Moa Pt WWTP

Damage Assessment Report – Stage 2

Prepared for s7(2)(a) – Privacy
Prepared by Beca Limited

17 April 2026

Contents

Appendices

No table of contents entries found.

Extension of Reliance – Stage 1 and 2 of the Services

Dentons Kensington Swan have requested that an extension of reliance is granted over the Moa Point WWTP Damage Assessment – Stage 1 and 2 reports to the following third parties: Wellington Water, Wellington City Council and s7(2)(b)(i) – Com confidence (together the "Extended Reliance Parties").

Beca Ltd will provide this extended reliance on the following terms: (a) there is a total aggregate of all liability to Dentons Kensington Swan and the Extended Reliance Parties of $500,000; (b) any amount for which Beca Limited is liable may only be recovered once as between all parties; (c) there an exclusion of liability for any indirect, special or consequential loss or damage; (d) no liability can arise to the extent that Beca Limited has fulfilled its duty of care and/or contractual obligations to Dentons Kensington Swan. Dentons Kensington Swan agrees to procure the agreement and acceptance of these extended reliance terms from the Extended Reliance Parties in advance of them being provided with a copy of the Moa Point WWTP Damage Assessment – Stage 1 and 2 reports. The expectation is that there will be a deed that formalises this arrangement signed by all parties in due course, in the interim the Moa Point WWTP Damage Assessment – Stage 1 and 2 reports are provided to Dentons Kensington Swan in accordance with the terms of the relevant contract and disclaimers contained in the report.

Assumptions and Limitations

The asset register provided for conducting the damage assessment contains a download of the Moa Pt Asset data available within the Client view of Veolia's Asset Management Portal (VAMP). The data was downloaded to provide to the Beca team undertaking the damage assessment. The original list (without modification) is in the "Original VAMP" tab. The assessment with additional fields is in the "Modified VAMP" tab.

The damage assessment was conducted incorporating information provided by Veolia on the level of submergence and visible indications of the water level reached (e.g. tide lines/debris lines).

Information on duration of submergence was not available to the assessors at the time of performing the assessment.

Information on atmospheric levels of hydrogen sulphide and moisture/humidity were not available to the assessors at the time of performing the assessment.

Our assessors made an experience-based assessment of the damage after visually assessing each relevant asset and taking into account how the flooding could have impacted the function of the asset. Factors such as IP rating, location of grease points, location of cables and termination points, etc informed this assessment.

The assessment was carried out only in areas where equipment was accessible, safe to approach, and physically reachable at the time of inspection.

At the time of assessment power was isolated to most of the site and it was not possible to conduct any testing of an asset's operation or performance. Further investigation and testing would be required to provide more confidence that the asset is expected to function as intended or otherwise.

The asset list provided to the assessors includes assets at differing levels of componentisation e.g. one asset (line-item) in the list may include a single pressure switch, multiple pressure switches or a motor control cubicle with power supplies and other individual components. Comments are provided in the spreadsheet for general indication. Refer to the Stage 2 Damage Assessment Report (this report) for further detail.

The damage assessment summary spreadsheet is provided as an attachment (Attachment A) to the Stage 2 Damage Assessment Report and must be read in conjunction with that report.

Revision History

Revision Nº	Prepared By	Description	Date
1	s7(2)(a) – Privacy	Stage 2 Damage Assessment Report	17/4/26

Document Acceptance

Action	Name	Signed	Date
Prepared by	s7(2)(a) – Privacy		17/4/2026
Reviewed by			17/4/2026
Approved by			17/4/2026
on behalf of	Beca Limited		

1 Introduction

A Beca multi-disciplinary team (mechanical and electrical/controls) undertook an assessment of the Moa St WWTP on 20, 21 and 23 February 2026, in order to assess damage to assets after the plant was flooded on 4 February 2026. The site assessment team consisted of the following team members:

Name	Role
s7(2)(a) – Privacy	Damage Assessment - Control Systems Engineering
	Damage Assessment - Electrical Engineering
	Damage Assessment - Mechanical Engineering
	Damage Assessment - Mechanical Engineering

The Beca team was provided with a full list of assets for the site via Veolia, the treatment plant operator/maintainer (Moa Pt – VAMP Asset data download – 17-2-26.xlsx). Veolia nominated the assets that were likely affected by the flooding to be those in the following areas:

- Odour control room
- Primary sludge pumps technical gallery and mezzanine floor area
- Sludge transport pumps chamber
- Service gallery
- Blower room
- Switchboard room
- UV room (note that the UV room was initially restricted to access, however became available during the site inspection phase, and was included in the assessment).

