Environmental Impact Assessment

To
York Potash Ltd

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Subject
York Potash MTS – EIA001 (5-1-3) Tunnel Narrative

1 Scope of MTS Tunnel

The purpose of the proposed Mineral Transportation System (MTS) is to transport the Polyhalite mineral from the mine site to the materials handling facility at Teesside where it will be treated before the finished products is then loaded onto cargo ship for transport.

The scope of the Mineral Transport System (MTS) comprises three elements:

A Tunnel
- A tunnel structure, of approximately 36.5km in length and internal finished diameter of 5.7m, with external diameter of 6m (increasing to 6.5m for segmental lined sections);

Shafts & Caverns
- A Shaft at the Dove’s Nest Mine Site to intersect with the minehead production shaft at approximately 360m below ground level;
- Intermediate shafts, along the route located approximately 8.1km, 23.9km and 29.4km from the Dove’s Nest Mine Site, at surface each of these sites will have buildings to house, man and equipment lifting capability and maintenance equipment;

Portal
- A Material Processing Surface area, at Wilton, Teesside with a decline entrance portal to the tunnel;
- An overland conveyor, transporting dry crushed Polyhalite from the production shaft to the Wilton Site.

Prior to completing the Definitive Feasibility Study (DFS) for the Mineral Transportation System, YPL are developing the Environmental Impact Assessment (EIA). In order to inform the EIA report this narrative sets out details regarding the scope and scale of the proposed development.

The scope set out in this report will be developed during the DFS. Therefore this narrative represents a preliminary stage of design and is subject to change.
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The proposed Mineral Transport System (MTS) is being developed to meet the identified functions at the least net present cost. However for the purposes of informing the environmental assessment reasonable “worst case” scenarios are developed. Figure 1 to 3 shows the tunnel and cavern envisaged schematic.

Figure 1 Tunnel Structure

Figure 2 Tunnel and Refuges structure
2 Preliminary Study (Tunnel)

2.1 General Function

The 36.5km MTS 6m diameter tunnel structure will contain the following functions to support delivery of 2,000 tonnes / hour of Polyhalite from the Dove’s Nest Mine Site to the Port Facility at Wilton:

- **A Transport System**
  to move Polyhalite from the Mine at Dove’s Nest to the Port Facility;

- **A Maintenance System**
  to allow the transport system to be maintained;

- **Water Transport**
  to remove any water entering the tunnel;

- **Power Supply**
  to supply power from Teeside to the Mine;

- **Operation Systems**
  to supply power to the services listed above;
Memorandum

- **Provision of Emergency refuges**
  to allow controlled evacuation from the tunnel in event of fire.

### 2.1.1 Transport System

A transport system is required to deliver Polyhalite from Dove’s Nest Mine Site to the Port Facility within an underground environment. A slurry pipe system, train system and conveyor system were considered as potential transportation systems.

For the basis of preliminary study, a number of tunnel conveyors are assumed to deliver the crushed ore to a surge bin at the materials handling facility. The tunnel conveyors will be less than 16km long respectively with transfer stations at the intermediate tunnel access and ventilation shafts. Tunnel conveyors will have approx. 2000 tonnes / hour capacity and belt width up to 1.4 meter. The conveyors will be designed using overland conveyor technology, providing low structural weight, low friction belt covers and large idler spacing.

### 2.1.2 Tunnel Maintenance System

A maintenance access system is required to allow access for a workforce to maintain the proposed transport system and the tunnel structure. A maintenance access system of a roadway and a train system were considered as potential maintenance systems.

For the basis of preliminary study, a narrow gauge railway, Schoma or equivalent, will be used to access the 36.5km tunnel from the Wilton portal to provide the workforce access to maintain the proposed conveyors and tunnels systems.

This underground maintenance access train would typically consist of:

- A maximum length of 50m; (4 cars plus the locomotive);
- 36t diesel powered locomotive;
- The motorised cars used to transport materials weight 17t when not loaded;
- This cars can be loaded up to a total weight of 42t (including the self-weight), which gives an additional 25t load on top of the self-weight. This is in line with the assumptions that the cars will need to carry a maximum load of 23tons;
- The maximum allowable weight of a fully loaded train is 285t;
- The maximum gradient allowed to haul the fully loaded cars is 3.3%;

The maintenance train would be housed at a train shed at Wilton Portal with an associated fuel depot. Within the tunnel, California Switches will be installed at cavern locations to allow passing of individual trains. In the preliminary design, these diesel trains are assumed to have dimensions 1.5m wide by 2.2m high and will run on tunnel invert, comprising of pre-cast invert, cast-in situ concrete or on a ballasted track installed behind the TBM.

