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### 1. Scope Compilation References

SCOPE COMPILATION REFERENCES					
SOURCE & Ref No.	Yes	No	N/A	Comments	
Inspections					
Return to service data packages					
Maintenance Strategy with Rev number					
SAP defects (attach list as appendix)					
Online Condition Monitoring					
Pre-outage performance test results					
Post outage performance test results					
GPSS/ Plant Performance data on UCLF incurred					
OMS / IIRMS recommendations (Audits Reports)					
Risk controls (IRM system)					
Previous audits and reviews (e.g. ERAP)					
Engineering Change Requests (Projects)					
LOPP strategy reports					
URS					
Philosophy (Outage)					
Condition Monitoring Report					
VA/PHD Viewer trends					
Corrective Actions	X				
CARAB reports					
Statutory Requirements					
Grid code requirements					
Waivers and Exemptions					
Calibration requirements					
Previous Outage SOW variations					
Post Mortems Actions from previous outages					
Pre-Outage plant walks					
Risk based inspection (RBI) report					
Simulation, TOIs, OON, SI					
<b>SUBSYSTEM</b>				<b>Y / N</b>	<b>Page No</b>

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## 2. Background

Crossover plant is a plant area for oil and water separation. There is a combination of six different plant areas. Although the areas are not centralized in one specific place, they are linked from a process point of view.

The six areas are as follows:

- Bypass connection between boiler blow-down line and dirty water line.
- Recovered water sump
- Berm system at dirty water dam
- Thickener, Coalesces and inlet structure.
- Auxiliary Cooling Water.
- Side-stream filtration.

Clean Water Drain and dirty Water Drain to the new inlet structure.

- Thickener.
- Coalesces.

The inlet structure is divided into two separate compartments, one for clean water and one for dirty water. On the clean water side there is a fixed bar screen, a measuring flume for flow measurement and a built-in overflow facility for excess flow conditions. On the dirty water side there is only fix bar screen and a built-in overflow facility. The dirty water flume is located just downstream before the inlet to the thickener.

An open channel provides the normal flow route to the thickener. On the overflow side for the dirty water from the inlet structure, the overflow connects to the existing 1500NB concrete pipe. The thickener is circular and 30m in diameter. In order to utilize the available falls for gravity feed, the thickener had to be sunk to the ground. A sloping tunnel provides access to the central underflow outlet, the centrifugal sludge pumps, and the sump pumps.

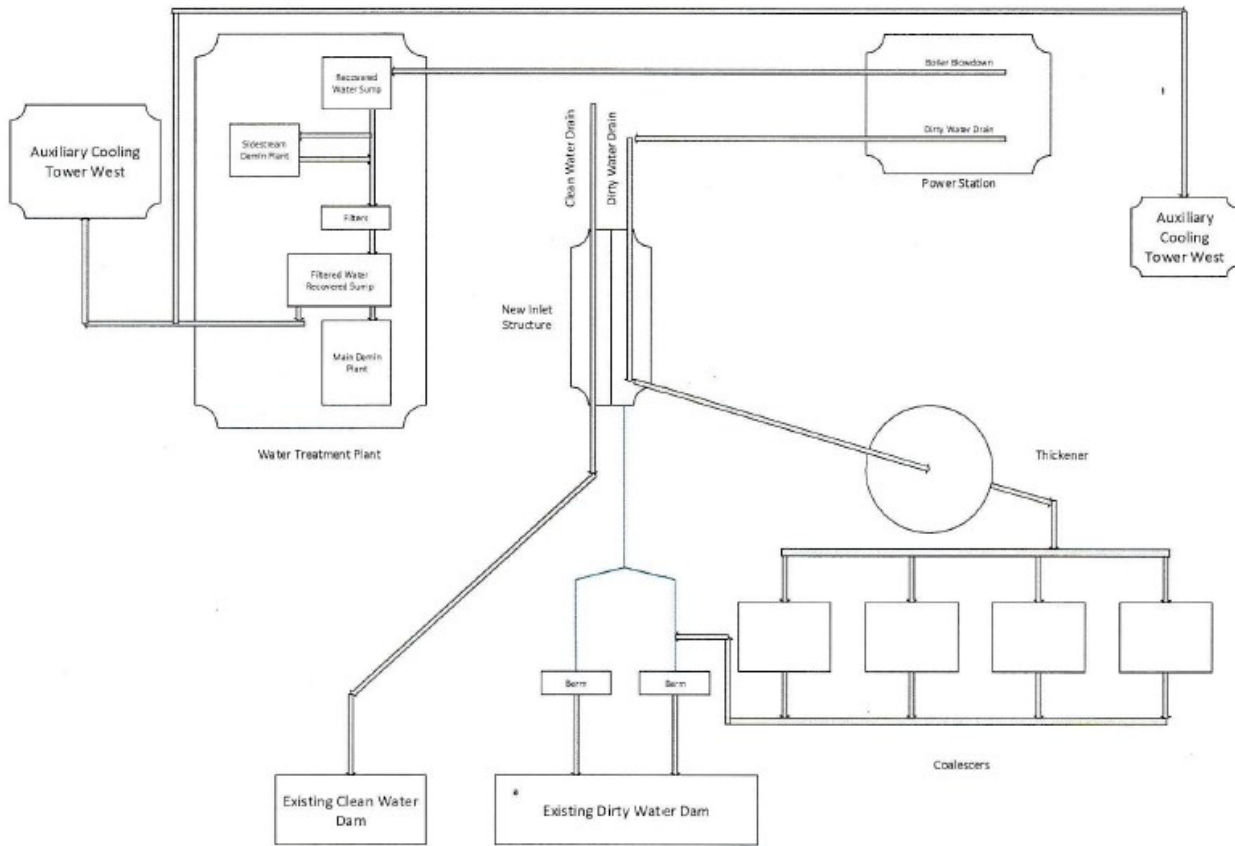
The four existing coalesces have been modified and now contains horizontal - flow coalesces packs for oil and sludge separation. Solids will settle downwards to form sludge, and this will be pumped to the drying beds. Oil will move to the surface and can then be collected in the manually operated horizontal pipe skimmer. This pipe skimmer will convey the oil/oily water to the oil sump by gravity.