Veolia provided a plan identifying the Moa Pt WWTP damage zone and these plans are included in Figure 1. This does not include the UV and sludge gallery mezzanine floor that were also partially flooded.

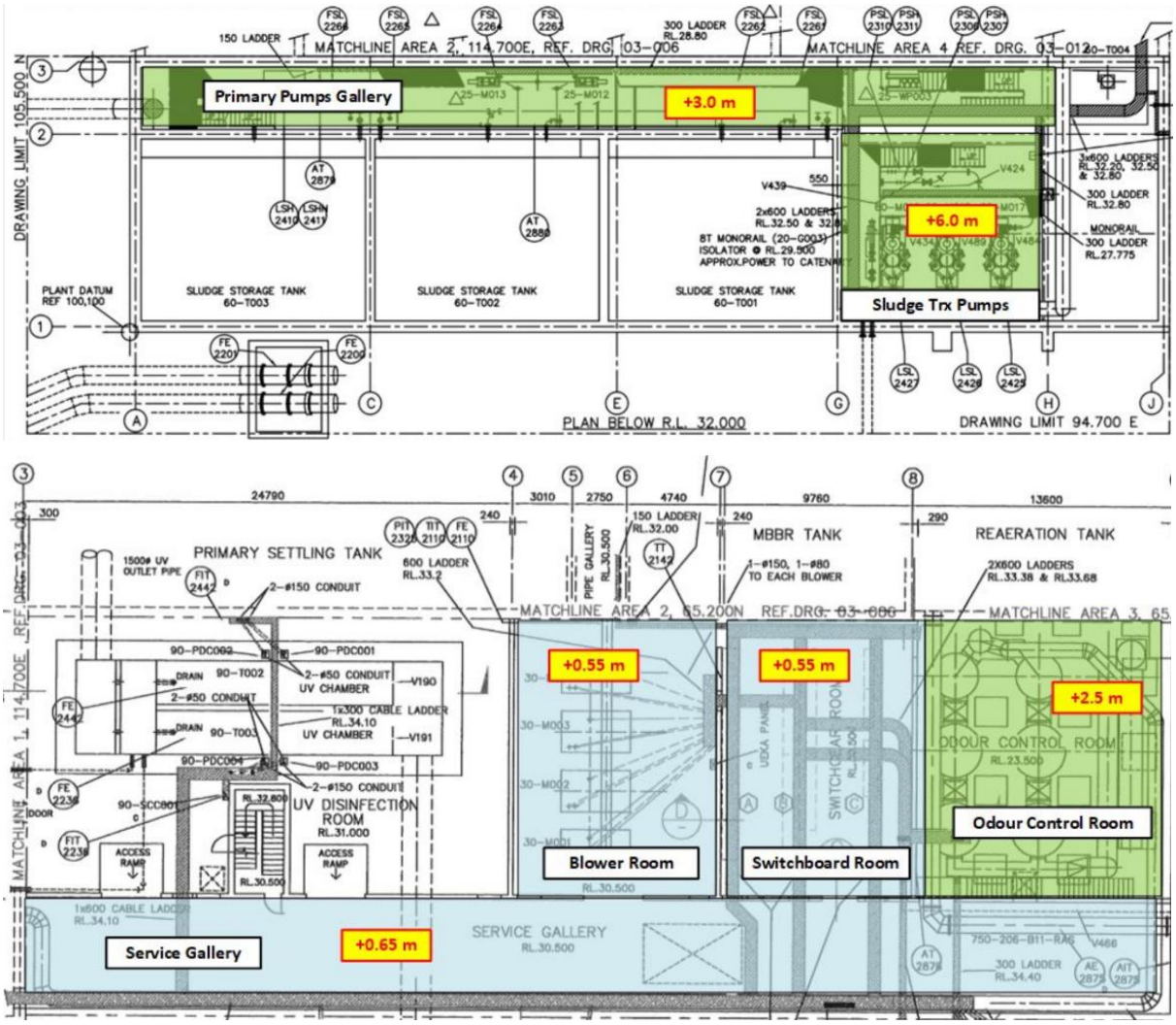

Figure 1 – Moa Pt WWTP Damage Zones (provided by Veolia)