### 2.1.3 Mine Power Supply

No national grid infrastructure is available in proximity to the Mine Site. To power the mine, a high voltage supply must either be supplied at surface within a trench across the National Park or also...
contained in the tunnel system. To minimise impact on National Park resources, the high voltage cables were located within the tunnel.

For the basis of preliminary study, two 66kV High Voltage cables will be used to supply power to the mine. These 66kV High Voltage cables will be stepped down within the tunnel to provide power to the transport system. Power to other systems will be provided by low voltage supplies available from many of the worksites.

During construction, the cable would be drawn along the tunnels one at a time, then man-handled into position, to create a trefoil arrangement.

Splicing of the cable would be delayed until after tunnel construction, as splicing of joints requires a localised clean tunnel environment, with no other activities occurring at the joint splice.

2.1.4 Tunnel Operational Systems

Operational systems will be provided in the tunnel to operate the individual systems and maintain a habitable environment. The provision is identified in terms of general (system-wide) technology and specific technology provision to support operations.

The list below identifies common infrastructure necessary to support individual technology systems such as power supplies, communication networks and control / equipment rooms.

- Electrical distribution – normal power supply;
- Uninterruptible power supply (UPS);
- Tunnel lighting;
- Fixed telecoms network;
- Radio communications network;
- Supervisory Control and Data Acquisition (SCADA) system;
- Communications equipment rooms;
- Control Rooms;

The list below identifies technology provision to support operations:

- Conveyor Operations;
- Control of Tunnel Ventilation;
- Tunnel and conveyor maintenance;
- Fire detection and alarm;
- Systems for Use of Safe Havens;
- Railway operations;

2.1.5 Provision of Emergency Refuges

In the event of a fire within the tunnel, the preferred option for personnel working underground to escape is via the maintenance train to one of the exits (portal, intermediate shaft or minehead). If this is not available personnel would evacuate away from an incident on foot.
Memorandum

As per Mining Regulations, appropriate self-rescuers are provided for the personnel working underground to escape without assistance. It is assumed that the proposed self-rescuers to be adopted would have approximately 45 minutes operating time, during which time the evacuees could walk approximately 1350m (average walking speed is assumed to be 30m / minute). Considering the length of the tunnel and adverse conditions in the event of fire, it is not likely that the evacuees would be expected to reach a place of relative safety or ultimate safety (i.e. bottom of the shafts or surface) by use of self-rescuers alone.

Therefore, emergency refuges are proposed at 1km intervals within the tunnel to allow the evacuees to replace rebreathers, rest during the evacuation period, communicate with emergency responders and either proceeds with self-evacuation if necessary; or to wait for rescue team assistance.

2.2 Construction Method

The following forms of construction have been considered for the tunnel for the purposes of the concept development:

- **Shielded TBM**
  To create a circular profile, with segmental lining support;

- **A Rock Gripper TBM**
  To create a circular profile, with shotcrete and rock bolt support;

- **A Road header**
  To create a horseshoe profile, with shotcrete and rock bolt support;

- **A Continuous Miner & Spot Bolter**
  To create a rectangular profile, depending on type with spot bolted support;

- **A Borer Miner**
  To create an ovaloid profile, with spot bolted support;

For the purposes of preliminary design, an open face rock gripper TBM has been selected as the most likely form of construction. Further study of construction methods will be carried out as site investigation data is obtained and one of the five methods identified above will be selected.

The current construction method, an open face rock gripper TBM consists of three major components, the Cutterhead / Cutterhead support, Gripper and Main Beam assemblies. The cutterhead holds disc cutters which are positioned for optimal boring of the rock. As the cutterhead turns, hydraulic propel cylinders push the cutters into the rock. The transfer of this high thrust through the rolling disc cutters creates fractures in the rock causing chips to break away from the tunnel face. Gripper pads behind the tunnel face push on the sidewalls and are locked in place while the drive cylinders extend, allowing the main beam to advance the TBM. The excavated material is transferred to the rear of the machine for removal from the tunnel. At the end of a stroke the rear legs of the machine are lowered, the grippers and propel cylinders are retracted. The
retraction of the drive cylinders repositions the gripper assembly for the next boring cycle. The grippers are extended, the rear legs lifted, and boring begins again. Temporary ventilation during the tunnel excavation phase will be provided by surface mounted axial fans that will introduce ducted fresh air to the tunnel face.

