



WJ GROUNDWATER
Expert in Groundwater

Method Statement

**Project Name: Woodsmith Mine Phase 3 Site
Preparation, Mobilisation and Installation of
Dewatering Equipment**

Client: Sirius Minerals

Project No.: Q7370

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Method Statement

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| WJ Project No. | Q7370 | Document Reference: | Q7370-RAMS-001_rev02 |
| Contract | Dewatering at Wood Smith Mine | | |
| Client | Sirius Minerals | | |
| | <u>Name</u> | <u>Signature</u> | |
| Method Statement briefing given by | | | |
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1. INTRODUCTION

1.1. The Works

The main contract works involves construction of four shafts and associated infrastructure as part of the development of Woodsmith mine. The work site is being prepared with a working platform level at between 200 and 203 mOD over a working area of approximately 220 m by 200 m.

The temporary works dewatering requirements are phased and relate to construction of access chambers and winder house plus basement excavations. The basement excavations extend around the Service Shaft and Production shaft (the two deep shafts). The target groundwater levels (GWL) and programme can be summarised as follows;

| Shaft | Service shaft | Production shaft | MTS |
|--------------------------|-----------------|------------------|-------|
| Platform level | 203.2 | 203.7 | 200.7 |
| Target GWL for basements | 195.0 | 195.5 | - |
| Basement programme | Oct 17 – May 18 | Dec 17 – May 18 | - |

Dewatering Wells will be installed in accordance with the outline well array shown on drawing 40-ARI-WS-71-CI-DR-1058, which minimise access constraints by locating most of the dewatering wells around the platform perimeter and along a batter slope which crosses the platform. The array mainly surrounds the western half of the platform (perimeter length 600 m approx. at 20 m centres) where the two deeper shafts and basement excavations are located. A discharge point has been identified approximately 40 m east of the working platform some 130 to 190 m from the nearest dewatering well (assuming the discharge lines follow around the excavation perimeter).

In order to control groundwater levels we propose the installation of an array of wells to the following outline specification:

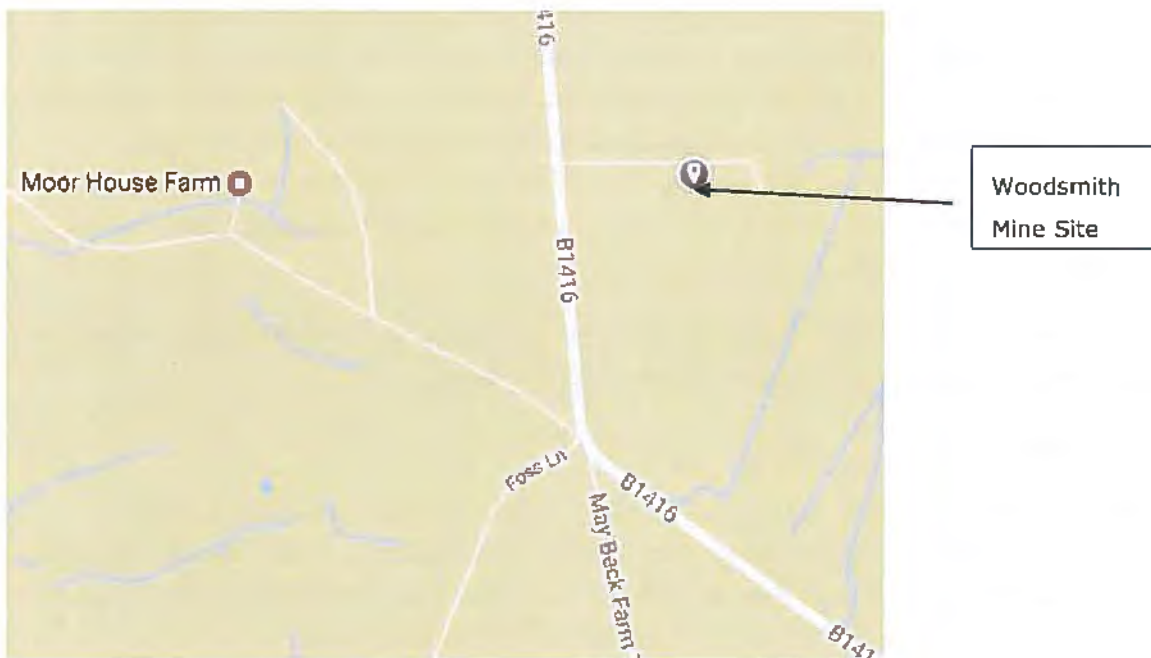
| Well Detail | Main deep shaft platform |
|---------------|---|
| No. of Wells | 30 No. wells |
| Well Location | Platform perimeter (and batter) at 20 m nominal spacing |
| Depth | 12 m approx. to toe into the Scarborough Formation |
| Bore Size | 250 mm nominal |
| Liner Size | 125 mm nominal |
| Pump Size | Up to 1 l/s |

Pumping would be undertaken using electric submersible borehole pumps installed in each well. The pumps would be powered from a control cabin with power cables generally following the line of the discharge pipework. The control cabin would house the pump starters, monitoring/alarm system and auto standby generator switch gear. Discharge will be to the location identified on the Arup drawing 40-ARI-WS-71-CI-DR-1058 via a 2,000 l v-notch discharge tank which provides flow monitoring, a visual assessment of

discharge water quality and a sampling point. Groundwater level monitoring would be carried out in accordance with the Groundwater Management Plan (Ref: 40-FWS-WS-70-WM-PL-0004) in existing piezometers around the site.

1.2. Site Location

The Woodsmith Mine site is located at National Grid Reference (NGR) 489400 505100 within the North York Moors National Park. The postcode for site is YO22 5HZ.





1.3. Expected Ground Conditions

The target aquifer for the dewatering is the Moor Grit Sandstone which underlies the whole of the platform area. The superficial glacial till deposits will have been largely removed over the northern half of the platform but a few meters thickness may be present over the southern half. The glacial till is predominantly cohesive and relatively low permeability, and in any case where the glacial till is removed the platform construction will include installation of a liner which will isolate surface water on the platform from the groundwater below. The Moor Grit comprises a fine to medium grained sandstone with occasional medium to coarse gravel to pebble beds, discontinuous argillaceous beds and thin coal laminations. The upper part of this unit is distinctly weathered to destructured, whilst the lower part is partially weathered. The Moor Grit sandstone is between 2.3 m to 13.2 m thick and the discontinuous argillaceous units within the mid-section ranged from 1 m to 5m in thickness. Test data suggests the Moor Grit aquifer is of medium to low permeability with a proposed most likely permeability of the order of 10-5 m/s. Groundwater contours indicate cross flow from west to east. Standing groundwater levels fluctuates by approximately 2 to 4 m seasonally and may be 2 to 5 m below platform level.

The base of the Moor Grit Sandstone is indicated to be at 195 to 192 mOD and is underlain by the relatively low permeability mudstone/siltstone units of the Scarborough Formation.

2. PROGRAMME

The drilling works are due to begin early June 2017. Drilling, installation and commissioning of the dewatering system is estimated to take between 5 and 6 weeks. Commissioning of the wells will take place concurrently with the drilling works. Well yield testing will be undertaken on around 10 no. wells to gather data for analysis to establish discharged flows and confirmation of dewatering design.

3. REFERENCES

The following current legislation and current WJGL documentation is applicable:

- The Management of Health and Safety Work Regulations 1999 (MHSWR)
- The Construction (Design and Management) Regulations 2015 (CDM)
- The Control of Substances Hazardous to Health Regulations (COSHH)
- The Provision and Use of Work Equipment Regulations 1998 (PUWER)
- The Manual Handling Operations Regulations 1992
- The Personal Protective Equipment at Work Regulations 1992
- The Lifting Operations and Lifting Equipment Regulations 1998
- WJGL Procedures Manual
- Client Specific Instructions



4. RESPONSIBILITIES

4.1. Staff Responsible for the Works

The WJ Contracts Manager/Project Manager has the overall responsibility for the works. The WJ Supervisor is responsible for the onsite management of all site setup and dismantling operations.

4.2. Personnel

The following personnel will be involved in this project:

| | Position | Name |
|----------------------------------|--|----------------------------------|
| Drilling phase | Project Engineer (Part time site attendance) | Michael Cummiskey (07738 837011) |
| | Lead Driller | Michael Crowley |
| | Second Man | Alex Walford |
| Installation/Commissioning Phase | Project Engineer (Part time site attendance) | Michael Cummiskey (07738 837011) |
| | Site Supervisor | Josh Somma |

Personnel details shall be confirmed on attendance of the pre-start briefing or site induction and contact details shall be distributed at this time.

4.3. Competency and Certification

Task Specific competencies are identified within the relevant Task Based Method Statements for a particular activity.

5. EMERGENCY PROCEDURES

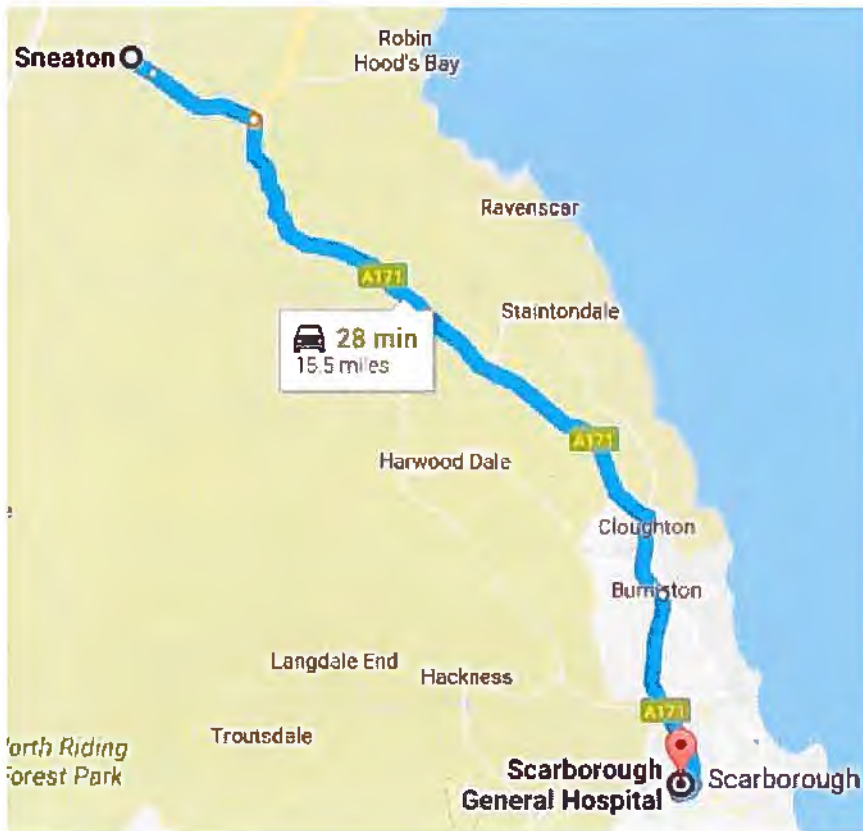
All staff will be briefed on the key points during the site induction, including location of fire assembly and muster points, location of fire extinguishing equipment and fire alarms, and response to environmental incidents.

Emergency Services: Tel: 999/112

In the event of an emergency, the nearest Accident and Emergency Hospital is as follows:

Scarborough Hospital, Woodlands Drive, Scarborough, YO12 6QL

Telephone: 01723 368111



6. PPE

The following PPE is the minimum acceptable for this project:

- Hard hat BS EN 397
- Yellow Hi-Vis vest or jacket BS EN 471 Class 3
- Yellow Hi Vis over trousers BS EN 471 Class 3
- Toe and insole protected boots BS EN 345
- PVC or Nitrile Gloves BS EN 374
- Safety glasses BS EN 166 1F

Should any other task specific PPE be required then this will be detailed within the task specific method statement.



