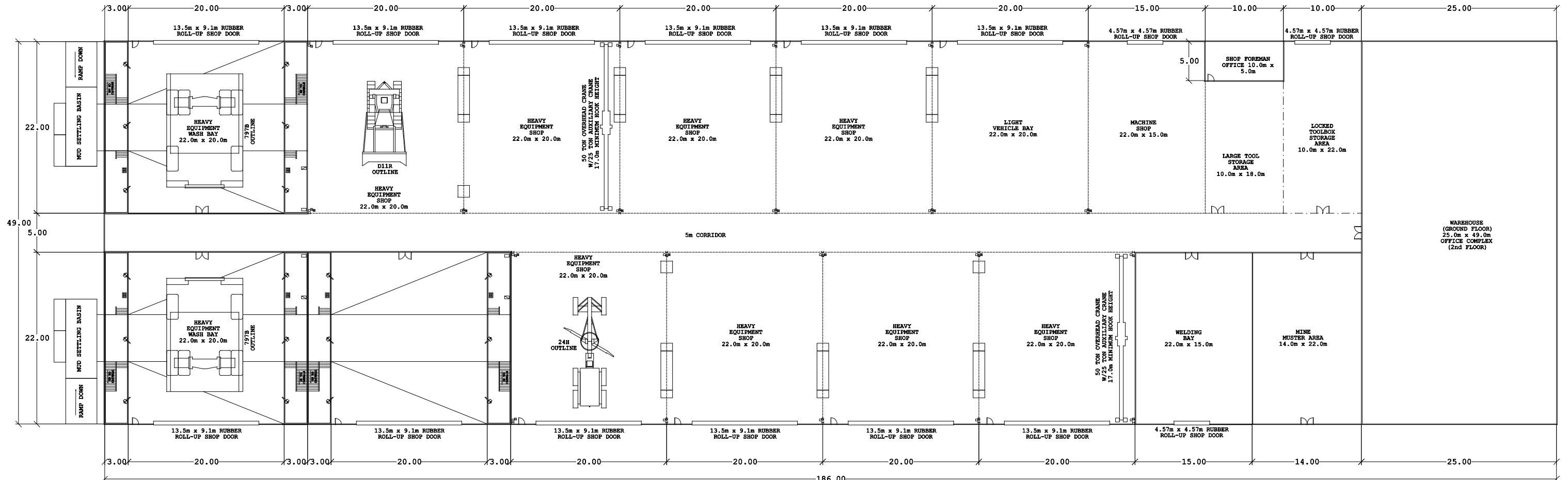
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KSM SEABRIDGE PROJECT - PFS

HEAVY EQUIPMENT SHOP

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MOOSE MOUNTAIN TECHNICAL SERVICES

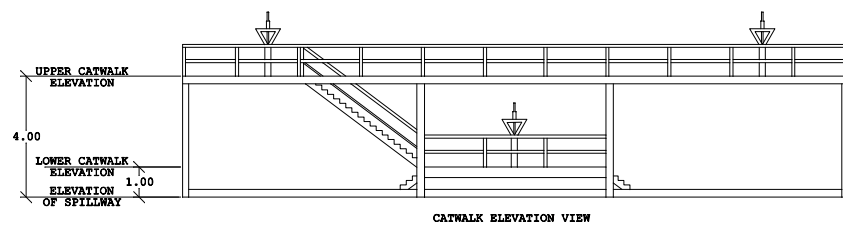
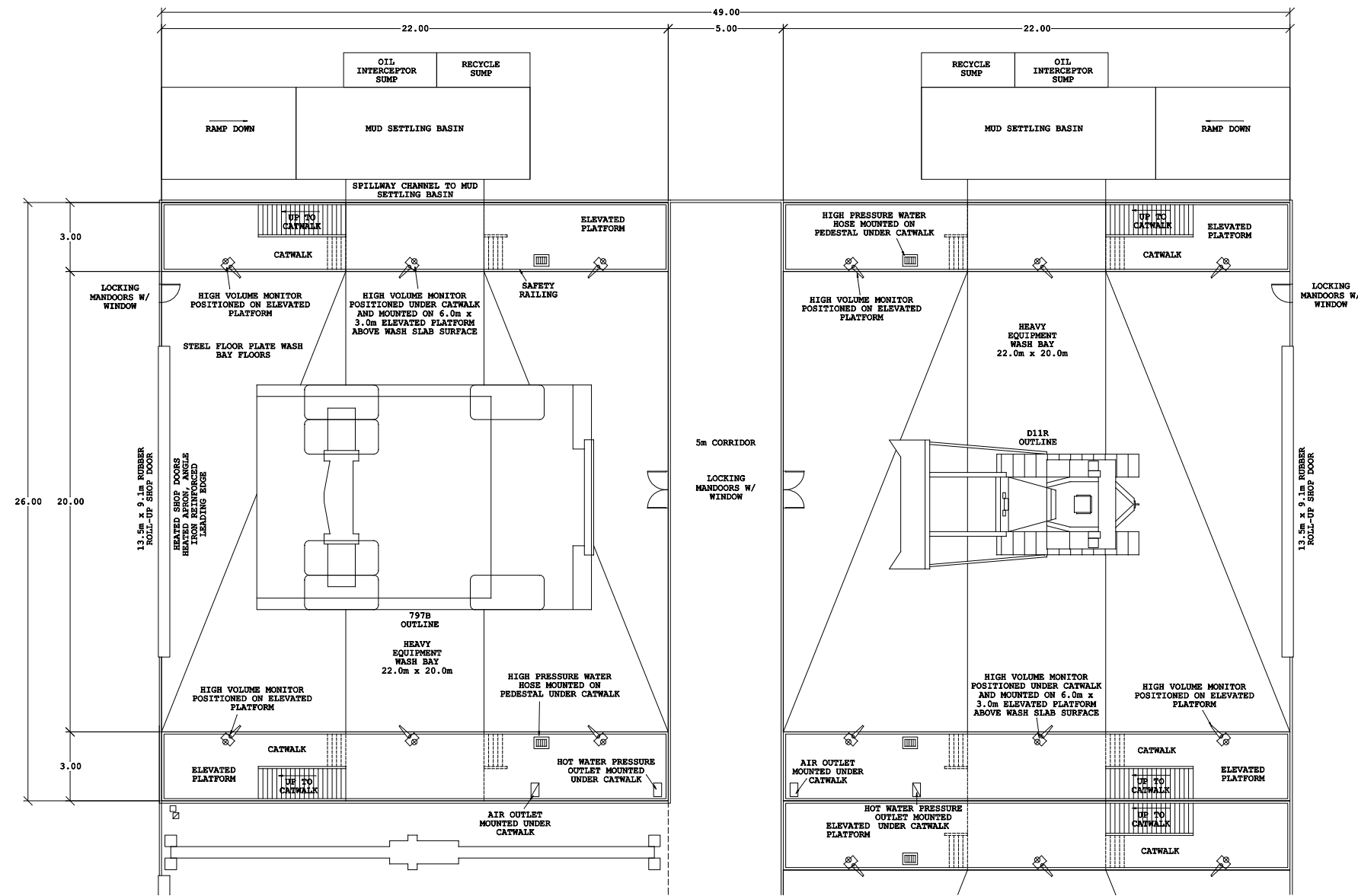
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KSM SEABRIDGE PROJECT - PFS

MAINTENANCE FACILITY LAYOUT

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MOOSE MOUNTAIN TECHNICAL SERVICES

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KSM SEABRIDGE PROJECT - PFS

HEAVY EQUIPMENT WASH BAY

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