A gripper TBM’s open design allows access directly behind the cutterhead for the installation of rock support (rock bolts, steel mesh and shotcrete). The open face gripper TBM would mitigate the risk of squeezing rock conditions, reducing the probability of a jammed shield body.

2.3 Tunnel Lining

The tunnelling conditions are based on excavation through the Redcar Mudstone. It is envisaged that tunnel support categories would include but not limited to:

- Spot Bolting
- Pattern Bolting with Shotcrete
- Pattern Bolting with Shotcrete and additional support measures (such as mesh and steel ribs)

It is envisaged that following the site investigation a range of support types would be defined, the quality of the rock mass would be logged on site and support measures applied behind the tunnel excavation process. It is envisaged that as a minimum the tunnel lining will comprise of shotcrete layer with spot bolting.

3 Preliminary Study (Shaft & Caverns)

3.1 General Function

4no. Shafts and Caverns will be required, one cavern at the bottom of each of the three intermediate shafts and one at the bottom of the mine head shaft in the following locations:

- One Shaft & Cavern at Tocketts Lythe (29.4km from Dove’s Nest Farm at the Minehead Site)
- One Shaft & Cavern at Lockwood Beck Farm (Outside National Park Boundary, 23.9km from Dove’s Nest Farm at the Minehead Site)
- One Shaft & Cavern at Lady Cross Plantation (Inside National Park Boundary, 8.1km from Dove’s Nest Farm at the Minehead Site)
- One Shaft & Cavern at Dove’s Nest Farm (Mine Site)

The primary functions of the Shaft & Caverns are as follows:
- Facilitate Tunnel Construction / Launch;
- Conveyor transfer station
Memorandum

- Emergency Egress;
- Operational & Emergency Ventilation;

3.1.1 Facilitate Tunnel Construction / Launch

The shaft has been sized to allow lowering of the parts of the TBM to the tunnel alignment; this sizing has providing the most onerous requirement in terms of overall size of shaft. If a different method was used the requirements and diameter of the shaft might be reduced. At the present stage it is envisaged that the intermediate shaft would have a diameter of 9m and that the MTS shaft at Dove’s Nest Farm (mine head) a diameter of 9.5m.

The tunnel cavern has been sized on the basis of the requirements for the conveyor belt transfer and for TBM Assembly at depth in the location of the tunnel alignment. The space requirements for the conveyor belt transfer allows for the most onerous requirement in terms of overall size. The assembly of the TBM requires the use of a pair of gantry cranes and the shape of the excavated caverns has been designed to accommodate the machinery.

3.1.2 Conveyor transfer station

The intermediate shafts caverns overall size is governed by the conveyor space requirements to allow for belt transfer. It is currently envisaged that belt transfer will occur at Lockwood Beck and Ladycross Plantation. At the two locations the caverns have been sized to house the conveyor belt transfer and supporting services, conveyors motors, walkway, emergency refuges, ventilation fans and maintenance train by pass facilities. At the present stage it is envisaged that the cavern at the two locations would have a horse shoe profile with the largest approximate span of 14m, approximate height of 16m over a length of 100m and additional length of excavation at a smaller size for a length of 200m. At Tocketts Lythe the cavern does not currently house a belt transfer station and has been sized to allow for TBM launch and reception and in the permanent case of house walkway, emergency refuges, ventilation fans and maintenance train by pass facilities. The cavern at the location would have a horse shoe profile with approximate span of 14m, approximate height of 16m and a length of 100m.

3.1.3 Emergency Egress

In the event of an emergency, an emergency winching system will be employed from surface to allow emergency evacuation of the tunnel. The surface construction worksite has been sized to allow emergency winding gear to be brought on site with sufficient hard-standing to allow winding gear and emergency support vehicles.

3.1.4 Ventilation

3.1.4.1 Operational ventilation

The design philosophy is to ventilate the tunnel from Wilton portal towards the mine, discharging the tunnel ventilation air with the mine extract air. Fan plants placed horizontally within the caverns at the base of the shafts are required for the operational ventilation scheme. The fans will be
Memorandum

used for intake only to ventilate the MTS tunnel during operations. Plenum chambers and dampers will be used to minimise any noise at shaft areas where used.