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Below is a schematic drawing of crossover plant



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## 2.1 Problem description

Various subsystem are not functional at the crossover plant and as a result, that hampers on the availability and reliability of the plant. Plant walk down was conducted and the following was found

### 2.1.1 Sludge sump



**Figure 1: Sludge sump**

- Sludge sump is fill of hardened ash
- Sludge pump 1 was removed and not available
- Sludge pump 2 is buried under hardened as

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### 2.1.2 Sludge sump local control panels



**Figure 2: sludge sump local control panel**

The local control panels of both sludge pump 1 and 2 are exposed to the rain and water ingress will affect operation of the system.

### 2.1.3 Sludge drying bed



**Figure 3: Sludge drying bed**

Sludge drying bed walls are damaged and sludge gate missing. All damaged walls around the sludge drying bed needs to be repaired

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### 2.1.4 Clarifier separator vertical tubes



**Figure 4: Clarifier separator tubes**

All 12 clarifier separator tubes are rusted and needs to be replaced and 2 of the 12 are leaking at the bottom

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### 2.1.5 Clarifier discharge valve on Coalesces 3 and 4



Figure 5: Clarifier discharge valve 1 and 2

All 8 clarifier discharge valves are rusted and needs to be replaced

### 2.1.6 Clarifier discharge valve on Coalesces 1 and 2



Figure 6: Clarifier discharge valve 1 and 2

Output or discharge leg of clarifier discharge valve incorrectly installed and the valve is missing

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### 2.1.7 Clarifier pump local control panels



**Figure 7: Clarifier local control panel**

Clarifier local control panel exposed to rain and as a result, they negatively affect operation of the clarifier system. Shelter to be installed to prevent rainwater

### 2.1.8 Flow coalesces packs



**Figure 8: Flow coalesces packs**

Flow coalesces packs is full of weeds and hard ash which needs to be removed

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### 2.1.9 Oil separation compressor plant



**Figure 9: Oil separation compressor plant**

Oil separation compressor plant has been out of service for a very long time. The compressor itself is rusty due to exposure to unfavourable weather conditions. The system needs to be replaced completely.