7. ATTENDANCES

It has been agreed that the following attendances will be provided by the Main Contactor:

| Issue | Method |
|--|--|
| Deliveries and lifting equipment | Drilling rig will be delivered by a flatbed lorry. All dewatering plant will be delivered, placed and collected by lorry mounted crane (eg Hiab type) vehicle or WJ forklift. Principle contractor / client to supply craneage for any plant which cannot be picked up by standard hiab crane. Assistance may be required during and at the end of a job when access can be poor and when we no longer have any lifting equipment on site to be self-sufficient. |
| Access to site | Access to the site will be made via the permitted routes |
| Access on site | Principle Contractor to prepare working platforms and access routes accessible by a tracked drilling rig and rough terrain forklift or telehandler. |
| Water supply for installation | A water supply is required to install the wells. 10,000 litres initially and 5,000 litres per day throughout the drilling works. WJ will provide an initial 27,000 litre water tanker with subsequent water abstracted from the initial drilled wells for reuse for forming subsequent drilled wells |
| Removal and disposal of spoil and arisings | The well arisings will comprise drilling slurry which will be contained in the drilling skips prior to removal by the Principle Contractor to a designated point to settle out any suspended solids before discharge. |
| Temporary storage of materials | We require an area of 10 by 10 m for well materials and plant. In addition at the locations of the two WJ compounds, we would require an area of 10 m by 5 m. |
| Location of pumps, pipework, tanks, electrical controls and generators | Principle Contractor to provide support, ducting and/or protection for pipework and cables as necessary and appropriate dry, flat stable area for pumping equipment. |
| Electricity and power | The Principle Contractor to provide and connect duty and standby electric power (3 phase, 415 v, 3P+N+E) to each electrical control unit/pumping station including provision of appropriate test certification for the supply and connection. Earth leakage protection is required. |
| Diesel fuel | Provide diesel fuel for generators and installation plant. |
| Underground services | The Principle Contractor is to check for services and underground structures and provide permit to dig where required. |
| Preparation of well locations | The Principle Contractor is to set out well and piezometer locations. WJ Groundwater will provide an indicative layout drawing. In addition the main contractor / client are to break out hard superficial layers such as concrete or tarmac and remove any artificial obstructions at each well location. |
| Control of rain / surface water | The Principle Contractor is to provide drainage channels, sumps and pumps for the control of rainwater and surface water at the site. |



| Issue | Method |
|--------------------|--|
| Welfare facilities | The Principle Contractor is to provide shared welfare facilities and other services as necessary to maintain a safe working environment in accordance with current Health and Safety legislation including temporary fencing and site lighting where required to provide a safe working environment. |
| Parking | Parking will be in the designated parking areas during the dewatering installation and for any subsequent visits. During installation this is likely to be up to 2 No. vans and 1 No. car, and for maintenance visits it is likely to be 1 No. van. |

8. SITE SPECIFIC RISK ASSESSMENT

The risk assessment has been compiled for site specific risks identified from client information and any site walkovers carried out. Task specific risk assessments are contained within the relevant method statements.



HAZARD & RISK ASSESSMENT FOR SITE SPECIFIC RISKS

To Evaluate Risk:

Likelihood (L) x Severity (S) = Risk (R)

Defined as High (11 - 25), Medium (6 - 10) or Low (1 - 5)

| L = Likelihood | S = Severity |
|-----------------------|-----------------------|
| 1 Very Unlikely | 1 Minor Injury |
| 2 Unlikely | 2 Lost Time Injury |
| 3 Likely | 3 Major Injury |
| 4 Very Likely | 4 Single Fatality |
| 5 Certain | 5 Multiply Fatalities |
| Assessed By: | Checked By: |
| Michael Cummiskey | Neil Coulter |
| Date: 24/03/2017 | Date: 24/03/2017 |



| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|----------------------------|--|---|-------------|---|----|---|---------------|---|---|
| | | | L | S | R | | L | S | R |
| General site works | Unsafe acts due to lack of awareness | Operatives, Visitors | 3 | 3 | 9 | <ul style="list-style-type: none"> Attend site safety induction & method statement briefing to be given by WJ Site Manager / Supervisor. Comply with site rules and WJ safety policy. Wear high visibility coat/long sleeved vest and PPE Carry out regular tool box talks for specific tasks. Display safety signage | 1 | 3 | 3 |
| General site works | Trips, Slips and Falls | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Keep work area tidy. Route cables and pipes to minimise trip hazards Backfill or cover any open holes with road plates and use barriers and signage. Keep materials equipment stored in designated laydown areas Do not go on site during the hours of darkness unless adequate lighting available. | 1 | 3 | 3 |
| Placing of fuel bowsers | Spills into nearby watercourse | Environment | 3 | 4 | 12 | <ul style="list-style-type: none"> All bowsers brought to site are to be double banded Do not place fuel bower within 7.5m of water course Fuel bowsers to be kept as far as practicable from boreholes and monitoring wells Fuel bowsers to be sited on top of plant nappies Plant nappies to be utilised during re-fuelling procedures | 1 | 4 | 4 |
| General site works | Security of plant, tools and other equipment | Operatives, Equipment, Visitors, Public | 3 | 4 | 12 | <ul style="list-style-type: none"> Operatives to ensure all equipment kept securely during site working hours Do not store items outside of Heras compounds Sirius Minerals to provide security outside of normal working hours – including secure perimeter fencing, appropriate site warning signage and security guards | 1 | 4 | 4 |
| Dewatering Target Drawdown | Seasonal high infiltration causing groundwater level to rise above target levels | Operatives, Equipment, | 4 | 3 | 12 | <ul style="list-style-type: none"> Dewatering system is designed with enough redundancy in the system through well numbers and pump capacity to take up the increased rainfall infiltration into the aquifer. Levels monitored during high rainfall periods to plan for WJ attendance to optimise system to maintain target drawdown levels | 1 | 3 | 3 |
| Dewatering Discharge | Seasonal high infiltration causing increased discharge rate to surface water | Environment | 4 | 2 | 8 | <ul style="list-style-type: none"> All dewatering discharge is screened from suspended solids at the point of abstraction through appropriately sized slotted pipework and filter material around the screen annulus. All discharge runs through a v-notch weir discharge tank, which will capture any other suspended solids before it enters the discharge point. All surface water pumping will be prevented from entering the dewatering network unless appropriate filtering of suspended solids are undertaken prior to entering the network | 1 | 2 | 2 |

9. ROTARY DRILLING OF DEWATERING WELLS

This document describes the works procedure for the construction of rotary cored boreholes and includes the installation of well liner and backfill materials.



9.1. Personnel and Equipment

9.1.1. Personnel

The following labour force will crew the rotary rig:

- Drill Rig Operator ('Foreman Driller'), will drive the rig and RTFL; holds current CPCS cards for both pieces of plant.
- Drill Rig Assistant ('2nd Man'), will also drive the RTFL and holds a current CPCS card

9.1.2. Competency and Certification

The minimum training requirements are as follows:

- CSCS experienced worker or general operative card
- NVQ Land Drilling for Lead Driller
- CPCS card for relevant plant
- Manual Handling (all crew members)
- First Aid (at least one per site)
- Valid driving license for support vehicles



9.1.3. Equipment

The following equipment will be needed in order to construct the borehole and install the backfill materials:

Drilling Equipment

- Rotary drilling rig - Fitted with compliant guarding
- 1 No. flush circulation pump (Selwood H80 Super Silent)
- 1 No. flush suction pump (Selwood S150 Super Silent)
- 2 No. water flush recirculation skips (2.5 x 6m)
- 100 mm diameter bauer pipework in 3 m and 6 m lengths
- Diesel powered compressor
- 50 mm fire hoses
- 2 No. intermediate bulk containers (IBCs)
- 250 mm nominal diameter temporary casing in 2 m lengths
- 250mm Tricone and/or drag bits
- Drill rods
- 200 mm down the hole hammer and rods
- Stuffing box arrangement to control ejected material
- Bunded fuel tank

Support Equipment

- Site based transit van (containing tools, spares, PPE, first aid kit, fire extinguisher)
- JCB 926 3.5 t capacity rough terrain forklift (or similar)

Well Installation Materials

- UPVC well screen and casing (125 mm nominal in various lengths)
- Pea Gravel
- 8/16 Sand
- 16/30 Sand
- Bentonite Pellets – Mikolit

Development Equipment

- 250 cfm compressor
- Air hose, whip checks and bubbler

9.2. Task Specific PPE and Safety Equipment

The following PPE and safety equipment should be used:



Personal Protective Equipment

The following PPE needs to be worn in addition to the minimum site PPE (specified in section 6.0) for this task:

- Ear defenders BS EN 352

Safety Equipment

- High pressure hose whip inhibitors
- Fire extinguisher (2kg Powder)
- First Aid kit
- Eye wash kit

9.2.1. Documentation and Certification

Safety Documentation to be carried

- Drill rig certificate of thorough examination
- Winch rope certificate
- Certification for other lifting equipment (shackles etc.)
- Operators certification
- Weekly Plant Inspection checklist
- Copies site specific Risk Assessment and Procedures (Method Statement)
- Rig set up layout drawing
- RTFL certification and Inspection checklist

9.3. Drilling Safety Procedures

- Carry out Method Statement briefing at the start of project and frequent tool box talks and issue records to main contractor. Carry out method statement review at regular intervals or if there is a change to the works or site conditions,
- Carry out daily start of shift briefing to identify day to day hazards and remind people of risks associated with activities,
- Foreman Driller to carry out daily site and plant inspections,
- Copies of all plant check sheets, inspection sheets and daily start of shift briefings to be given to the main contractor on a weekly basis,
- Foreman Driller to review every rig set up prior to commencing drilling. Comments to be logged on drilling rig inspection forms,
- Drill rig will have sufficient guarding of moving parts in accordance with legislation (interlock guard within 0.5 m from the floor and 2 m high),
- Set rig up on flat, stable ground,
- Each well location to be scanned for services by the main contractor,
- Establish and enforce drilling exclusion zone with physical barriers and warning signs,



- Whilst drilling in progress only the 2nd Man to enter the drilling exclusion zone,
- The driller will always maintain clear sight of the 2nd man inside the exclusion zone,
- Use RTFL or telehandler to lift heavy items (drill rods, casings),
- Store drill rods and casings in stillages when not in use,
- No casings or rods will be joined together in any location other than the well position,
- All high pressure water hoses to be fitted with whip inhibitors (whip checks) at joints and terminations.

9.4. Transportation of Rig

Transport of rig and equipment to / from site

- Rig to be carried on appropriate vehicle
- Rig to be loaded by authorised personnel
- Rig to be securely restrained on vehicle by suitably qualified person
- Rig to be cleaned prior to transportation to remove excess spoil / gravel
- Ensure surfaces suitable for heavy vehicles
- Drilling rig will be unloaded from plant trailer by tracking the vehicle off of the trailer ramps. Only the drilling rig operator is permitted to load or unload the rig.
- When tracking rig use 2nd man as banksman

Access to drilling locations

Site preparation carried out by Main Contractor / Client.

- Flat, stable, free of trip hazards area 5 m x 14 m at each well location
- Ensure each location is free of buried services,
- Provide suitable clear firm unobstructed drive on access for the rig and RTFL.
- Adequate headroom for the drilling rig (11 m)
- Remove/breakout all tarmac, concrete and other hard superficial layers
- A permit to dig will be issued by Main contractor prior to drilling.
- Stack casings / rods in suitable, secure trestles or racks.

9.5. Drilling

Sections 9.5.1 to 9.5.4 describe the possible drilling techniques that could be used for drilling on this project. The holes could be drilled by installing temporary casing to full depth or by installing temporary casing part way or using symmetrix hammer system (if unstable ground conditions are encountered) and then drilling through this casing to depth using open hole techniques. The technique used will be determined by the ground encountered conditions during drilling.

9.5.1. Set up of Drill Rig

- The drill rig will be located over the marked well location



- Use stabilisers and hydraulic jacks as required.
- The driller will be instructed on the required depth of drilling for the well and given an indication on the levels of the main strata to be drilled through based on details from the nearest site investigation borehole log available.
- A sump hole approx. 0.5 m x 0.5 m x 0.5 m deep will be formed adjacent to the well location. The suction of the returns pump will be placed here

9.5.2. Installation of Temporary Casing

- Prior to the commencement of drilling the jetting and returns pumps will be setup and connected to the rig.
- Appropriate pressure hose, with whip checks at the joints, will connect the rig to jetting pump.
- Once the drilling rig is sited on the well location, a starter length of temporary drill casing will be drilled into the ground until a suitable seal is formed around the base.
- Stillages of the temporary casing will be placed in front of the rig using a forklift.
- The lead length of temporary drilling casing fitted, with cutting shoe, will be lifted from the stillage using the rigs' winch and a lifting head, and placed within the clamp and breaker. The lifting head is removed and the drive head attached. The rig's rotary head is used to spin the casing down while flushing with drilling mud.
- Borehole arisings mixed with the flushing medium is pumped from the sump back to the recirculation tanks. The arisings are settled out in the tanks. Clean mud is picked up by the flushing/jetting pump and is re-circulated down the borehole. Additional mud is added as required.
- Casings are threaded together using hydraulic clamp and breaker which will require the 2nd man to enter the guarding. Extra care is required when connecting the casing - ensure slow rotation (less than 15 RPM). At all times the Driller and 2nd Man will remain in visual contact. Rotation controlled only when switch is depressed by the driller.
- If visual contact is lost between the 2nd man and the driller then the operation will be stopped until it can be regained.
- Additional lengths of casing will be added until the borehole has reached its completed depth.