3.1.4.2 Emergency ventilation

Emergency operation fans are to be located horizontally within the caverns at the base of the intermediate shafts and at the MTS mine head shaft. The fans will be operated during emergency for intake of fresh air or exhaust of smoke. Plenum chambers and dampers will be used to minimise any noise at shaft areas where used.

3.2 Construction Methods

The following forms of construction have been considered for the shaft and cavern for the purposes of the concept development:

- **Drill & Blast**
  Traditional Shaft Sinking Technique

- **Vertical Shaft Sinking Machine**
  Excavation of groundmass using a sinking and lining machine with roadheader excavation;

For the purposes of preliminary design, a traditional drill and blast method has been selected as the most likely form of construction. Further study of construction methods will be carried out as site investigation data is obtained.

At each of the shaft locations it is proposed to create a level working platform (150m x 200m in plan dimension typical, 85m x 85m minimum) at surface to support construction equipment for shaft sinking. Worksite facilities are to be established at each shaft location compromising of offices, ablution blocks, workshops and store facilities.

Prior to commencement of the shaft sinking site set up activities will include construction of the foundations for the winding gear, erection of the winders, installation of temporary construction fans and concrete batching plant. Water storage facilities and temporary power supply provided by a diesel generator will be installed.

Prior to commencement of the upper section of shaft, the perimeter of the shaft box will be grouted, on a 1.5 m offset grid, to a distance of ~5 to 10 m beyond the walls. This grout annulus will extend below the base of the excavations down into the Redcar Mudstone. For the purpose of the preliminary design it is envisaged that to reduce water ingress, in addition to grouting it may be required to construct the upper section of the shaft within a secant piled wall. On completion of grouting and pile installation, the rock within the shaft box will be broken out in ~5 m deep stages with the lining installed progressively from the surface, sealing the shaft box from groundwater ingress. Water within the ungrouted central section of the excavations will be removed by pumping from sumps at the base of each stage of the excavation during rock extraction. During excavation, only limited water ingress is anticipated through the grout annulus. It is expected that the water from the dewatering process will be treated on site prior to discharge.
A reinforced concrete circular wall will be built inside the initial excavation to create a shaft collar and to provide a foundation to support the shaft excavation equipment that will be erected and employed during the excavation of the intermediate shafts. For the pre-sinking phase of the shaft construction as “A” type head-frame will be erected.

During the shaft sinking phase the “A” type frame will be replaced by the shaft sinking headgear. Again, pre-exavcation grouting is assumed to be required through water bearing strata. After the construction of the shaft collar, the excavation will proceed using a drill and blast method, holes are expected to be drilled by two crawler drilling rigs or equivalent. While initial grouting work is carried out, it is assumed that excavation equipment and purpose-made shaft sinking equipment will be installed at the top of the shaft.

The following excavation equipment will be used to sink the shaft:

- a kibble and stage winder
- a five deck shaft stage platform
- a shaft mucker
- a shaft drill rig
- sinking fans
- compressors
- batching plant
- diesel generators plant

The access platform could consist of a five deck platform, typically handled by synchronized winches that are fixed onto a movable gantry structure at the top of shaft. The platform will act as working place during the various excavation activities. It will be positioned a distance from the base of the shaft to protect the platform from the blasting activity and will be secured to the shaft walls by means of hydraulic jacks.

Excavated rock could be removed by the compact backhoe excavator or equivalent, loading muck buckets. All the equipment and the buckets could be handled in and out the shaft by mobile hydraulic cranes.

The proposed construction sequence would be provided below:

- Pre-exavcation grouting, where required;
- Drill & Blast;
- Excavate rock, inspect and document the quality and characteristics of the rock mass in the sidewalls;
- Install the temporary excavation support based on the rock mass inspection results;
- Lower the working platform and begin the next excavation cycle
- The sinking cycle will be repeated until the shaft is completed.
Memorandum

Based on the proposed production programme, each TBM will arrive on site before the completion of the intermediate shaft and of the assembly cavern, so some elements of the machine will be partially assembled on the surface, taking into consideration that dimensions and weights of each single element do not exceed the capacity of the erection facilities.

Before the TBM assembly begins, a detailed erection program will be set up, with the assistance of the TBM supplier, in order to define the sequence of the pieces to be erected and to evaluate the time and resources required.