### 2.1.10 Clarifier plant



**Figure 10: Clarifier plant**

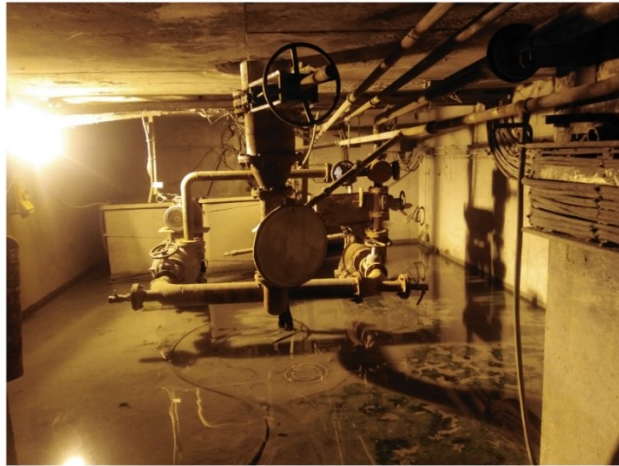
Roof needs to be installed on the clarifier plant to prevent rainwater from entering electrical panels.

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### 2.1.11 Underground centrifugal pumps



**Figure 11: Underground centrifugal pumps**

Both underground centrifugal pumps not working, the area was previously flooded by water and also affected electrical equipment

### 2.1.12 Sluice gates



**Figure 12: sluice gate**

Sluice gates are worn-out and some are stuck in open position preventing the control and flow of water to desired channel

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### 2.1.13 Civils



**Figure 13: Damaged walls**

There is several area of visible damage to the walls and as a result debris and foreign object passes and result in blockage of the pumps

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## 2.2 Objectives

This document aims to clarify the scope of work for the mechanical refurbishment of the cross over plant at Kendal Power Station

## 3. Detail scope of work

The contractor shall be responsible to execute the following scope of work on order to assure availability and reliability of the crossover plant

### 3.1 Sludge drying bed

- Cleaning and removal of ash on both sludge drying bed 1 and 2 – 50m X 30m X 1m (sludge bed dimensions)
- Repair damaged concrete wall of both sludge drying bed 1 and 2



- Surface concrete repairs (0.2 m X 0.3 m X 0.3 m) along with rebars

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- Surface concrete repairs (0.2 m X 0.3 m X 0.3 m) along with rebars



- Repair of the 0.5 m X 0.3 m X 0.3 m along with the rebars



- Replacement of 6m X 1.5 m X 0.6 m wall, including rebars

- Refurbishment of isolation gates – 4 off 400mm X 200 mm stainless steel with handles

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- Replacement of all missing isolation gates – 12 off 400mm X 200 mm stainless steel with handles
- Installation of surf guards to prevent foreign objects from entering the sludge sump – 2 off rectangular guards with stainless steel frame and menlath sheet (700mm X 300mm X 400mm)
- Removal of hard ash on sludge drying bed dissipater flow diverter

### 3.2 Sludge sump

- Complete removal of ash inside the sludge sump – Sludge sump dimensions (5m X 7m X 12m)
- Removal, strip, assess and service of sludge pump 2 (if the pump can't be repaired or serviced then a new pump must be purchased)
  - Hazleton submissible sludge pump
  - Model : 50L SSB
  - Serial No.: KDP 004
  - Head: 12 m
  - Flowrate : 5 l/s
- Purchase of new sludge pump 1
  - Hazleton submissible sludge pump
  - Model : 50L SSB
  - Serial No.: KDP 004
  - Head: 12 m
  - Flowrate : 5 l/s
- Installation of new pipe work and valves
  - 6m 100mm galvanized carbon steel pipe
  - 1 X 90° bend
  - 100mm butterfly valve with a lever
- Installation of sludge pump 1 and 2
- Restore electrical power and C&I controls
- Installation of electrical panel roof for rain cover

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### 3.3 Clarifier oil separator plant

- Replacement of all 12 clarifier separator vertical pipes/tubes with stainless steel tubes – 12 of 3m 350mm Schedule 40 stainless steel pipes



- Replacement of 2 all clarifier discharge valves - 50mm Saunders diaphragm valve
- Replacement of all 8 clarifier sludge sump pump supply isolation valves - 100mm Saunders diaphragm valve
- Servicing of both pneumatic pump system
  - ARO pneumatic pump
  - Model : 666150 – 322
  - Serial No.: 10043810
  - Max working pressure: 8 Bar
- Replacement of all filters
  - Ultraspil filter
- Replacement of oil separation compressor system

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- Min pressure output = 1200 kPa
- Max pressure output = 1560 kPa

- Empty and clean oil catchment tank – 2m3 tank
- Replacement of all missing pipework on the oil catchment tank
  - 30m 50mm PVC pipe
  - 10 X 90° elbows
  - 50mm PVC ball valve
- Replacement of all plastic piping and fittings for oil separation system to stainless steel
  - 50mm 35m stainless steel pipe
  - 12 X 90°
- Clean and remove weeds on all 4 coalescence streams
- Draining and inspection of supported propylene plates installed at a 60' angle of inclination in rectangular packs. – Polypropylene coalescers packs (see the picture below)