9.5.3. Rotary Open Hole Drilling

- Boring commences through the starter casing (installed as above) with the flushing medium being pumped down the drill rods.
- Borehole arisings mixed with the flushing medium rises over the starter casing and is pumped to the tanks with the sludge pump. The arisings are settled out in the tanks. Clean mud is picked up by the flushing pump and is re-circulated down the borehole. Additional mud is added as required.
- If there is any evidence of contaminated material (odours, oils, waste material) drilling will stop and Supervisor contacted.
- Drilling will be carried out by direct circulation methods using tricone or drag bits.



- Rods are added as depth increases. Stillage's of the rods will be placed in front of the rig using a forklift.
- Rods and casings are threaded together using (if available) hydraulic clamp and breaker. Final tightening will be with manual rod spanner. Extra care is required when connecting rods - ensure slow rotation (less than 15 RPM). At all times the Driller and 2nd Man will remain in visual contact. Rotation controlled only when switch is depressed by the driller.
- As each rod is added the pressure in the rods is allowed to dissipate before breaking the joint.
- The arisings will be monitored to give an indication of the strata encountered.
- Well drilling ceases at the required depth as required.

9.5.4. Drilling – Symmetrix

- The symmetrix hammer and casing system will be attached to the drill head and the air hoses attached to the flush system.
- A stuffing box arrangement will be fitted to the clamps on the drill head to control ejected material.
- When drilling with air control measures will be taken as outlined in the risk assessment. Drilling with air will leave a mound of spoil adjacent to the well location. This will need to be removed to a designated storage area for later disposal by Sirius Minerals periodically as drilling proceeds
- If there is any evidence of contaminated material (odours, oils, waste material) drilling will stop and the Sirius Minerals site team contacted. Sirius Minerals will advise as to how to proceed.
- Drilling will be continued using the hammer to progress the casing until competent strata is reached.
- Upon reaching competent strata, drilling will continue using open hole techniques to depth.
- Drillers are to monitor returns and drilling progress to ensure no unacceptable ground loss occurs. Occurrences of lost ground and borehole instability to be noted.
- When a new rod or length of casing is being added to drill string; the flushing pump valve will be closed and the pressure allowed to dissipate. This will be visually monitored by the lead driller.
- Rods and casings are threaded together using (if available) hydraulic clamp and breaker. Final tightening will be with manual rod spanner. Extra care is required when connecting rods - ensure slow rotation. At all times the Driller and 2nd Man will remain in visual contact.
- The arisings will be monitored to give an indication of the strata encountered.
- On reaching total depth, the drill rods are then removed from the well and installation of the wellscreen and filter pack commences as detailed below.

9.5.5. Spoil Disposal

- Spoil and slurry from the drilling will be deposited within the settlement skips (water flush method) or adjacent to the borehole (symmetrix hammer method).
- Sirius Minerals will be responsible for removing this material from the settlement tanks when the tanks near full of drilling slurry or the slurry becomes too thick to use as a flushing medium.



9.5.6. Refuelling

- Diesel for the plant will be stored in a 1000 litre bunded fuel cube, sited on a plant nappy.
- When refuelling is required the cube will be moved by RTFL to the plant.
- The plant will be visually inspected for damaged prior to the refuelling operation taking place.
- The nozzle from the cube will be put into the tank of the plant and the hand pump utilised to transfer fuel from the cube to the plant.
- The operator will visually monitor the fuel level in the plant and stop pumping when the tank is full. Spill kits will also be placed adjacent to the refuelling operation.
- The operator will ensure that the nozzle is clear of fuel prior to removing it from the tank and placing it back in the bunded fuel tank.
- The cap for the fuel will be replaced.
- The bunded fuel tank will be placed back in the storage area when not being used.

9.6. Installation of Well Materials and Development

9.6.1. Installation

Once the drilling works have been completed the following procedure will be followed to install the liner and back fill materials

- The strata encountered will be recorded on the borehole record sheet. The driller will advise his Supervisor if the strata encountered is different from that expected and the installation specification amended if required.
- A bottom plug will be attached to the lower screen length to be installed.
- The wellscreen and casing will then be installed as the well installation section drawing. The auxiliary winch will lift and lower the screen and casing as the sections are secured together.
- The annulus backfill will be installed as shown in Q7370.002r0 Cross-section.
- Any temporary casing will be removed by rotation and lifted out with the auxiliary winch.

9.6.2. Development

Following installation of the well liner and gravel pack well development procedures will commence.

- The discharge nozzle or "bubbler" will be attached to the air line and placed down the well, approximately 1-2 m from the base. The airline will then be connected to a 250 cfm compressor.
- The well will then be pumped on by airlift until the discharge water is free of drilling mud and/or fines. The airline will then be lifted in 2.5 m intervals and pumped on at each level to the top of the screened section of the well.
- Well development will be continued, with the airline being raised at intervals over the screened section of the well and alternatively surged and pumped. Development will only cease when fines removal is negligible.



9.6.3. Completion

- The well liner will be left approximately 300 mm proud of the surrounding ground.
- Any open sumps, well annulus or pits adjacent to the well will be backfilled with suitable material, packaging material tidied away
- Dismantle drilling exclusion zone
- The rig will then move off.

9.7. Task Specific Risk Assessment

The risk assessment has been compiled for task specific risks identified from observation of works being carried out and with consideration for the health and safety of the operatives undertaking the task and any potential effects on the environment that the task may have.



HAZARD & RISK ASSESSMENT FOR ROTARY DRILLING INCLUDING INSTALLATION AND DEVELOPMENT

To Evaluate Risk:

Likelihood (L) x Severity (S) = Risk (R)

Defined as High (11 - 25), Medium (6 - 10) or Low (1 - 5)

| L = Likelihood | S = Severity |
|-------------------|-----------------------|
| 1 Very Unlikely | 1 Minor Injury |
| 2 Unlikely | 2 Lost Time Injury |
| 3 Likely | 3 Major Injury |
| 4 Very Likely | 4 Single Fatality |
| 5 Certain | 5 Multiply Fatalities |
| Assessed By: | Checked By: |
| Michael Cummiskey | Neil Coulter |
| Date: 24/03/2017 | Date: 24/03/2017 |



Method Statement

| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|--------------------------------------|-------------------------------------|----------------------|-------------|---|----|---|---------------|---|---|
| | | | L | S | R | | L | S | R |
| Attending Site | Traffic Interface | Operatives/ Public | 3 | 5 | 15 | <ul style="list-style-type: none"> SIRIUS MINERALS will provide appropriate traffic management during the works especially at mobilisation and demobilisation stages. WJ operatives to comply with the SIRIUS MINERALS traffic management plan. WJ operatives to be extra vigilant when moving into and out of the site. | 1 | 5 | 5 |
| General | General site works | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Attend site safety induction by SIRIUS MINERALS & method statement briefing to be given by WJ Engineer. Comply with site rules and WJ safety policy. Wear high visibility long sleeved coat/waistcoat and high visibility trousers and PPE Carry out regular tool box talks for specific tasks. Copies of the signed briefing record will be given to SIRIUS MINERALS Carry out Daily Activity Briefings. Maintain exclusion zone around working area. Do not permit public to enter site compound. | 1 | 3 | 3 |
| General | Plant and equipment | Operatives, | 3 | 4 | 12 | <ul style="list-style-type: none"> All plant and equipment to be suitably serviced and maintained by competent fitters. Check all plant certification. Inspect equipment at the start of each shift. Secure equipment in the pond area at the end of each shift. | 1 | 4 | 4 |
| General | Open water course | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> SIRIUS MINERALS to establish site compound. Operatives to be briefed to remain within site compound. | 1 | 4 | 4 |
| Loading and off-loading of equipment | Lifting gear & loads | Operatives | 3 | 4 | 12 | <ul style="list-style-type: none"> Check slings, ropes and shackles for damage and capacity (certificates should be available for scrutiny). Only competent plant operators to use lifting devices. Slung loads to be secure and balanced, use guide ropes, use hard standing for reception. Keep clear of slung loads; keep hands away from loads especially at point of landing. Wear suitable PPE. Use competent slinger Maintain communication between banksman and driver. Operatives to police the working area and to be aware of movements of public at all times. Lift plans are to be in place and followed. These can be a generic lift plan for delivery vehicles. | 1 | 4 | 4 |
| Tracking Rig | Collisions with persons or property | Operatives, Visitors | 3 | 3 | 9 | <ul style="list-style-type: none"> Use trained, competent banksman when tracking rig Walk the route that is to be taken prior to tacking rig Ensure adequate headroom is given for rig | 1 | 3 | 3 |
| Drilling and Installation | Noise | Operatives | 5 | 3 | 15 | <ul style="list-style-type: none"> Use ear defenders when running pumps, compressor or rig if noise level exceeds 80dB. Switch off plant not being used. | 2 | 3 | 6 |
| Drilling and Installation | Pressurised water | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Lead driller to make visual assessment of pressure within rods by checking flow of water from casing. Eye protection to be worn by all. | 2 | 2 | 4 |
| Drilling | Compressed Air & Hoses | Operatives | 4 | 3 | 12 | <ul style="list-style-type: none"> Whip checks to be used on compressed air hoses. Hoses to be checked for damaged prior to use | 2 | 3 | 6 |
| Lifting drill casing and rods | Muscular Skeletal | Operatives | 4 | 3 | 12 | <ul style="list-style-type: none"> Operative trained in manual handling techniques. Copies of training records to be given to SIRIUS MINERALS Lift only one rod / casing section at a time. Wherever possible place the rods / casing in front of rig using RTFL and lift in to place using rig winch. Maximum weight to be lifted by one person (depending on ergonomic position) is 20 or 25kg. All loads over this weight must be lifted by more than one person | 1 | 3 | 3 |



Method Statement

| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|--------------------------------------|-------------------------------------|----------------------|-------------|---|----|---|---------------|---|---|
| | | | L | S | R | | L | S | R |
| Adding casing / rods to drill string | Trapping fingers | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Use correct gloves. When lowering sections of casing or rods onto existing string they are only to be held on the sides. Lead driller and 2nd man to be in view of one another. Operation to be halted if view can't be maintained | 1 | 3 | 3 |
| Drilling | Contact with rotating rods / casing | Operatives, Visitors | 4 | 4 | 16 | <ul style="list-style-type: none"> Rigs to be fitted with compliant guarding and interlock switches When crewing casing / rods together, whilst gates are open, ensure slow rotation used (<15rpm) | 1 | 4 | 4 |
| Drilling (symmetrix method) | Ejected Material | Operatives | 4 | 3 | 12 | <ul style="list-style-type: none"> Use stuffing box arrangement to control material ejected from bore. Minimise air pressure to reduce velocity of ejected material. Establish exclusion zone around rig | 2 | 3 | 6 |
| Drilling and Installation | Services | Operatives | 2 | 5 | 10 | <ul style="list-style-type: none"> Permit to dig to be issued by SIRIUS MINERALS Sump holes to be dug using insulated tools only. | 1 | 5 | 5 |
| Installing risers | Muscular skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Operatives to be trained in manual handling techniques. Copies of training records to be given to SIRIUS MINERALS. Lift only one riser at a time. Use mechanical lifting gear if possible. | 2 | 2 | 4 |
| Lay out equipment | Muscular-skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Wear suitable PPE. Tie loose clothing, employ correct lifting techniques and obtain assistance with loads if required. Use mechanical lifting gear if possible. | 2 | 2 | 4 |
| Well Development | Compressed Air | Operatives | 4 | 3 | 12 | <ul style="list-style-type: none"> Operatives to inspect hoses prior to use. Use whip checks on air lines. Route airlines away from other activities. | 2 | 3 | 6 |
| Re-fuelling | Diesel fuel | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Avoid contact with diesel fuel and wash hands in clean water with soap, use barrier cream prior to commencing work. No refuelling to take place adjacent to waterways Use bunded tanks and drip trays. Contain any spills immediately using bunds and sand. | 1 | 3 | 3 |
| Re-fuelling | Diesel fuel | Environment | 3 | 2 | 6 | <ul style="list-style-type: none"> Refuelling to be performed by trained operatives. Use bunded tanks and drip trays. Contain any spills immediately using bunds and sand. Spill kits to be maintained adjacent to re fuelling station. | 1 | 2 | 2 |
| Maintenance | Trip hazards & holes in ground | Operatives, Visitors | 4 | 3 | 12 | <ul style="list-style-type: none"> Keep site in a clean and tidy state. Remove unwanted or unused items as soon as possible. Do not go on site during the hours of darkness unless adequate lighting available and only if accompanied by another person. Backfill drilled holes to ground level. Route any water hoses and pipes in order to minimise crossing of access and egress routes. | 3 | 3 | 9 |
| Groundwater | Wells disease | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Do not wash with groundwater. Use welfare facilities provided Wear appropriate gloves, wash in clean water with soap before eating, drinking or smoking. Cover cuts and abrasions with waterproof plasters/dressings. Notify GP if flu-like symptoms occur. | 1 | 4 | 4 |



| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|----------------------|---|--------------------|-------------|---|---|---|---------------|---|---|
| | | | L | S | R | | L | S | R |
| Soil and Groundwater | Chemical contamination | Operatives | 2 | 3 | 6 | <ul style="list-style-type: none"> Contamination not anticipated on this site. If encountered drillers will stop work and notify project team. SIRIUS MINERALS will advise of further requirement once nature of any contamination has been established. Where required ensure that monitoring and observations are made and reported. Do not wash with groundwater. Wear standard PPE. Wash with clean water and soap before eating, drinking or smoking. Cover cuts and abrasions with waterproof plasters/dressings. Notify supervisor if any of the following symptoms; nausea, dizziness, headaches or drowsiness are experienced. | 1 | 3 | 2 |
| Environment | Contamination of groundwater or water courses | Wildlife | 2 | 2 | 4 | <ul style="list-style-type: none"> Control water generated during installation. Use only self banded static re-circulation pumps. Avoid spillage during refuelling - install pumps accessible by mechanical plant. | 1 | 2 | 2 |
| Whole Body Vibration | Exposure to vibrations from mobile plant | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Take measures to avoid or reduce exposure. Provide information and training to employees. | 2 | 1 | 2 |



10. INSTALLATION AND COMMISSIONING OF THE DEEPWELL SYSTEM

A Pumped deepwell system is to be installed to the following specification:

| Well Detail | Main deep shaft platform |
|---------------|---|
| No. of Wells | 30 No. wells |
| Well Location | Platform perimeter (and batter) at 20 m nominal spacing |
| Depth | 12 m approx. to toe into the Scarborough Formation |
| Bore Size | 250 mm nominal |
| Liner Size | 125 mm nominal |
| Pump Size | Up to 1 l/s |

10.1. Personnel and Equipment

10.1.1. Personnel

The following labour force will be needed to install the pumps:

- Installation Supervisor will install the pumps within the well liners
- Additional labour from Main Contractor (if required)
- Electrician – as required

10.1.2. Competency and Certification

The minimum training requirements are as follows:

- CSCS experienced worker or general operative card
- Manual Handling (all crew members)
- First Aid (at least one per site)

10.1.3. Equipment

The following equipment will be needed in order to install the pumps:

Well Equipment (1 no. set per pumped well)

- 1 No. submersible pump (up to 1 l/s per well)
- uPVC rising main (50 mm diameter)
- 25 mm dip tube
- Headworks and control valve with sampling tap
- Drop cable and wellhead isolator
- Armoured electrical cable
- Support ropes with certification



Electrical Control Equipment and Power Supply

- MAC cabins (electrical control cabins) to contain:
- Changeover switches
- RCD trips
- Three or six way control panels with electrical protection
- Three phase 415 v Duty and standby generators with bunded fuel tank

Monitoring Equipment

- Dipmeter
- Steel rule (metric)
- Datalogger with instruments and modem

10.2. Task Specific PPE and Safety Equipment

The following PPE and safety equipment should be used:

Personal Protective Equipment

The following PPE needs to be worn in addition to the standard site PPE for this task:

- Hi Vis Waterproof over trousers BS EN 471 (optional)
- Toe and insole protected lace-up and/or wellington boots BS EN 345
- Ear defenders BS EN 352 (if noise levels breach 80dB)

Safety Equipment

- Fire extinguishers
- First Aid kit
- Eye wash kit

10.2.1. Documentation and Certification

Safety Documentation to be carried

- Support rope certificate
- Operators certification
- Copies site specific Risk Assessment and Procedures (Method Statement)

10.3. Installation of Submersible Pumping Equipment

An electric submersible pump will be installed in each well with the pump inlet located around 1 m from the base of the well. The pump will be suspended by rope and will be connected to ground level by 50 mm diameter uPVC rising main. A control valve will be fitted at ground level. The electric drop cable from the submersible pump will be connected at ground level to an electrical cable will be laid along the line of the discharge pipe from the well head to the pump controls located in the MAC cabin.



The pumps will generally be lowered into the wells using the support rope wound around a capstan.

Pump installation using a capstan;

- The Supervisor shall check that the lifting clamps and rope are certified, in date and in good condition.
- The certified lifting rope shall be attached to the pump using the D-shackle.
- The first length of riser shall be screwed into the top of the pump and the power cable and lifting rope securely fixed to the riser.
- The lifting rope shall be wrapped around an immobile structure to form a hitch knot and the object used as a capstan to take the weight of the pump and riser assembly and control the speed at which the assembly is raised and lowered. One operative shall control the rope at all times during the installation process.
- The pump shall be positioned over the well and lowered until the top joint on the first length of riser is exposed above the top of the well liner. A set of clamps shall be placed below the top joint and the assembly lowered until the clamps rest on the well liner.
- A second length of riser shall be screwed into the top of the first length of riser.
- The pump and riser assembly shall be slightly lifted to take the weight, the clamps removed and the assembly lowered until the top joint on the second length of riser is exposed above the top of the well liner.
- The clamps shall be placed below the top joint and the assembly lowered until the clamps rest on the well liner.
- The next length of riser shall be screwed into the top of the previous length of riser.
- The process shall be repeated until the pump is at the required depth.
- The power cable and rope shall be secured to each length of riser using tape.
- Once the pump is at the required depth the headworks shall be screwed onto the top length of riser. The headworks complete with pump and riser assembly shall be lifted slightly to take the weight off the clamps.
- The clamps shall be removed.
- The headworks shall be lowered until it rests on the top of the well liner.
- The certified lifting rope shall be securely tied off around the headworks.

Where possible the pumps should be installed by mechanical means, either by crane or forklift.

If the pumps need to be removed for maintenance or exchange during the running period they will be removed using a crane and suitable lifting equipment provided by the main contractor.

10.4. Electrical Connection of the System

Power for the system will be provided by Mains from duty and standby generators. Connection will be provided through plugs and isolators to facilitate rapid movement of the system. See Section 11.0 for details of electrical installation and associated risk assessment.



10.5. Testing and Monitoring of Wells

Once several wells are commissioned they will be pumped on a continuous basis with flowrates monitored in the V-notch tanks and water levels monitored in selected wells and piezometers.

At a convenient point during the commissioning period a switch-off test will be carried out to estimate the rate of recovery of piezometric levels. This will involve switching the well system off for a period of up to a few hours and monitoring groundwater levels in the wells and piezometers. Knowledge of the rate of recovery is important to allow confirmation that the alarm facilities are sufficient.

During the commissioning phase the discharge from the dewatering system will be visually checked to ensure that no fines are being produced. During the running phase this will be carried out by Sirius Minerals.

10.5.1. Yield Testing Procedure

- As soon as possible following well drilling and development (usually within 5 days after well completion) the pump of the type specified will be installed approximately 1 m from the base of the well.
- A 20 mm diameter dip pipe will be installed within the well
- A 50mm mechanical flow meter will be fitted to the well head and a flexible hose connected to the discharge pipeline and tank at the final point of discharge
- Base line dips will be recorded in the well and up to 2 No adjacent piezometers or wells (within approximately 1 - 20 m radius) for at least 24 hours prior to pump switch on.
- The pump will be switched on and water levels in the well and piezometers recorded every 15 minutes for the first hour and hourly thereafter for up to 3 hours
- The pump will be switched off and the recovery will be monitored and recorded every 15 minutes using a downhole datalogger device (diver).
- If it can be determined that the pump is sized appropriately it will be left in the well ready for operation when the group of wells is ready for switch on
- The flow meter will be disconnected and fitted to the next well.
- This procedure will be repeated on approximately 1/3rd of the dewatering system to determine individual well yields and projected flows for the system collectively. The results of the monitoring will be examined to confirm that the installed system will achieve the target drawdown.

10.6. Handover to Running Period

The nominated person from Sirius Minerals must carry out DAILY ESSENTIAL MAINTENANCE. This involves:

- Checking all pumps are operating and have not tripped out
- Recording well and piezometer drawdown
- Recording pumped flowrate (at V-notch)



- Ensuring discharge lines and tanks do not become blocked or damaged
- Taking water samples for analysis (if requested by Sirius Minerals).

10.7. Task Specific Risk Assessment

The risk assessment has been compiled for task specific risks identified from observation of works being carried out and with consideration for the health and safety of the operatives undertaking the task and any potential effects on the environment that the task may have.



HAZARD & RISK ASSESSMENT FOR INSTALLATION AND COMMISSIONING OF A
DEWATERING SYSTEM

To Evaluate Risk:

Likelihood (L) x Severity (S) = Risk (R)

Defined as High (11 - 25), Medium (6 - 10) or Low (1 - 5)

| L = Likelihood | S = Severity |
|-------------------|-----------------------|
| 1 Very Unlikely | 1 Minor Injury |
| 2 Unlikely | 2 Lost Time Injury |
| 3 Likely | 3 Major Injury |
| 4 Very Likely | 4 Single Fatality |
| 5 Certain | 5 Multiply Fatalities |
| Assessed By: | Checked By: |
| Michael Cummiskey | Neil Coulter |
| Date: 24/03/2017 | Date: 24/03/2017 |



| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|-----------------------------------|--------------------------|--------------------|-------------|---|---|--|---------------|---|---|
| | | | L | S | R | | L | S | R |
| General | General site works | Operatives, public | 2 | 3 | 6 | <ul style="list-style-type: none"> Comply with Sirius Minerals site rules and WJ safety policy. Co-ordination and sequencing of work to prevent clash of activities. Wear high visibility, long sleeved coat/waistcoat and high visibility trousers. Do not allow unauthorised persons on to site. | 1 | 3 | 3 |
| General | Plant and equipment | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> All plant and equipment to be suitably serviced and maintained by competent fitters. Check all plant certification. Use bunds and drip trays to prevent ground contamination. | 1 | 3 | 3 |
| Loading and off-loading equipment | Lifting gear & loads | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Load/unload in site compound. Check slings, ropes and shackles for damage and capacity (certificates should be available for scrutiny). Only competent plant operators to use lifting devices. Slung loads to be secure and balanced, use guide ropes, use hard standing for reception. Keep clear of slung loads, keep hands away from loads especially at point of landing. Wear suitable PPE. Use trained and competent banksman/slinger signaller Maintain communication between banksman and driver. | 1 | 3 | 3 |
| General | Open water course | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Sirius Minerals to establish appropriate protection at discharge point. Operatives to be briefed on access procedures to discharge point. | 1 | 4 | 4 |
| Installing pump and riser | Muscular skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> If possible - Use mechanical lifting equipment to install pump Operatives have received manual handling training. Lift only one riser at a time. | 2 | 2 | 4 |
| Lay out equipment | Muscular-skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Wear suitable PPE. Tie loose clothing, employ correct lifting techniques and obtain assistance with loads if required. | 2 | 2 | 4 |
| Electrical installation | Electric shock | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> To be carried out by WJ Installation supervisor or WJ Electrician only. 415 v wire armoured cables to be used. Cables to be routed and labelled appropriately. Panels to be fitted with appropriate fuses and electrical protection. No lone working to be carried out. Carry out works in a suitable clean flat area where possible No other trades to be working in same area | 1 | 4 | 4 |
| Running system | Diesel fuel | Operatives | 3 | 2 | 6 | <ul style="list-style-type: none"> Avoid contact with diesel fuel and wash hands in clean water with soap, use barrier cream prior to commencing work Use bunded fuel tank | 1 | 2 | 2 |
| General | Open Excavations | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Access to open excavations to be restricted to authorised personnel. Sirius Minerals to establish edge protection once excavation commences. Separate briefing to be carried out if access to excavation is required. | 1 | 3 | 3 |
| Groundwater | Wells disease | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Do not wash with groundwater. Wear appropriate gloves, wash in clean water with soap before eating, drinking or smoking. Cover cuts and abrasions with waterproof plasters/dressings. Notify GP if flu-like symptoms occur. | 1 | 4 | 4 |



| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|----------------------|---|--------------------|-------------|---|---|---|---------------|---|---|
| | | | L | S | R | | L | S | R |
| Environment | Contamination of groundwater or water courses | Wildlife | 2 | 2 | 4 | <ul style="list-style-type: none"> Control water generated during installation Avoid spillage during refuelling – install pumps accessible by mechanical plant Take proximity of water courses into account when considering pumps locations Only discharge to authorised location Frequently check discharge for suspended solids | 1 | 2 | 2 |
| Whole Body Vibration | Exposure to vibrations from mobile plant | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Take measures to avoid or reduce exposure Provide information and training to employees | 2 | 1 | 2 |