1.1 Report Structure

This report presents a summary of Electrical Assessment Recovery Considerations in Section 2 and contains information relevant to electrical assets through the remainder of this report. These considerations are grouped according to the various electrical asset types/groups present at the site, and provide information relevant to discussion in subsequent sections. Sections 3 through 9 present damage assessment information for assets grouped into the plant areas listed above. Section 10 is a summary of miscellaneous issues including assets which were listed in Veolia's VAMS asset register which were not able to be assessed and a list of revisions to ratings that occurred following the Stage 1 Assessment.

Each report section (3 through 9) includes:

- A description of the asset area and flooding impacts
- A summary of the functional groups and relevant assets and summary of electrical and mechanical damage assessment ratings
- A sub-section for each asset Functional Group (e.g. Section 0 Anti Scalant Dosing System) including:
    - Justification for Mechanical and Electrical Impacts
    - Relevant photo(s)
    - Recovery guidance notes for specific assets

The rating categories used when conducting the Stage 1 damage assessment is shown below

1. None (Expected to function)
2. Minor (Expected to function, potential reduction in remaining life)
3. Moderate (May not function, expected reduction in remaining life)
4. Major (Expected to not function)
5. Unable to assess
6. Exposure to multiple components included against this asset item
7. UNKNOWN
8. N/A (for example where an asset was purely mechanical, such as a valve, the electrical damage assessment is N/A)

Assets with a rating of 6 were noted that additional detail would be provided in this report (Stage 2 Report). These assets typically included one line for an asset that actually has multiple sub-components that may have had different levels of exposure and damage. For example the sludge transfer pumps (see section 5.2.4) where a pump is listed as one asset however the justification for electrical impacts references the associated electrical components, including, but not limited to, motors, cabling, instruments, controls, and junction boxes.

A colour scheme was used throughout this report to make it easier for the reader to understand where these ratings were applied. The mapping of different damage assessment ratings to different colours is shown below in Table 1. These colours were selected to show at a glance the assessed level of damage (green/orange/red) or where detail/explanation is required (grey).

Table 1: Colour scheme and damage assessment ratings used in this report

Rating Colour	General Descriptor	Related Stage 1 Report Damage Assessment Rating
	None	1. None (Expected to function)
	Minor – Moderate	2. Minor (Expected to function, potential reduction in remaining life) 3. Moderate (May not function, expected reduction in remaining life)
	Major	4. Major (Expected to not function)
	Miscellaneous (refer to separate sections for more detail)	5. Unable to assess 6. Exposure to multiple components included against this asset item 7. UNKNOWN 8. N/A

1.2 Report Submission Format

Files and documentation included in this report are stored on an Autodesk Construction Cloud site (LINK). Access to this site is managed by Beca. The full set of files for the Stage 2 Visual Damage Assessment include the following:

- Report document in PDF Format
  - **Moa Pt WWTP Stage 2 Damage Assessment Report_Rev 1.pdf**
- Site Inspection Photos
  - Photos were taken by the assessment team during inspection of the site. The full set of photos (Site Inspection Photos) captured during the inspection are saved on the Autodesk Construction Cloud site (LINK).

- Updated damage assessment spreadsheet (note this is primarily provided in PDF file format, with the native Excel spreadsheet also provided to allow for sorting/filtering etc.)
    - **Attachment A - Damage Assessment Asset List_Rev 2.pdf**
    - **Attachment A - Damage Assessment Asset List_Rev 2.xlsx**
- Site photo summary in PDF format. This was provided with the Stage 1 Assessment as a reference of selected photos. It has not been updated since the Stage 1 report and remains at Revision 1
    - **Attachment B - Stage 1 Damage Assessment Photos_Rev 1.pdf**
- Marked up versions of Moa Pt WWT site elevation drawings in PDF format. The markups were provided with the Stage 1 Assessment to indicatively show the level of flooding in different parts of the plant. They have not been updated since the Stage 1 report and remain at Revision 1
    - **Attachment C - 3631575-SKT-001_2 Moa Section drawing markups_Rev1.pdf**