- Removal all 4 clarifier sludge pumps

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- Hazleton submissible sludge pump
- Model : 50L SSB
- Serial No.: KDP 004
- Head: 12 m
- Flowrate : 5 l/s
  
- Conduct detail technical assessment on the pumps and if found to be serviceable then service or refurbish all 4
- If the pumps are not repairable then purchase 5 new pumps including a spare
- Install all 4 sludge pumps
- Replace all rusty and defective pipe work
  - 102m 100mm galvanised carbon steel pipe
  - 12 X 90°
  - 2 X T-piece
  
  - 22m 50mm galvanized carbon steel pipe
  - 10 X 90°
- Replace all defective isolation gates
  - 4 off 600mm X 250mm stainless steel plates
- Installation of roof across the clarifier plant to prevent rain water from entering electrical panels – 40 X 40 m
- Restoration of electrical power and C&I controls and protections
- Assure all electrical systems and lighting are restored to good working condition

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### 3.4 Thicker

- Installation of the gearbox
- Installation of filters
- Electrical connections
- Refurbishment of the Eimco Thickener Consisting of the following
  - An open reinforced concrete tank, full bridge truss structure, central rotating drive mechanism, submerged rotating rake arms, blades, central feed well baffle, central 45" conical discharge outlet and cone scrapers.
- Bridge Truss structure refurbishment.
- Refurbishment of all submerged rotating arms, blades, baffles, outlets, and scrapers
- Commissioning the plant

### 3.5 Underground pumping system

- Cleaning and removal of underground water and debris
- Removal of both underground centrifugal pumps since the casings are rusted
  - 2 X Warman 4/3 C slurry pumps
- Removal of all rusted and defective piping
  - 6m 150mm galvanized carbon steel pipe
  - 3 X 150 mm 90° bends
  - 2 X 150mm to 80mm reducer
  - 1 X 150mm T-piece
  - 1 x 250mm to 150mm reducer
  - 8m 80mm galvanized carbon steel pipe
  - 2 X 80 mm 90° bends
  - 1 X 80mm T-piece
  - 90m 50mm galvanized carbon steel pipe
  - 14 X 50 mm 90° bends
  - 3 X 50mm T-piece
- Purchase of new centrifugal pumps and piping
  - 2 X Warman 4/3 C slurry pumps
- Installation of pipe work
  - 6m 150mm galvanized carbon steel pipe

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- 3 X 150 mm 90° bends
- 2 X 150mm to 80mm reducer
- 1 X 150mm T-piece
- 1 x 250mm to 150mm reducer
- 8m 80mm galvanized carbon steel pipe
- 2 X 80 mm 90° bends
- 1 X 80mm T-piece
- 90m 50mm galvanized carbon steel pipe
- 14 X 50 mm 90° bends
- 3 X 50mm T-piece
  
- Installation of new centrifugal pumps
  - 2 X Warman 4/3 C slurry pumps
  
- Installation of electric motors
  - 2 X 7.5 Kw Three phase induction motors
  - Voltage : 380V
  - Current : 14,4 A
  - RPM : 1450
  - Serial No.: 1001431406 (Delba Electrical Co)
  
- Replacement of isolation valves
  - 2 X 100mm Saunders diaphragm valves
  - 2 X 80mm Saunders diaphragm valves

### 3.6 Clean and dirty water inlet

- Replacement of all defective sluice gates
  - 3 X 2 m stainless steel plate
  - 0.5 X 3 m stainless steel plate
  - 3 X 3 m stainless steel plate
  - 0.5 X 2 m stainless steel plate
  
- Replacement of all defective screens
  - 1 X 4 m grating

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- 3 X 6 m grating
- 3 X 6 m grating

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### 3.7 Civils

- Repair all damaged concrete walls



- Surface concrete repairs, estimated total area = 30m<sup>2</sup>

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- Surface concrete repairs, estimated total area = 15m<sup>2</sup> including rebars

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#### 4. Acceptance

This document has been seen and accepted by:

Name	Designation
Thando Gxota	Aux Engineering Manager (Act)
Siyanda Malgas	Aux Eng Mechanical Engineer

#### 5. Revisions

Date	Rev.	Compiler	Remarks
February 2024	01	J Lekalakala	SOW – added more technical specifications

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