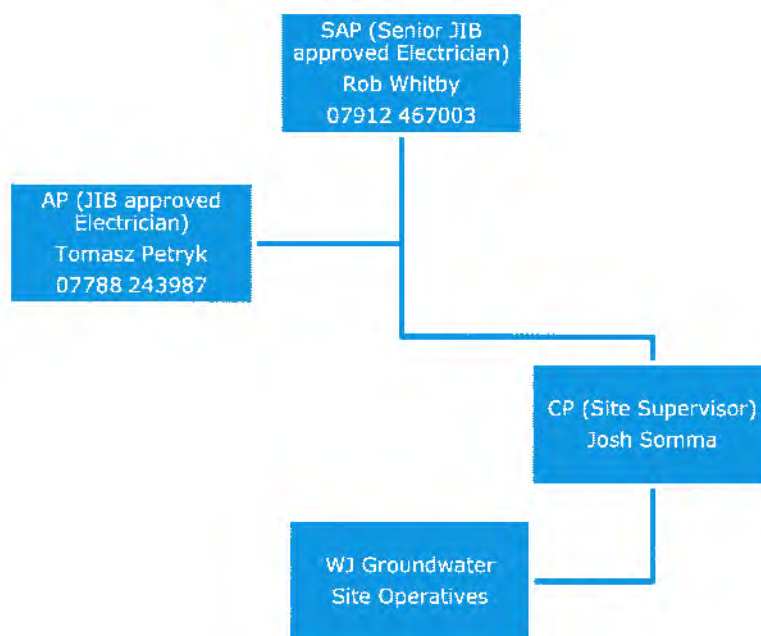
11. INSTALLATION AND COMMISSIONING OF ELECTRICAL SYSTEM

The aim of this document is to provide a safe procedure for the installation, commissioning, testing, isolation and removal of the dewatering electrical system.

11.1. Personnel and Equipment

11.1.1. Personnel

The following electrical organisational chart will be needed to install, commission, test and decommission the electrical system on the project:



For the exact roles and responsibilities, please refer to the WJ job descriptions

11.1.2. Competency and Certification

The minimum training requirements are as follows:

- City & Guilds 2391 & 2377 for SAP and AP roles
- JIB approved electrician ECS gold card for SAP and AP roles
- CSCS experienced worker or general operative card for CP and site operative roles
- Manual Handling (all crew members)
- First Aid (at least one per site)

11.1.3. Equipment

The following plant & equipment will be needed in order to install the dewatering electrical system:



Well Equipment (1 no. set per pumped well)

- 3 phase 415V submersible electrical pump
- 16 amp 4 pin plugs
- 16 amp isolator switches
- SWA electrical cables

Electrical Control Equipment and Power Supply

- MAC cabins (electrical control cabins) to contain
 - AMF Changeover switches
 - RCD's
 - Six way control panels with electrical protection
 - Three phase 415V Duty/standby generators

Testing & Isolation Equipment

- Proving Unit
- Voltage Tester
- Fluke Tester
- Lockout hasps for MCB's, fuses and 3 phase plugs
- Padlocks & warning labels

11.2. Task Specific PPE and Safety Equipment

The following PPE and safety equipment should be used:

Personal Protective Equipment

The following PPE needs to be worn in addition to the standard site PPE for this task:

- Hi Vis Waterproof over trousers BS EN 471 (optional)
- Toe and insole protected lace-up and/or wellington boots BS EN 345
- Ear defenders BS EN 352 (if noise levels breach 80 dB)

11.2.1. Documentation and Certification

Safety Documentation to be carried or produced

- Copies of the site specific Risk Assessment and Procedures (Method Statement)
- Pump Installation Sheet (PIRS)
- Electrical Installation Certificate
- Electrical Inspection Condition Report

11.3. Installation of Submersible Pumping Equipment

An electric submersible pump will be installed in each well with the pump inlet located around 1 m from the base of the well. The pump will be suspended by rope and will be connected to ground level by 50mm diameter uPVC rising main. A control valve will be fitted at ground level. The electric SWA drop cable from

the submersible pump will be connected at ground level to an electrical pump isolator switch. From the isolator SWA cable will be laid along the line of the discharge pipe to the pump control panel located in the MAC cabin. For exact procedures of how to install and remove a pump, please refer to Section 10.0 for the complete procedure.

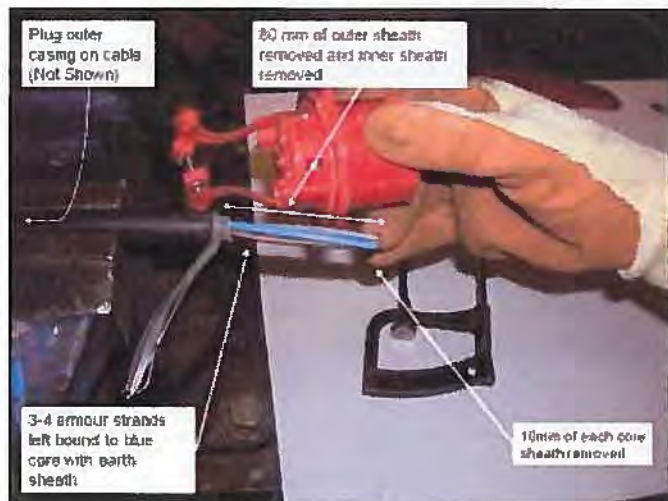
11.4. Electrical Connection of the System

3 Phase 415v power for the system will be provided from a duty / standby generator setup by WJ and will connect to WJ's electrical pump control cabin and will terminate in a 125amp socket connection complete with earth leakage protection (RCD) Connection will be provided through plugs and isolators to facilitate rapid movement of the system.

The control panels in the MAC cabin will be linked to the pump in each well by armoured cable with plug/socket connections. The cable will generally be laid on the surface along the line of the water collection pipe terminating in an isolator next to each well location. Marker tape will be used to indicate the presence of cabling. Where it is necessary for cables to pass under existing or proposed vehicle crossings roped ducting will be installed by Sirius Minerals.

11.4.1. Connection of Plugs

- a) Undo retaining screws in plug and remove outer casing; slide outer casing onto cable.
- b) Loosen cable clamp and terminal screws for earth, L1, L2 and L3 cores
- c) Score outer sheath and armour approximately 80 mm from end of cable.
- d) Remove outer sheath and all except 3 or 4 of the armour strands these should be adjacent to the blue cable.
- e) Lightly score and remove inner sheath with a Stanley Knife (**note: take care so as not to damage inner cores**).
- f) Trim approximately 10 mm of sheaf from each of the cores.
- g) Trim remaining armour strands to length of blue cable.
- h) Place length of Green/Yellow sheaving/tape over armour and blue core.
- i) Insert cores into appropriate terminal and tighten screws:

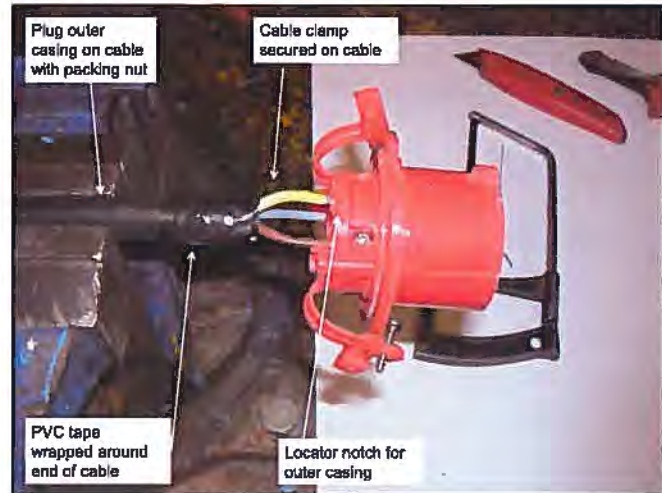


| Core | Terminal |
|-------|----------|
| Brown | L1 |
| Black | L2 |

Grey L3

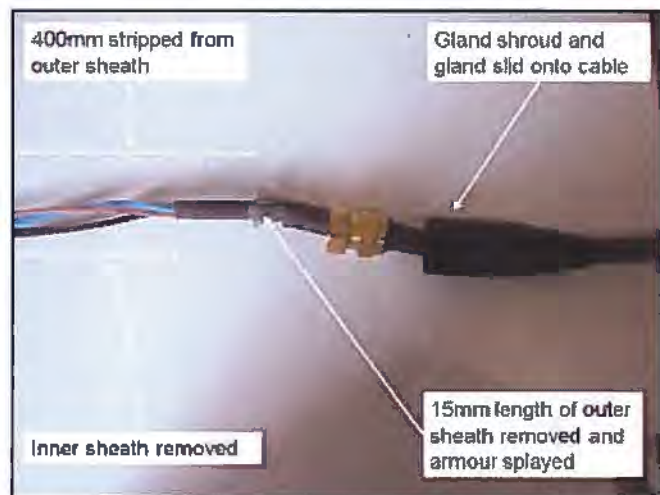
Blue/Armour (with Green/Yellow sheath) Earth (\pm)

- j) Wrap 3-4 turns of black tape around end of cable.
- k) Tighten clamp around cable and check for cable security.
- l) Relocate plug into outer casing, making sure to align the locator notch and tighten screws.
- m) Tighten packing nut and gland.



11.4.2. Connection of Isolators

- a) Remove gland shroud from base of isolator and trim to suite cable size. Remove gland from base of isolator.
- b) Slide gland shroud and gland onto cable.
- c) With junior hacksaw, cut through outer sheath of cable and part way through the armour, approximately 400mm from end of cable.
- d) Remove outer sheath and armour.
- e) Remove approximately 350mm of the inner sheath/core.
- f) Remove approx. 15mm of the outer sheath and rotate to splay armour.
- g) Remove cover from isolator and feed cores through gland in base.
- h) Secure gland using spanner ensuring the armouring is gripped to ensure earth continuity.
- i) Strip 6mm from end of blue core, fit **Green & Yellow*** earth tape or sheath over blue cable, and secure into earth terminal. (***It must be Green & Yellow**)

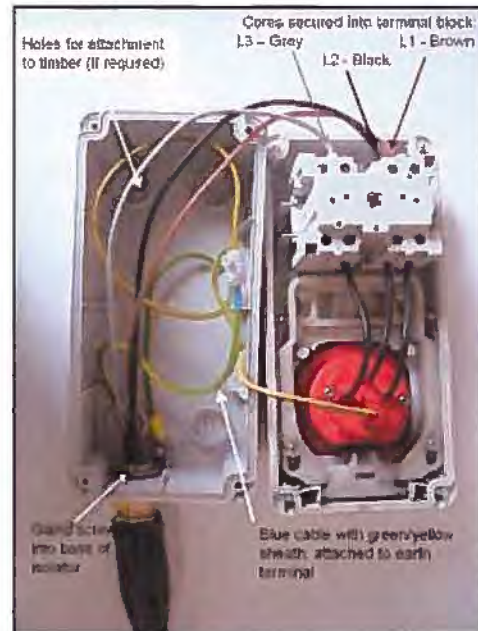


- j) Strip 6mm from each of the remaining cores and secure cables into isolator terminal block.

| Core | Terminal |
|-------|-----------|
| Brown | L1 |
| Black | L2 |
| Grey | L3 |
| Blue | Earth (⊕) |

(With Green/Yellow sheath/tape)

- k) If attaching to timber support**, do so now whilst isolator is open.
- l) Replace cover and attach to appropriate point, secure cable within 300mm of gland and fix identification sticker to front face.