A summary list of relevant folders on the ACC site is provided below

File	ACC Link
Stage 2 Visual Damage Assessment	https://acc.aus.autodesk.com/docs/files/projects/bd20c3e0-22b5-445e-8b9d-1d84d2a919d5?folderUrn=urn%3Aadsk.wipprodanz%3Afs.folder%3Aco.YZFkE3uSRFa0Y027s1KSmw&viewModel=detail&moduleId=folders
Site Inspection Photos	https://acc.aus.autodesk.com/build/files/projects/bd20c3e0-22b5-445e-8b9d-1d84d2a919d5?folderUrn=urn%3Aadsk.wipprodanz%3Afs.folder%3Aco.Y0FfZ4uFQGeH1OR45j1lyA&viewModel=detail&moduleId=folders
Stage 1 Visual Damage Assessment	https://acc.aus.autodesk.com/docs/files/projects/bd20c3e0-22b5-445e-8b9d-1d84d2a919d5?folderUrn=urn%3Aadsk.wipprodanz%3Afs.folder%3Aco.P_joDpNXS-SYVrWR6lVW0g&viewModel=detail&moduleId=folders

2 Electrical Assessment Recovery Considerations

2.1 Inspection Basis

A site inspection of electrical equipment in affected wastewater treatment facility areas was undertaken following the flooding event. The assessment was limited to visual inspection only and was conducted in locations where access was considered safe at the time of inspection. No equipment was dismantled and no electrical or functional testing was performed as part of this assessment.

Due to the nature of wastewater flooding, equipment in affected areas may have been exposed to standing water, elevated humidity, suspended solids, and potentially corrosive gases such as hydrogen sulfide (H_2S). These conditions may contribute to corrosion, contamination of electrical contacts, degradation of insulation systems, potential damage to electronic circuitry and increased likelihood of failure where equipment was energised at the time of flooding (for example, electrical short-circuiting).

2.2 IP Rating

Devices and equipment affected by the flooding were subjected to full immersion, partial immersion, or prolonged exposure to water and moisture. Although some devices are manufactured with defined IEC standard Ingress Protection (IP) ratings, it cannot be confidently concluded that the affected equipment remains safe or reliable for continued operation.

Many IP ratings are not designed for full immersion, extended submersion, or contact with contaminated water, including wastewater. Furthermore, IP ratings represent performance under controlled conditions and do not guarantee protection under flood conditions or exposure to aggressive environments.

It should also be noted that the effectiveness of IP protection can degrade over time due to ageing, wear, and environmental exposure. In addition, equipment that has been opened for maintenance, servicing, or modification may no longer retain its original factory sealing, further reducing its resistance to water and moisture ingress.

As a result, the condition, safety, and functional integrity of the affected devices cannot be assured without detailed inspection, testing, or replacement, regardless of the stated IP rating.

As shown in Figure 2 below, an IP rating of IPX8 is required to protect from the prolonged submergence experiences during the flooding.

For assets where the rating is provided to a NEMA scale, the equivalent IP rating has been used.

Figure 2: IP Ratings guide

2.3 Electrical Asset Types

The following sections outline diagnostic inspections and tests that may be considered to support recovery and return-to-service evaluation of affected equipment. These actions are presented as possible recovery assessment measures only, and further engineering evaluation and testing may be required to support repair, refurbishment, or replacement decisions.

Relevant industry guidance includes:

- NEMA-GD-1 Evaluating Water-Damaged Electrical Equipment
- National Fire Protection Association – NFPA 70B Electrical Equipment Maintenance
- IEEE – IEEE 43 Insulation Resistance Testing of Rotating Machinery
- International Electrotechnical Commission – IEC 61800 Adjustable Speed Drive Systems

2.3.1 Switchboards and Electronic Components

The switchboard has been partially submerged during a wastewater flooding event. This assessment is limited to visual inspection only, and no intrusive inspection or electrical testing has been undertaken at this stage.

Based on visual observation alone, the structural and electrical integrity of the switchboard cannot be determined. Floodwater ingress, particularly in a wastewater environment, may result in internal contamination, corrosion, and degradation of insulation and protective components, which may not be visible externally.

Accordingly, no conclusion is made regarding the serviceability or safety of the switchboard.