The five heaviest component of a 6m diameter open face gripper TBM are likely to be:

- Main Beam (approx. 80 tons);
- Cutterhead Support & Main Bearing (approx. 100 tons);
- Gripper Carrier (approx. 60 tons)
- Rear Support (approx. 30 tons);
- Cutterhead (approx. 70 tons).

These components will need to be lowered to the TBM Assembly cavern using a specially designed winching frame. Once at the base of the shaft the TBM pieces will be moved by gantry crane into position. This crane is likely to be equipped with two winches with 100 tons capacity, to erect the heavy pieces of the main body of the TBM. A smaller traveling crane, with a 35 ton capacity, will be positioned in the cavern, for the erection of the back-up. When the TBM erection is completed, the gantry crane will be removed, while the overhead crane will remain as service lifting device for the running of the TBM.

3.3 Shaft & Cavern Lining

Temporary excavation support would be installed after each round of excavation. Within poor ground conditions, where stand-up time might be limited due to poor rock quality, vertical grouted spiles can be installed from the shaft base to stabilize the rock and allow for larger excavation lifts.

It is envisaged that the shaft & cavern support system could include:

- Spot Bolting
- Pattern Bolting with Shotcrete
- Pattern Bolting with Shotcrete and additional support measures (such as mesh and steel ribs);
- Cast-In Situ Concrete;

It is envisaged that following the site investigation a range of support types would be defined, the quality of the rock mass would be logged on site and support measures applied behind the tunnel excavation process.
Space Requirements for TBM Assembly

1. Space provided for services allows for the installation of a leaky feeder, dewatering, radio repeater, lighting & LV power to cavern / TBM during construction.

2. The shaft at each location will continue to be sunk until a depth 30m below the cavern is reached. The drawworks are designed to lift 30m of the shaft with a 5:1 drum ratio and allow lowering of muck buckets so they can be top emptied.

3. The shaft area will be caged off to prevent workforce from walking beneath unprotected shaft. Men & Material transport will be by cage system, muck transported by vertical conveyor or muck bucket system.

4. A 1:2m temporary ventilation duct is provided.

5. Allowance for tunnel transformer and workshop facilities in rear of cavern.

Space Requirements for TBM Operation

1. Shaft area caged off to prevent workforce from walking beneath unprotected shaft. Men & Material transported to and from pit bottom by cage system, muck transported by vertical conveyor or muck bucket system.

2. At Footwall level the cavern will be impounded by water tight concrete to form a pool within the cavern; a permanent sump will be sunk for managing water ingress during construction and a sump return pipe installed in the shaft for removal of water to surface.

3. A invert slab will be cast to enable safe working and appropriate water protection system such as a waterproof membrane shall be installed on the internal surface to channel water away equipment and workforce.

4. The headgear shall be designed to carry the maximum TBM piece weight of 55 tons. Refer to Arup Shaft Design Specification for further details.

5. A 1.2m temporary ventilation duct is provided.

6. During Shaft & Cavern Excavation Stage:
   - Over-run allows space to bury of the stage if required and allows lowering of muck buckets so they can be top emptied.
   - 50 tonne gantry crane provided for assembly of the TBM, 35 tonne overhead crane provided for assembly of the back-up.
   - A 1.2m temporary ventilation duct is provided.
   - Three 900mm gauge railway sidings provided at the rear of the cavern for storage of materials; during TBM Operation Stage:
   - Chain conveyor transfers spoil from Bunkerage to muck-buckets, which are side loaded.
   - A 1:2m temporary ventilation duct is provided.
   - Temporary sump will be sunk for managing water ingress during construction and a sump return pipe installed in the shaft for removal of water to surface.
   - Spaceproofing technical note for further details;
   - A 1.2m temporary ventilation duct is provided.

7. During TBM Construction Stage:
   - A 1:2m temporary ventilation duct is provided.
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8. During TBM Operation Stage:
   - A 1:2m temporary ventilation duct is provided.
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1. Cavern for conveyor transfer and associated cavern for level change of maintenance train has been provided, a combined length of approx. 243m of conventional tunnel is required to provide the space.

2. Assumed minimum internal tunnel envelope for spaceproofing of 5.05 m internal diameter assumed for TBMs diameter (refer to Civil structural details). Minimum internal tunnel envelope for spaceproofing does not account for construction tolerance and lining thickness.