**Isolators must be secured in an upright position and not contained within manholes or buried structures

11.4.3. Lugs on Larger Cables

- m) Trim outer sheathing and remove any armouring
- n) Remove short length of sheathing from individual core; bevelling the end of the outer sheath
- o) Place lugs on cable and using a crimping tool attach to the cable.
- p) Check security of lug.

11.4.4. Plugs, Isolators and Pump Cabling

This will be carried out by the installation supervisor (CP), who is competent to undertake basic plugs and isolator wiring and testing operations (non energised state), with labour as required for the manual handling element.

An extension cable will be laid from the control cabin to the individual well location (not connected and energised). This will be done prior to mains or generator electrical connection to the control cabin. The cable drum will be supported during the operation by cable jacks, telehandler or scaffold trestle. As the cable is pulled out, electrical warning identification stickers will be stuck to the cable every 5 m and the well number marked up. Additional stickers will be used where the cable passes through ducts or other areas where continuity can't be guaranteed.

Once the cable has been pulled out, an isolator will be fitted to the end of the cable adjacent to the pump and a plug fitted to the cable end at the control cabin. These will be identified using stickers. The plugs and isolators will be fitted following the procedures outlined above.



Following the installation of the extension cable, it will be tested by the installation supervisor for the following parameters:

- Rotation check;
- CPC resistance through R1 and R2; and
- Insulation resistance.

These will be recorded on the PIRS along with the serial number of the test equipment.

The isolator and cable will then be secured and the remainder of the PIRS completed noting:

- Which panel and channel the pump is connected to;
- That the thermal overload has been checked for setting and operation;
- The dynamic water level in the well, noting that this should be approximately 1.0 m above the pump intake, with the pump 'trimmed' where required. This is to ensure sufficient water is passing over the pump motor to aid cooling;

11.4.5. Control Cabin and Connection to Duty/Standby Power

The control cabin will be prepared in the yard and fitted out with the appropriate pump control panels, power supply tails and alarm requirements as specified by the project manager. This will be checked by a WJ Electrician and an initial Electrical Installation Certificate issued and will detail the following which is to be sent to site with the cabin.

- The constituent parts of the system;
- The results of the electrical testing and visual inspections;
- The equipment used during the testing process.

All connections to duty /standby power for dewatering systems will be made by a WJ electrician and would come from either:

- Mains power through a duty generator and with a 100 mA (time delayed) trip and earthed 125 amp socket; installed and certified by WJ. A copy of the certificate will be provided by WJ at the time of installation.
- Where requested, a standby generator will be connected to the control cabin via plug/socket or direct to connection to Bus Board. The signal cable from the AMF panel would be connected to the sockets on the standby generator.
- All generators will be fitted with a 100 mA (time delayed) trip which will be tested as part of the commissioning process.
- The components of the system will be earth bonded where required.



11.4.6. Initial Inspection

Once all cables, plugs and isolators have been installed by the installation supervisor, the system will undergo an initial inspection by a WJ qualified JIB electrician and will include the following checks within both electrical control cabin and site infrastructure:

- Circuits identified and separate with no borrowed neutrals
- RCD's are adequately provided within each circuit
- Identification and testing of protective devices to include disconnection times
- Means of isolation suitably labelled
- Provision for disconnecting the neutral
- Main earthing terminal is provided, adequately accessible and identified
- Correct cable glands and gland plates used
- Cables are correctly sized and connections secured around both the control cabin and to pumps, plugs and isolators.
- Conductors correctly identified
- Correct fuses or circuit breakers installed
- Suitable segregation of circuits
- Retest notice clearly identified within installation
- All switchgear is correctly connected, earthed, easily isolated and securely fixed to the inside of the control cabin.
- All wiring accessories, lighting controls, sockets, conduits, trunking etc. to be checked and complaint

11.4.7. Initial Testing

The WJ electrician on completion of his initial inspection will undertake initial testing to allow the electrician to complete and issue an Electrical Installation Certificate.

The following sequence of tests shall be carried out:

- Continuity of protective conductors
- Insulation resistance
- Protection by SELV, PELV or by electrical separation
- Polarity
- Earth electrode resistance
- Protection by automatic disconnection of the supply
- Earth fault loop impedance
- Additional protection
- Prospective fault current
- Phase sequence



- Functional testing
- Voltage drop

A schedule of inspections and test results shall accompany the electrical installation certificate

11.4.8. Testing of Earthing Arrangements

Where power comes via a mains socket installed and certified by a client, the electrical equipment will be earth bonded through the control cabin to the socket.

In all other cases involving generators (either duty and/or standby) additional earthing protection will be required. This might be via some part of the works on site (sheet pile, steel well liner) or via a dedicated earth rod installed by WJ (the installation of an earth rod may require a permit to break ground as issued by the main contractor).

If an earth rod is required, a suitable location would be selected by the WJ electrician in collaboration with the appropriate person from the Main Contractors team. A suitable electrode will be driven into the ground, this will generally be a copper rod. Though for the purposes of testing, the electrode must be disconnected from the earthing system of the installation.

The instrument is connected as shown above with terminals C1 and P1 being connected to the electrode under test (X). To ensure that the resistance of the test leads does not affect the result, separate leads should be used for these connections.

If the test lead resistance is negligible, terminals C1 and P1 may be bridged at the instrument and connected to the earth electrode with a single lead.

Terminals C2 and P2 are connected to temporary spikes which are driven into the ground, making a straight line with the electrode under test. It is important that the test spikes are far enough from each other and from the electrode under test. If their resistance areas overlap, the readings will differ for the reason indicated in (figure 8.14 to be inserted).

Usually the distance from X to Y will be about 25 m, but this depends on the resistivity of the ground. To ensure that resistance areas do not overlap, second and third tests are made with the electrode Z 10% of the X to Y distance nearer to, and then 10% further from, X. If the three readings are substantially in agreement, this is the resistance of the electrode under test. If not, test electrodes Y and Z must be moved further from X and the tests repeated.

The tester provides an alternating output to prevent electrolytic effects. If the resistance to earth of the temporary spikes Y and Z is too high, a reduction is likely if they are driven deeper or if they are watered.

11.4.9. Safe Isolation & Lock Out Tag Out (LOTO) Procedures

Notify all affected workers that a lockout is required and the reason for the lockout.



Machine or Equipment Shutdown and Isolation

If the equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.). Only workers knowledgeable in the operation of the specific equipment should perform shutdown or re-start procedures.

Operate the energy-isolating device(s) so that all energy sources (electrical, mechanical, hydraulic, etc.) are disconnected or isolated from the equipment.

Electrical disconnect switches should never be pulled while under load, because of the possibility of arcing or even explosion.

Stored energy, such as that in capacitors must also be released by methods such as grounding.

Pulling fuses is not a substitute for locking out. A pulled fuse is no guarantee the circuit is dead. Even if a circuit is dead, another person could inadvertently replace the fuse.

Equipment that operates intermittently, such as a pump may seem harmless when it is not running. Do not assume that because equipment is not operating at a particular point in time that it will remain off for the duration of any work to be performed on it.

Application of Lockout/Tagout

Lock out and tag the energy-isolating device with an assigned, individual lock. A worker will not be protected unless he/she uses his/her own padlock. For Submersible Pumps assemblies attach a Plug Clips supplied in electrical kits to the supply plug

If more than one worker is working on the same piece of equipment at the same time, each one should lock out the equipment, by placing a personal lock and tag on the Lock off hasp when he/she begins work, and should remove those devices when he/she stops working on the machine or equipment. This may mean switching off all supply panels and then locking off the MAC Cabin.

Locks and tags should clearly show the name of the person who applied the device, the date, and the reason for the lockout. This identifies who is servicing the equipment. In a multiple lockout/tagout situation, it will also identify any worker(s) who may not have finished working.

Locks and tags must be durable enough to withstand the environment in which they are to be used. Information on the locks and tags should remain legible.

Locks must be substantial enough to prevent removal without the use of excessive force. Tags must be substantial enough to prevent accidental or inadvertent removal.

Both locks and tags should be easily recognized and provide appropriate information about the lockout.



For some equipment it may be necessary to construct attachments to which locks can be applied. An example is a common hasp to cover an operating button. Tags must be attached to the energy isolating device(s) and to the normal operating control in such a manner as to prevent operation during the lockout.

Verification of Isolation

After ensuring that no workers can be injured, operate the push button or other normal controls to verify that all energy sources have been disconnected and the equipment will not operate.

Return operating controls to neutral position after the test. A check of system activation (e.g. use of voltmeter for electrical circuits) should be performed to ensure isolation.

The equipment is now locked out.

Release from Lockout/Tagout

Before locks and tags are removed and energy is restored to the equipment, inspect the work area to ensure that non-essential items have been removed and that machine or equipment components are operationally intact.

Ensure workers are a safe distance from any potential hazard.

Each lock and tag should be removed from each energy-isolating device by the worker who applied the lock and tag.

Notify affected workers that locks and tags have been removed.

General Lockout Recommendations for Generator Equipment

Disengage the power and stop the machine before servicing.

Do not clean, unplug, lubricate, adjust or repair any machine while it is running, unless it is specifically recommended in the service or owner's manual.

Lock out the ignition and put a warning sign over the ignition that tells everyone that you are working on the machine.

General Protection Procedures

All electrical control cabins, panels and electrical control systems shall be securely locked using padlocks, panel locks or mortice locks as appropriate during periods when they are not being worked on or maintained.

All electrical control cabins, panels and electrical control systems should not be left open and unattended unless lockout controls are implemented as detailed above.



All electrical control cabins, panels and electrical control systems should be checked at the end of each shift and break periods to ensure that locks are put in place to ensure that no access can be gained into the systems.

All electrical control cabins, panels and electrical control systems shall be appropriately labelled with 'electrical warning' and 'no access other than by authorised personnel only' signs, electrical tags etc. as appropriate.

11.4.10. Routine Maintenance and Periodic Inspection & Testing of Electrical Systems

Due to electrical system is installed on a construction site a 3 monthly regime of routine checks and periodic inspection and testing will be carried out and will look to identify and rectify the following:

- Any defects identified by the WJ site supervisor and/or client are rectified
- Inspection of the system to look for:
 - Breakages
 - Wear/deterioration
 - Signs of overheating (from electrical switchgear within the MAC cabin or at the well head (pump isolator)
 - Missing parts (covers, screws, loose fixings especially pump isolators at each well head)
- Confirm that all switchgear remains accessible and not obstructed, doors of enclosures are secure and adequate labelling is in place (especially along cable runs see section 1.4.4)
- Operate switchgear where practicable, pumps switch on and off and RCD's using the test button

These routine checks outlined above may not need be carried out by the SAP or AP and could be undertaken by the CP on site. However due to the short duration between the Electrical Installation Re-certification it is usually undertaken by either the SAP or AP.

During the Periodic Inspection & Testing works, the SAP or AP will undertake inspections and tests in accordance with sections 1.4.6 & 1.4.7 and will adopt the safe isolation and LOTO procedures identified within sections 1.4.9. A Periodic Electrical Inspection Report will be produced together with a new Electrical Installation Certificate. The Periodic Electrical Inspection Report must include the following:

- A description of the extent of the works, including parts of the installation inspected and details of what the inspection and testing covered.
- Any limitations which may have been imposed during the inspection and testing of the installation.
- Details of any damage, deterioration, defects and dangerous conditions, which may give rise to danger and any rectification of repairs undertaken
- Schedule of Inspections
- Schedule of test results



11.5. Task Specific Risk Assessment

The risk assessment has been compiled for task specific risks identified from observation of works being carried out and with consideration for the health and safety of the operatives undertaking the task and any potential effects on the environment that the task may have.