To establish the condition of the equipment, it is recommended that the switchboard be:

- Isolated and kept out of service until further assessment is completed
- Subject to detailed inspection, including disassembly where required
- Cleaned and dried in accordance with manufacturer guidance
- Tested by a suitably qualified person, including as a minimum:
    - Insulation Resistance (IR) testing
    - Verification of protective device operation
    - Additional electrical tests as deemed necessary

Any decision regarding reuse, repair, or replacement should be made based on the outcomes of detailed inspection and testing, and in accordance with applicable standards, manufacturer recommendations, and asset owner requirements.

Electronic components within switchboards and control panels may be susceptible to moisture ingress, contamination deposits, and corrosion of conductive surfaces following exposure to floodwater. Residual contaminants may affect insulation integrity and electrical reliability over time.

To support evaluation of equipment condition and potential recovery, the following activities may be considered:

- Detailed visual inspection for contamination, corrosion, or residue on terminals, bus supports, and printed circuit boards
- Cleaning and controlled drying of affected internal compartments where accessible
- Insulation resistance testing of internal wiring and circuits
- Functional verification of protection relays and electronic modules
- Verification of communication and control circuits

Industry guidance such as NEMA GD-1[1] notes that certain electronic devices exposed to water may require replacement depending on contamination level and equipment condition. Refer to section 3 of the NEMA guide for a table of recommendations and requirements for various categories of electrical equipment that has been subject to water damage.

2.3.2 Motors

Electric motors located in flooded or high-humidity areas may experience moisture ingress into stator windings and termination boxes, corrosion of internal components, and contamination of bearings. Reduced insulation resistance may occur if moisture remains trapped within the windings.

[1] Refer to NEMA GD-1: https://www.nema.org/docs/default-source/secure-document-library/nema-gd-1-2016-evaluating-water-damaged-electrical-equipment-guide.pdf?sfvrsn=7034f9b6_2

For recovery assessment purposes, the following diagnostic tests may be considered:

- Insulation resistance testing (IR) of stator windings (winding to winding and winding to earth)
- Polarization Index (PI) testing to evaluate insulation condition
- Winding resistance measurement to confirm electrical integrity
- Bearing inspection and lubrication condition verification
- Operational testing with vibration monitoring during controlled startup

These practices align with IEEE 43 guidance for rotating machinery and vibration evaluation methods described in ISO 10816 / ISO 20816.

2.3.3 Instruments (Transmitters, Sensors and Field Devices)

Field instrumentation exposed to flooding may be vulnerable to moisture ingress through cable glands, corrosion of electrical connectors, and contamination of sensing elements

To assist recovery evaluation, the following inspections and checks may be considered:

- Visual inspection of instrument housings, cable entries, and connectors
- Signal loop verification (e.g., 4–20 mA loop checks)
- Functional testing of measurement outputs
- Calibration verification for pressure, level, flow, and analytical instruments where applicable

These actions are consistent with general industrial instrumentation maintenance and calibration practices.

2.3.4 Variable Speed Drives (VSD)

Variable Speed Drives contain power electronics, control boards, and semiconductor components that may be particularly sensitive to moisture and contamination following flooding events. Condensation or conductive residue inside drive enclosures may affect insulation performance or electronic reliability.

For evaluation of affected drives, the following activities may be considered:

- Internal visual inspection of power modules, control boards, and terminals
- Cleaning and drying of internal compartments where accessible
- Insulation resistance testing of input and motor output circuits
- Verification of cooling fan operation and ventilation paths
- Functional testing and controlled commissioning checks

Relevant guidance for such equipment can be found within IEC 61800 series standards and NEMA GD-1 recommendations.

2.3.5 Bus Bars within Switchboards

Bus bars and associated connections within switchboards may be affected by surface corrosion, contamination deposits, or reduced contact integrity following exposure to floodwater, humid conditions and H2S. These conditions may increase electrical resistance at joints and lead to localized heating during operation.

To support evaluation prior to energization, the following checks may be considered:

- IR Testing
- Visual inspection for corrosion, contamination, or discoloration
- Cleaning of conductive surfaces where appropriate
- Contact resistance measurement across bolted joints
- Thermographic inspection after re-energization

These inspection and testing practices are commonly referenced in NFPA 70B and NETA maintenance testing guidance.