3. Size of conveyor (Lady Cross) based on YPL/Bechtel instruction from meeting held on 13th September 2014. Provision for maintenance walkway width and approx. height based YPL/Bechtel instruction from meeting held on 13th September 2014.

4. Assumed no conveyor protective covering required and no details of dust extraction associated with the conveyor have been provided or shown on drawing.

5. Maintenance vehicle based on Clayton Tunnel Locomotive. Envelopes assumed for ballast track for 1.8m height x 1.5m width loco to haul a belt reel 1.4m x 3m height.

6. Assumed track gauge 900 mm.

7. Train over-sizes facility only inside cavern. Passing bay, assumed on level vertical alignment for an assumed 35m long maintenance train.

8. All elements to be carried on the maintenance train assumed to be within the belt reel envelope.

9. Emergency refuges assumed to be 1.5m width x 7m length x 2m height for 5 occupants. Final size to be confirmed with mine inspectorate.

10. Switch room size incorporated in conveyor service zone, mezzanine deck. Assumed no conveyor protective covering required and no details of dust extraction have been provided, a combined length of approx. 243m of conventional tunnel is required to provide this space.

11. 66kV HV Cable to be routed to surface, stepped down to 11kV to power conveyors, 66kV return HV cable also running in tunnel. Refer to HV Cable drawings for details.

12. Lineal refuges assumed to be: 1.5m width* 17m length * 2 m height, for 15 occupants.

13. Crash check structure provide to prevent damage to conveyor in permanent case (refer to Civil Structural details).

14. 5m diameter shaft provided as per client instruction.

15. Deepening to resist conveyor thrusts not shown on drawings for clarity.

16. assumed 6m TBM diameter (refer to Civil/structural details). Minimum internal tunnel envelope for spaceproofing of 5.05 m internal diameter, assumed no conveyor protective covering required and no details of dust extraction have been provided, a combined length of approx. 243m of conventional tunnel is required to provide this space.
1. Cavern for conveyor transfer and associated cavern for level change of maintenance train has been provided, a combined length of approx. 274m of conventional tunnel is required to provide this space.

2. Assumed minimum internal tunnel envelope for spaceproofing of 5.05 m internal diameter assumed for TBM diameter (refer to Civil/structural details). Minimum internal tunnel envelope for spaceproofing does not account for construction tolerance and lining finish.

3. Size of conveyor (Lockwood Beck) based on YPL / Bechtel instruction from meeting held on 12th September 2014. Provision for maintenance walkway width and approx. height based YPL / Bechtel instruction from meeting held on 12th September 2014.

4. Assumed no conveyor protective covering required and no details of dust extraction associated with the conveyor have been provided or shown on drawing.

5. Maintenance vehicle based on Clayton Tunnel Locomotive. Envelopes assumed for ballast track for 1.8m height x 1.5m width to haul a belt reel 1.4m wide x 3 m height.

6. Assumed track gauge 900 mm.

7. Train by-passes facility only inside cavern. Passing bay, assumed on level vertical alignment for an assumed 30m long maintenance train.

8. All elements to be carried on the maintenance train assumed to be within the belt reel the shaft envelope.

9. Emergency refuge assumed to be 1.5m width x 1.7m length x 2 m height, for 15 occupants. Final size to be confirmed with mine inspectorate.

10. Switch room size incorporated in conveyor service zone, mezzanine deck.

11. 66kV HV Cable to be routed to surface, stepped down to 11kV to power conveyors, 66kV return HV cable also running in tunnel. Refer to HV Cable drawings for details.

12. Assumed 1m dia. winch / emergency lift inside shaft.

13. Crash check structure provided to prevent damage to conveyor in permanent case (refer to Civil / Structural details).

14. 5m diameter shaft provided as per client instruction.

15. Deepening to resist conveyor thrusts not shown on drawings for clarity.

16. Assume a track and conveyor undercrossings provided to pass from one side of cavern to other.
1. Cavern for conveyor transfer and associated cavern for level change of maintenance train has been provided, a combined length of approx. 274m of conventional tunnel is required to provide this space.

2. Assumed minimum internal tunnel envelope for spaceproofing of 5.05 m internal diameter, assumed for TBM diameter (refer to Civil/structural details). Minimum internal tunnel envelope for spaceproofing does not account for construction tolerance and lining thickness.