HAZARD & RISK ASSESSMENT FOR THE INSTALLATION, COMMISSIONING, TESTING & ISOLATION OF AN ELECTRICAL DEWATERING SYSTEM

To Evaluate Risk:

Likelihood (L) x Severity (S) = Risk (R)

Defined as High (11 - 25), Medium (6 - 10) or Low (1 - 5)

| L = Likelihood | S = Severity |
|-------------------|-----------------------|
| 1 Very Unlikely | 1 Minor Injury |
| 2 Unlikely | 2 Lost Time Injury |
| 3 Likely | 3 Major Injury |
| 4 Very Likely | 4 Single Fatality |
| 5 Certain | 5 Multiply Fatalities |
| Assessed By: | Checked By: |
| Michael Cummiskey | Neil Coulter |
| Date: 24/03/2017 | Date: 24/03/2017 |



| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|---------------------------|----------------------------|--------------------|-------------|---|----|--|---------------|---|---|
| | | | L | S | R | | L | S | R |
| General | General site works | Operatives, public | 2 | 3 | 6 | <ul style="list-style-type: none"> Comply with Sirius Minerals site rules and WJ safety policy. Co-ordination and sequencing of work to prevent clash of activities. Wear high visibility, long sleeved coat/waistcoat and high visibility trousers. Do not allow unauthorised persons on to site. | 1 | 3 | 3 |
| Installing pump and riser | Muscular skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Use mechanical lifting equipment to install pump Operatives have received manual handling training. Lift only one riser at a time. | 2 | 2 | 4 |
| Lay out equipment | Muscular-skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Wear suitable PPE. Tie loose clothing, employ correct lifting techniques and obtain assistance with loads if required. | 2 | 2 | 4 |
| Electrical installation | Electric shock | Operatives | 5 | 4 | 20 | <ul style="list-style-type: none"> To be carried out by WJ SAP and AP with assistance from CP for site cabling, plugs and isolators only. 415V steel wire armoured (SWA) cables to be used. Cables to be routed and labelled appropriately. Panels to be fitted with appropriate fuses and electrical protection. Operate safe isolation and LOTO procedures at all times Carry out works in a suitable clean flat area where possible Carry out periodic 3 monthly inspection and testing regime | 1 | 4 | 4 |
| Running system | Diesel fuel for generators | Operatives | 3 | 2 | 6 | <ul style="list-style-type: none"> Avoid contact with diesel fuel and wash hands in clean water with soap, use barrier cream prior to commencing work Use bunded fuel tank | 1 | 2 | 2 |



12. INSTALLATION AND COMMISSIONING OF THE DEWATERING DISCHARGE LINE

12.1. Introduction

This document describes the works procedure for the commissioning of the discharge line in accordance with WJ Groundwater Limited (WJGL) standard procedures.

12.2. Personnel and Equipment

12.2.1. Personnel

The following labour force will be needed to install the discharge pipework:

- Site Supervisor will install the pumps within the well liners
- Additional labour from WJ (as required)

12.2.2. Competency and Certification

The minimum training requirements are as follows:

- CSCS experienced worker or general operative card
- Manual Handling (all crew members)
- First Aid (at least one per site)

12.2.3. Equipment

Discharge Equipment

- 6 m lengths of 150 diameter rigid discharge pipe and bauer couplings with a 10 bar rating (anticipated operating pressures up to 4 bar),
- 1 No. 2000 ltr V-notch discharge tank
- 50 mm diameter flexible hose connections from each well head

12.3. Task Specific PPE and Safety Equipment

The following PPE and safety equipment should be used:

Personal Protective Equipment

The following PPE needs to be worn in addition to the minimum site PPE (specified in section 6.0) for this task:

- Hi Vis Waterproof over trousers BS EN 471 (optional)
- Toe and insole protected lace-up and/or wellington boots BS EN 345
- Ear defenders BS EN 352 (if noise levels breach 80 dB)

Safety Equipment

- Fire extinguishers

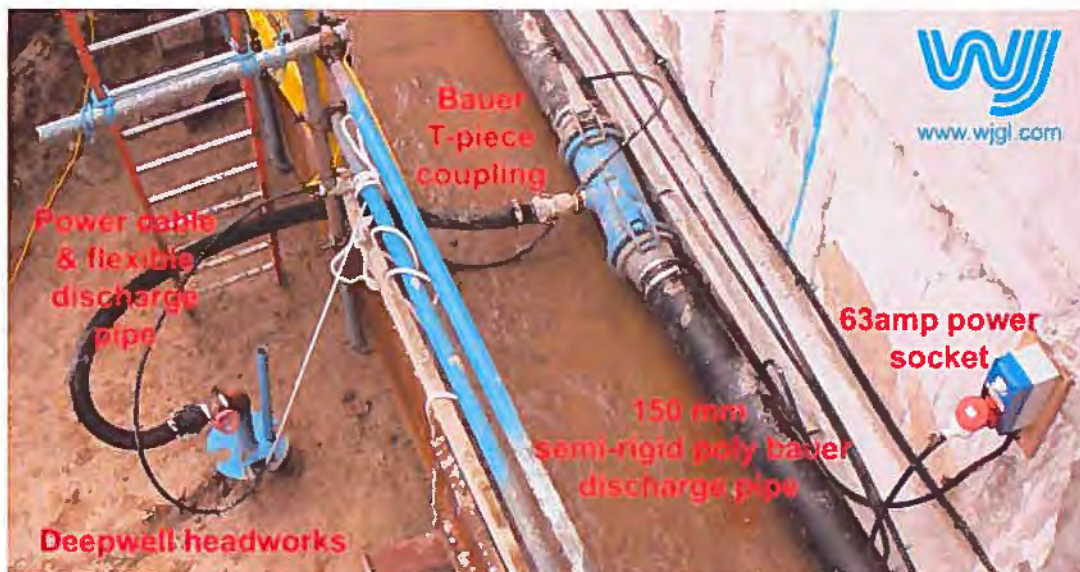
- First Aid kit
- Eye wash kit

12.4. Connection of Discharge Pipework

The discharge pipework will be delivered to site on a flatbed lorry. The pipework will be laid and distributed around the site by WJ operatives.

Semi-rigid 150 mm diameter pipework will be laid around the perimeter of the excavation to form a water collection discharge main from the proposed deepwells. The 150 mm ring main will be laid to connect the wells to the discharge point. T-pieces will be installed at appropriate points in the discharge pipe. Sirius Minerals will provide edge protection. If access is required, ducting will be provided and installed by Sirius Minerals. Flexible discharge hoses will connect each well to the rigid discharge main.

Indicative photograph showing standard discharge arrangements:



A single discharge pipe will run around part of the perimeter of the site to a v-notch weir tank located at the discharge point. The movement and craneage of the v-notch tank next to the discharge point will be provided by WJ (providing there is adequate access for a rough terrain fork-truck).

12.5. Testing and Monitoring of Discharge Line

Once the discharge line is in place and a few wells are commissioned they will be pumped on to test the discharge line and visually check for any leaks. The v-notch tank will also be visually monitored to ensure that it is discharging correctly into the proposed discharge point. Should leaks in the discharge line be encountered the pumps will be temporarily turned off whilst the repairs are undertaken. Once the discharge line is free from leaks and fully commissioned the remaining dewatering wells may be switched on.



12.6. Handover to Running Period

The nominated person (Sirius Minerals) must carry out DAILY ESSENTIAL MAINTENANCE. This involves:

- Ensuring discharge lines and tanks do not become blocked or damaged.

12.7. Task Specific Risk Assessment

The risk assessment has been compiled for task specific risks identified from observation of works being carried out and with consideration for the health and safety of the operatives undertaking the task and any potential effects on the environment that the task may have.



HAZARD & RISK ASSESSMENT FOR COMMISSIONING OF DISCHARGE LINE

To Evaluate Risk:

Likelihood (L) x Severity (S) = Risk (R)

Defined as High (11 - 25), Medium (6 - 10) or Low (1 - 5)

| L = Likelihood | S = Severity |
|-------------------|-----------------------|
| 1 Very Unlikely | 1 Minor Injury |
| 2 Unlikely | 2 Lost Time Injury |
| 3 Likely | 3 Major Injury |
| 4 Very Likely | 4 Single Fatality |
| 5 Certain | 5 Multiply Fatalities |
| Assessed By: | Checked By: |
| Michael Cummiskey | Neil Coulter |
| Date: 24/03/2017 | Date: 24/03/2017 |