2.3.6 Power Outlets

Power outlets located in flooded areas may retain moisture or contamination within internal contacts and insulation materials, potentially affecting electrical safety and reliability.

For recovery assessment, the following checks may be considered:

- Visual inspection for contamination or corrosion
- Insulation resistance testing of associated circuits
- Verification of protective earthing continuity
- Functional verification of outlet operation including earth leakage if fitted

Industry guidance such as NEMA GD-1 indicates that receptacles exposed to floodwater may require replacement depending on the level of contamination and equipment condition.

2.3.7 Switches (Local Electrical or Control Switches)

Electrical switches located within flooded areas may experience contact corrosion, contamination, or mechanical degradation due to prolonged exposure to moisture and wastewater residues.

For recovery evaluation, the following inspections and tests may be considered:

- Visual inspection for corrosion, contamination, or physical damage
- Mechanical operation verification
- Contact resistance measurement where accessible
- Functional electrical testing under controlled conditions

Maintenance and inspection guidance for such devices is referenced within NFPA 70B, while NEMA GD-1 notes that some wiring devices exposed to floodwater may require replacement depending on condition.

2.3.8 Cables

Following the wastewater flooding event and the potential partial or full submersion of electrical cables, exposure to contaminated water may affect the insulation system and long-term reliability of the cable assemblies. Where cable ends or terminations were submerged, there is a risk that water may have entered the cable and migrated along the insulation system. This moisture tracking can adversely affect the insulation and may promote corrosion of the copper conductors over time.

In addition, any damage to cable sheaths or outer jackets may provide a pathway for water ingress into the cable construction. Prolonged moisture presence within the cable may result in insulation degradation and reduced long-term reliability, even where no immediate functional failure is evident.

Also, where evaluation of the affected cable systems is considered, typical industry practices may include visual inspection of cable jackets/sheaths, terminations, splices, and associated enclosures, together with electrical testing such as insulation resistance measurements and conductor continuity verification. Depending on cable voltage class and system criticality, additional diagnostic testing methods may include dielectric withstand or Very Low Frequency (VLF) testing. For medium-voltage cable systems, diagnostic techniques such as dissipation factor (tan delta) testing and partial discharge measurements are also commonly used to assess insulation condition and identify potential moisture ingress or degradation.

Industry guidance for these testing methods is provided in recognized electrical testing and maintenance standards, including but not limited to:

- IEEE Std 400 – Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
- IEEE Std 400.2 – Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)
- IEEE Std 400.3 – Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment
- IEEE Std 400.4 – Guide for Field Testing of Shielded Power Cable Systems Using Dissipation Factor (Tan Delta)
- NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- NETA MTS – Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems
- NFPA 70B – Standard for Electrical Equipment Maintenance

These documents provide generally accepted industry guidance describing inspection and testing methods that may be used to evaluate the condition of electrical cable systems and associated equipment following abnormal environmental exposure such as flooding or water intrusion.

2.4 Closing Note

At the time of inspection, floodwater was no longer present at the site. All observations and assessments contained within this report are therefore based on visible high-water level marks and associated physical evidence. It is noted that high-water level marks typically represent conditions where water levels were relatively stable over a period; however, transient higher water levels, including short-duration surges or wave action, may have occurred above the recorded high-water level and may not be fully reflected in the visible marks. Accordingly, inferred exposure levels represent a minimum assessment of flood impact.

The recovery actions and guidance outlined in this report represent indicative diagnostic and evaluation measures to support consideration of asset recovery following flooding exposure. As the assessment was limited to visual inspection only, additional inspection, testing, and detailed condition assessment may be required to support decisions regarding equipment cleaning, refurbishment, continued serviceability, or replacement.

3 Damage Assessment Findings – Odour Control Room

3.1 Asset Area and Flooding Impacts

The location of the Odour Control Room is shown below in Figure 3.