3. Size of conveyor (Lockwood Beck) based on YPL / Bechtel instruction from meeting held on 12th September 2014. Provision for maintenance walkway width and approx. height based YPL / Bechtel instruction form meeting held on 12th September 2014.

4. Assumed no conveyor protective covering required and no details of dust extraction associated with the conveyor have been provided or shown on drawing.

5. Maintenance vehicle based on Clayton Tunnel Locomotive. Envelopes assumed for belt track for 1.8m height x 1.5m width to a bell roof 1.4m wide x 2.0m height.

6. Assumed track gauge 900 mm.

7. Train by-pass facility only inside cavern. Passing bay, assumed on level vertical alignment for an assumed 35m long maintenance train.

8. All elements to be carried on the maintenance train assumed to be within the bell roof envelope.

9. Emergency refuges assumed to be: 1.5m width* 17m length * 2 m height, for 15 occupants. Final size to be confirmed with mine inspectorate.

10. Switch room size incorporated in conveyor service zone, mezzanine deck.

11. 66kV HV Cable to be routed to surface, stepped down to 11kV to power conveyors, 66kV return HV cable also running in tunnel. Refer to HV Cable drawings for details.

12. Assumed min dia. winch / emergency lift inside shaft.

13. Crash check structure provide to prevent damage to conveyor in permanent case (refer to Civil / Structural details).

14. 6m diameter shaft provided as per client instruction.

15. Deepening to weld conveyor thrusts not shown on drawings for clarity.

16. Assumed 6 track and conveyor undersilaging provided to pass from one side of cavern to other.
NOTES:

1. Assumed minimum internal tunnel envelope for spaceproofing of 5.05 m internal diameter, assumed 6m TBM diameter. Minimum internal tunnel envelope for spaceproofing does not account for construction tolerance and lining thickness.

2. Assumed no conveyor protective covering required.

3. Size of conveyor (Tocketts Lythe) based on YPL / Bechtel instruction from meeting held on 12th September 2014. Provision for maintenance walkway width and approx. height based YPL / Bechtel instruction from meeting held on 12th September 2014.

4. Maintenance vehicle based on Clayton Tunnel Locomotive. Envelopes assumed for ballast track for 1.8m height x 1.5m width loco to haul a belt reel 1.4m wide x 3m height as per Client instruction.

5. Track gauge 900 mm.

6. Train by-pass facility only inside cavern. Passing bay assumed on straight horizontal alignment for an assumed 35m long maintenance train.

7. All elements to be carried on the maintenance train assumed to be within the belt reel the swept envelope.

8. Emergency refuges assumed to be: 1.5m width* 17m length * 2 m height, for 15 occupants. Final size to be confirmed with mine inspectorate.

9. Sump assumed outside cavern section, as shown.

10. Assumed 1m dia. winch emergency lift inside shaft.

11. Storage and maintenance space provided.

12. Crash check structure provided.
NOTES:

1. Minimum internal tunnel envelope for spaceproofing does not account for construction tolerance and lining thickness.
2. Assumed for drainage system; protective covering required.
3. Specific protection measures to be provided at dedicated ventilation locations.
4. Only 66kV cables (duty and standby) assumed 150mm dia., over insulation, spacing 2m apart. 3m long 250mm diameter pipes at transport sections. Cable installation is to be overseen by Consultant designer.
5. Maintenance vehicle based on Clayton Tunnel Locomotive. Brackets assumed to be installed for 1.9m length. 1.9m width to allow a belt reel of 1.9m height as per Client instruction.
6. Track gauges 900 mm.
7. Train to pass facility coded inoured. Placing key assumed on straight horizontal alignment for an assumed 25m long maintenance train.
8. All elements to be carried on the maintenance train assumed to be within the belt reel envelope and swept envelope.
9. Lighting; indication layout.
10. Invert drainage assumed 250mm dia. open.
11. Space allowance for train signals assumed 3800mm width.
12. Provision for tunnel services includes:
   - Optic fibre backbone
   - Radio repeater (LoS)
   - Optic fibre backbone
   - Automatic fire detection cables
   - Low voltage cables
   - Automated fire detection cables
13. Emergency refuge assumed to be 5m, 17m length x 2.4m height, for 15 occupants. Final size to be confirmed with mine inspectorate.

GREEN DESIGN FOR TENDER
COSTING PURPOSES ONLY