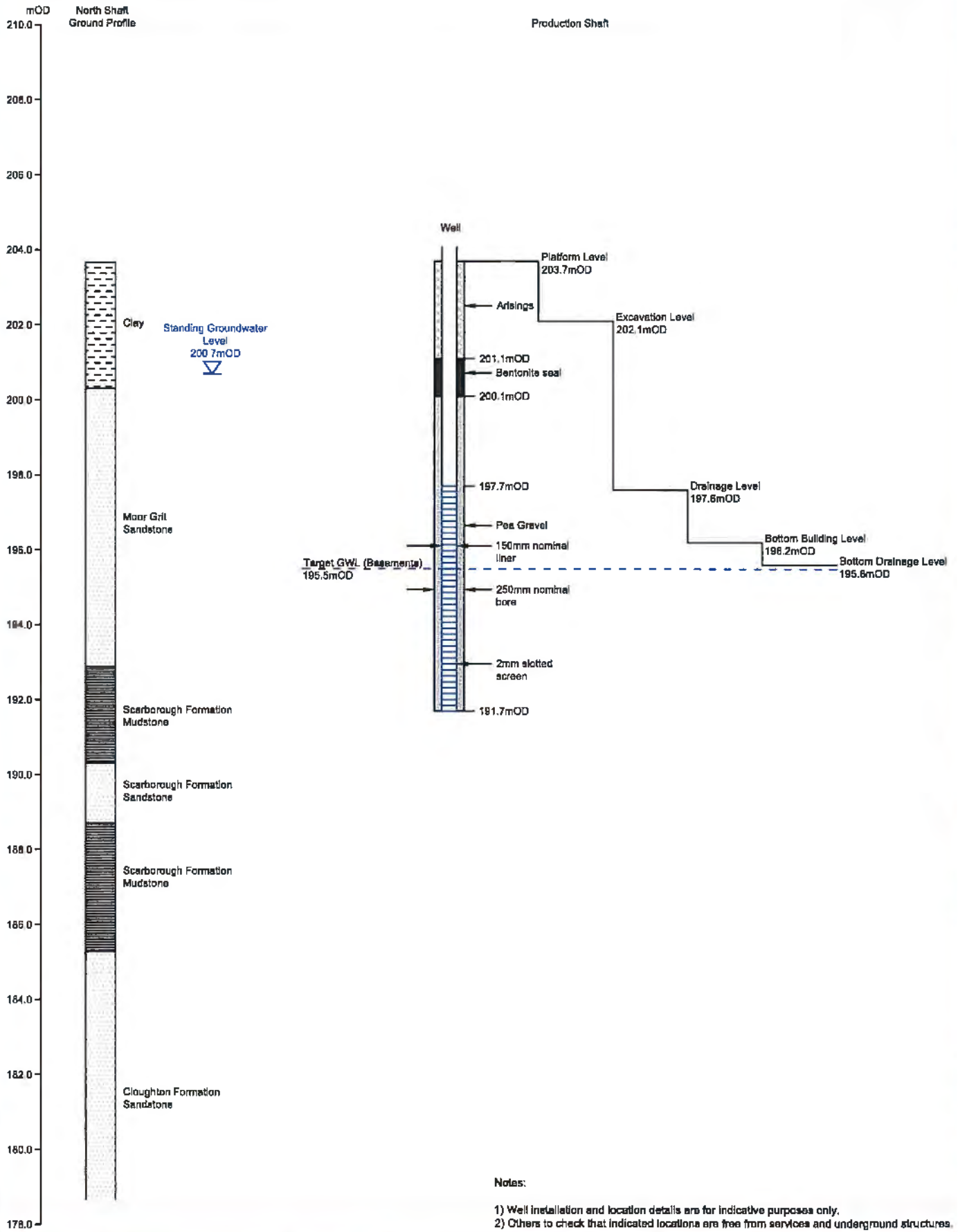


| Activity / Element | Potential Hazards | Population at Risk | Risk Rating | | | Control Measures Specified | Residual Risk | | |
|--|---|-----------------------|-------------|---|---|--|---------------|---|---|
| | | | L | S | R | | L | S | R |
| General | General site works | Operatives, public | 2 | 3 | 6 | <ul style="list-style-type: none"> Comply with Sirius Minerals site rules and WJ safety policy. Co-ordination and sequencing of work to prevent clash of activities. Wear high visibility, long sleeved coat/waistcoat and high visibility trousers. Do not allow unauthorised persons on to site. | 1 | 3 | 3 |
| General | Plant and equipment | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> All plant and equipment to be suitably serviced and maintained by competent fitters. Check all plant certification. Use bunds and drip trays to prevent ground contamination. | 1 | 3 | 3 |
| Loading and off-loading equipment | Lifting gear & loads | Operatives | 3 | 3 | 9 | <ul style="list-style-type: none"> Load/unload in site compound. Check slings, ropes and shackles for damage and capacity (certificates should be available for scrutiny). Only competent plant operators to use lifting devices. Slung loads to be secure and balanced, use guide ropes, use hard standing for reception. Keep clear of slung loads, keep hands away from loads especially at point of landing. Wear suitable PPE. Use trained and competent banksman/slinger signaller Maintain communication between banksman and driver. | 1 | 3 | 3 |
| Lay out discharge pipeline | Muscular-skeletal injury | Operatives | 4 | 2 | 8 | <ul style="list-style-type: none"> Wear suitable PPE. Tie loose clothing, employ correct lifting techniques and obtain assistance with loads if required. Use mechanical assistance where possible. Plan installation route and check for potential obstructions before moving pipes. | 2 | 2 | 4 |
| Groundwater | Wells disease | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Do not wash with groundwater. Wear appropriate gloves, wash in clean water with soap before eating, drinking or smoking. Cover cuts and abrasions with waterproof plasters/dressings. Notify GP if flu-like symptoms occur. | 1 | 4 | 4 |
| Environment | Contamination of groundwater or water courses | Wildlife | 2 | 4 | 8 | <ul style="list-style-type: none"> Frequently undertake visual inspection of pipeline to check for leaks and damage. Frequently check discharge for suspended solids. Caution to be taken when working next to existing services to mitigate the risk of damage. | 1 | 4 | 4 |
| Working around existing heavy fuel oil pipelines | Damage to existing services leading to spillage of heavy fuel oil | Operatives / Wildlife | 2 | 4 | 8 | <ul style="list-style-type: none"> Plan installation route and check for potential obstructions before moving pipes. Take care when lifting pipe work into place around existing services. Lifting plan must be in place prior to carrying out mechanical lift of discharge pipe over existing pipeline. | 1 | 4 | 4 |
| Whole Body Vibration | Exposure to vibrations from mobile plant | Operatives | 2 | 4 | 8 | <ul style="list-style-type: none"> Take measures to avoid or reduce exposure Provide information and training to employees. | 2 | 1 | 2 |



APPENDIX A – DRAWINGS AND FIGURES

Drawing Q7370.002r1 Dewatering Installation Cross Section



Notes:

- 1) Well installation and location details are for indicative purposes only.
- 2) Others to check that indicated locations are free from services and underground structures.

| Rev No | Drawn by | Check by | Date | Reason for revision | Project Name: Woodsmith Mine, Whitby |
|--------|----------|----------|----------|---------------------|--|
| 00 | DC | MP | 17/03/17 | Issue for review | Drawing Title: Installation Cross Section |
| 01 | DC | NC | 04/04/17 | Issue for review | |
| | | | | | Drawing No: Q7370/002 |
| | | | | | Scale: As Indicated |



APPENDIX B – COSHH ASSESSMENTS

COSHH Sheet – Diesel

COSHH Sheet – Silica Sand







COSHH Sheet – Mikolite Bentonite

COSHH ASSESSMENT

| | | | |
|---------------------------------|--|-----------------------|---------------|
| Product Name | Silica Sand (All Grades) | COSHH # | 5 |
| Description of Substance | Orange granular sand sized particles | Assessed by | PR |
| Composition | Various minerals grains | Date | 11/09/09 |
| Task/Activity | Backfill of boreholes and use in filter vessels | Risk Phrases | R36, R37, R38 |
| Suppliers Details | Universal Minerals Ltd 14a Middlewich Road Industrial Estate Middlewich Cheshire CW10 9NX | Safety Phrases | S22, S36, S37 |
| | | Telephone # | 01606 834 723 |
| | | MSDS Attached | |

| SUBSTANCE PROPERTIES | | | | | | | |
|---|---|---|---|---|--|---|---|
|  |  |  |  |  |  |  |  |
| Flammable | Oxidising | Explosive | Harmful | Toxic | Irritant | Dangerous to Environment | Corrosive |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ROUTE OF EXPOSURE | | | | | | PERSONS AT RISK | | | | | |
|-------------------|---|----------------|---|------------|---|------------------|---|-------------------|---|----------|---|
| Skin | M | Eyes | M | Inhalation | M | Users of Product | Y | Members of Public | N | Visitors | N |
| Ingestion | L | Cuts/Abrasions | L | Injection | L | Other Workers | Y | Young Persons | N | | |

| PPE REQUIREMENTS | | | | | | | |
|---|---|---|---|---|--|--------|--------|
|  |  |  |  |  |  | Other: | Other: |
| Gloves | Face Shield | Goggles | Apron/Overalls | Dust Mask | Respirator | | |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ADDITIONAL CONTROL MEASURES | |
|---|---|
| General Precautions Long term exposure to crystalline silica may cause silicosis in the lungs. Contact with the skin, eyes, mucous membranes may cause irritation by abrasion. | Control Measures Use PPE as specified above. Minimise dust creation. Use mechanical lifting where possible |
| First Aid/Hygiene Arrangements Inhalation: Remove casualty from area. Seek medical advice if irritation continues. Skin: Remove contaminated clothing and wash area with soap and water Eye: Flush eye with clean water, Ingestion: Give casualty water, seek medical advice | Fire Precautions Material is non-flammable. Select media to fight surrounding material. Wear self contained BA and full protection. |
| LEV Requirements (Local Exhaust & Ventilation) Use in well ventilated area. | Monitoring Requirements None required during routine use. |
| Transport Arrangements Classified as not dangerous for transport. | Storage Requirements Store in dry, well ventilated area. |
| Spillage Procedures Sweep up spillage. Material may still be used if not contaminated by soil or other materials | Disposal Requirements In accordance with local regulations |
| Comments | |
| | |

COSHH ASSESSMENT

| | | | |
|--------------------------|---|----------------|---------------|
| Product Name | Bentonite Pellets - Mikolit | COSHH # | 8 |
| Description of Substance | Creamy, free flowing granules | Assessed by | MB |
| Composition | Clay mix with sodium carbonate, calcium montmorillonite clay and magnetite | Date | 27/11/2014 |
| Task/Activity | A bentonite sealant for creating impermeable seal in completed boreholes. | Risk Phrases | |
| Suppliers Details | Boode UK Ltd, 22-23 Brindley Road, Dodwalls Bridge, Hinckley, Leics, LE10 3BY | Safety Phrases | |
| | | Telephone # | 01455 611 317 |
| | | MSDS Attached | No |

| SUBSTANCE PROPERTIES | | | | | | | |
|---|---|---|---|---|--|---|---|
|  |  |  |  |  |  |  |  |
| Flammable | Oxidising | Explosive | Harmful | Toxic | Irritant | Dangerous to Environment | Corrosive |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ROUTE OF EXPOSURE | | | | | |
|-------------------|---|--------------------|---|------------|---|
| Skin | L | Eyes | L | Inhalation | L |
| Ingestion | L | Cuts/ Abrasions | L | Injection | L |

| PERSONS AT RISK | | | | | |
|------------------|---|-------------------|---|----------|---|
| Users of Product | Y | Members of Public | N | Visitors | N |
| Other Workers | Y | Young Persons | N | | |

| PPE REQUIREMENTS | | | | | | | |
|--|--|--|--|--|---|--------|--------|
|  |  |  |  |  |  | Other: | Other: |
| Gloves | Face Shield | Goggles | Apron/ Overalls | Dust Mask | Respirator | | |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ADDITIONAL CONTROL MEASURES | |
|---|---|
| General Precautions | Control Measures |
| Dust may cause an irritation. | Maintain good hygiene procedures. Wear correct PPE |
| First Aid/Hygiene Arrangements | Fire Precautions |
| Inhalation: Remove casualty to fresh air. Perform artificial respiration if breathing stopped. Get immediate medical aid Skin: Remove contaminated clothing, wash skin. Eye: Flush eye with copious amounts of clean water. Ingestion: Seek medical attention. | Material is non combustible. Select fire-fighting media appropriate for surrounding materials. |
| LEV Requirements (Local Exhaust & Ventilation) | Monitoring Requirements |
| No special requirements. | No special requirements under normal usage. Follow doctors advice following abnormal exposure. |
| Transport Arrangements | Storage Requirements |
| Not classified for transport. | Store in original packaging. Store in a dry cool environment. Prevent contact with water. |
| Spillage Procedures | Disposal Requirements |
| Sweep spilt product into a pile. Keep dust production to a minimum. May be re-used if uncontaminated. | Maybe disposed of as a solid non-hazardous waste. |
| Comments | |







COSHH ASSESSMENT

| | | | |
|--------------------------|--|----------------|----------------------|
| Product Name | Diesel | COSHH # | 9 |
| Description of Substance | Straw/red coloured liquid | Assessed by | MB |
| Composition | Mixture of hydrocarbons in C10-C28 range with improver additives | Date | 27/11/2014 |
| Task/Activity | Refuelling of plant | Risk Phrases | R40,R65,R66,R51/53 |
| Suppliers Details | Crown Oil/Total/Team Flitwick/Husk Oil | Safety Phrases | S2,S43,S45,S38/37S61 |
| | | Telephone # | 1923 694 000 |
| | | MSDS Attached | No |

| SUBSTANCE PROPERTIES | | | | | | | |
|---|---|---|---|---|--|---|---|
|  |  |  |  |  |  |  |  |
| Flammable | Oxidising | Explosive | Harmful | Toxic | Irritant | Dangerous to Environment | Corrosive |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ROUTE OF EXPOSURE | | | | | |
|-------------------|---|----------------|---|------------|---|
| Skin | M | Eyes | L | Inhalation | L |
| Ingestion | L | Cuts/Abrasions | M | Injection | M |

| PERSONS AT RISK | | | | | |
|------------------|---|-------------------|---|----------|---|
| Users of Product | Y | Members of Public | N | Visitors | N |
| Other Workers | Y | Young Persons | N | | |

| PPE REQUIREMENTS | | | | | | | |
|--|--|--|--|--|---|--------|--------|
|  |  |  |  |  |  | Other: | Other: |
| Gloves (Nitrile or similar) | Face Shield | Goggles | Apron/Overalls | Dust Mask | Respirator | | |
| Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No | Yes/No |

| ADDITIONAL CONTROL MEASURES | |
|--|---|
| General Precautions Prolonged/repeated skin exposure to diesel will cause dryness and dermatitis. | Control Measures Maintain good hygiene facilities Use specified PPE. |
| First Aid/Hygiene Arrangements Inhalation: Remove casualty to fresh air. Get medical advice if symptoms continue. Skin: Wash skin thoroughly. Remove contaminated clothing. If injected under skin get medical advice URGENTLY. Eye: Wash eye with copious amounts of water. Seek medical advice if irritation continues. Ingestion: Wash mouth with water and give water to drink. If large amount, seek medical attention. DO NOT INDUCE VOMITING | Fire Precautions Use dry powder, foam or water fog. Small fires – CO2 DO NOT USE WATER JETS Fires in enclosed spaces should only be tackled by trained personnel using SCBA. |
| LEV Requirements (Local Exhaust & Ventilation) Use in well ventilated area. Avoid low spots where fumes/vapour could accumulate. | Monitoring Requirements |
| Transport Arrangements Hazchem code 3/Z Symbol: Flammable Liquid UN ID #: 1202 | Storage Requirements Store in approved bunded tanks as per BSI, IoP and HSE guidance. |
| Spillage Procedures Treat as a fire hazard. Prevent spillage entering watercourse or drainage system. May cause surfaces to become slippery Absorb onto absorbent clay or clean up using dedicated spill kits | Disposal Requirements Dispose of used spill kits and spill residue in the hazardous waste bin supplied on site. DO NOT discharge to water courses or public drainage system |
| Comments | |