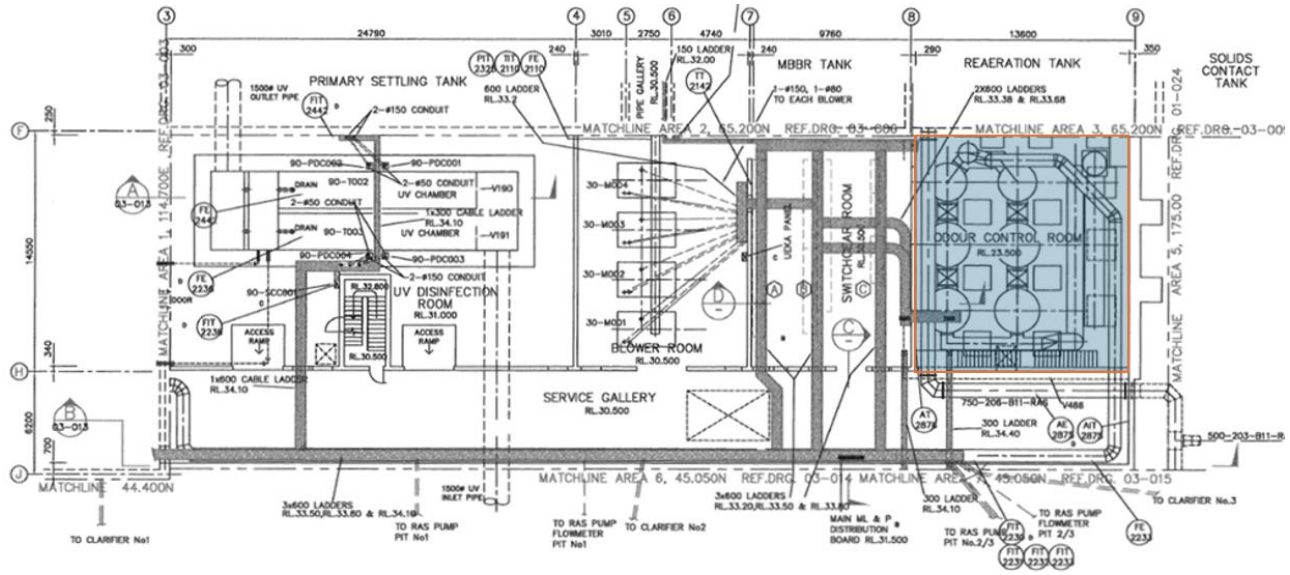

Figure 3: Location of the Odour Control Room

Beca was advised that this location was submerged to a level of 2.5m above floor level. This impact is shown indicatively below in Figure 4.

Figure 4: Odour Control Room indication of the approximate level to which assets were submerged (Scrubber recirculation pumps, (L), Scrubber extraction fans (R))

3.2 Assets

All assets in the Odour Control Room are grouped by VAMP (asset register) Functional Group and summarised in Table 2 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 2: Summary of assets located in the Odour Control Room grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Anti Scalant Dosing System (Storage, Piping, Pumping, Valving)	Anti Scalant Storage Tank		
	All Anti Scaling Plastic Pipework		
	Anti Scaling Pump		
	All Anti Scaling Valves		
Foul Air Ducting & Damping	V801 Odour Control Room Foul Air Damper		
	Foul Air Ducting		
Neutralisation Analysis/Measurement	Flow Switches, Pressure Indicators, Tank Level Indicator Transmitter		
	AT-2856 Neutralisation pH Indicator Transmitter		
Neutralisation System (Piping, Pumping, Valving)	All Neutralisation Pipework		
	Neutralisation Discharge Pumps (2)		
	All Neutralisation Valves		
Odour Control Air Extraction	Extraction Fans (3)		
Odour Control Analysis/Measurement	All Odour Control Pressure Switches		
	All Odour Control Position Switches		
	AT-2860/2862 Odour Scrubber A Stage 2 pH/ORP indicator Transmitter		
	pH, pH/ORP, Indicator Transmitter, Chlorine Indicator, Flow indicator		
	All Odour Control Pressure Indicators		
	All Odour Control Level Switches		
	Odour Scrubber Inlet/Outlet H2S Indicator Transmitter		
Odour Control Ducting	Extraction Fan 1 Actuated Damper (3)		
	All Other Odour Control Dampers, Ducting, Scrubber outlets		
Odour Control Plastic Pipework and Valving	All Odour Control Pipework		
	All Other Odour Control Valves		
	All Actuated Odour Control Valves		
Odour Scrubbing A & B	Odour Scrubber A Recirculation Pumps (6)		
	Odour Scrubber A Stage 1 – Acid, Stage 2 - Caustic & Hypo, Stage 3 - Caustic		
	Odour Scrubber B Recirculation Pumps (6)		
	Odour Scrubber B Stage 1 – Acid, Stage 2 - Caustic & Hypo, Stage 3 - Caustic		
Safety Showers	Odour Control Safety Shower/Eyewash Station		

Several smaller Functional Groups have been combined to simplify the report. Note that there is a VAMP Functional Group “Neutralisation Storage” which includes only the neutralisation storage tank. This is a structural asset and is thus not relevant for mechanical and electrical assessment.

Each functional group and its component assets are discussed in greater detail below.

3.2.1 Anti Scalant Dosing System

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295101	Anti Scalant Storage Tank	1. None (Expected to function)	4. Major (Expected to not function)
E-00295104	All Anti Scaling Plastic Pipework	1. None (Expected to function)	8. N/A
E-00295102	Anti Scaling Pump	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295103	All Anti Scaling Valves	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

All components of the anti scalant dosing system including level switches and junction box (refer to electrical impacts) were fully submerged. The anti scalant storage tank and pipework are of plastic construction. As the storage tank was open, water ingress would have occurred. The tank and pipework are expected to remain functional with no notable impact on asset life.

The valves are a combination of PVC and stainless steel construction. The stainless steel valves had moderate corrosion, and while the submergence event may result in minor impacts on asset life, given their existing condition any further deterioration is unlikely to materially reduce the remaining asset life.

The dosing pump is likely to have water ingress to the motor, as a result, it is not expected to be functional.

Justification for Damage Rating - Electrical Impacts

The anti-scalant storage tank was observed to be below the high-water level. Level switches associated with the tank were identified as having been fully submerged and are therefore unlikely to operate as intended. The associated level switch junction box was located within the flooded area and is considered at risk of water ingress.

The anti-scalant dosing pump was observed to have been fully submerged during the flooding event and is not expected to be functional without assessment or intervention.

Photos

Figure 5: Anti Scalant Dosing System (L) and Anti Scalant Dosing Pump (R)

Recovery Guidance (Indicative)

The following guidance is provided for consideration of asset recovery, with reference to Section 2 of this report. The actions noted reflect observed exposure conditions and typical recovery pathways where continued use is being evaluated.

- Replacement of flooded level switches, or inspection and testing where reuse is being considered.
- Replacement of the affected junction box and associated wiring, or verification through inspection and testing.
- Replacement of the anti-scalant dosing pump, or assessment and testing if reuse is proposed.
- Removal of debris and residual contamination from the tank and surrounding areas to reduce the risk of further deterioration.

3.2.2 Foul Air Ducting & Damping

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295341	V801 Odour Control Room Foul Air Damper	1. None (Expected to function)	8. N/A
E-00295356	800-375-D41-VA Switchgear Room And Odour Control Room Foul Air Ducting	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The Foul Air ducting and dampeners are primarily of FRP construction and located above the water submergence level. The ducting and dampeners are expected to remain functional with no notable impact on asset life.

Justification for Damage Rating - Electrical Impacts

Mechanical assets only - not assessed for electrical impacts.

Photos

Figure 6: Foul Air Ducting

Recovery Guidance

The following guidance is provided for restoration of function:

1. N/A

3.2.3 Neutralisation Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295369	All Neutralisation Flow Switches	8. N/A	4. Major (Expected to not function)
E-00295368	All Neutralisation Pressure Indicators	8. N/A	4. Major (Expected to not function)
E-00295367	LIT-2420 Waste Neutralisation Holding Tank Level Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295108	AT-2856 Neutralisation pH Indicator Transmitter	8. N/A	7. UNKNOWN

Justification for Damage Rating - Mechanical Impacts

Only one of two pressure indicators of the chemical neutralisation system was installed at the time of inspection. The installed pressure indicator was observed to be in very poor condition and likely not functioning at the time of submergence. Due to the existing asset condition, it is unlikely that further asset damage due to submergence has occurred.

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Pressure indicators associated with the chemical neutralisation system were identified within the inundation area and are unlikely to have been functional at the time of submergence. As above, several indicators were observed to be either in poor condition or missing prior to the flooding event. Based on the pre-existing condition of these assets, additional damage attributable to submergence is considered unlikely.

Asset observations were as follows:

- E-00295367: Observed to have been fully submerged.
- E-00295368 and E-00295369: Observed to be in poor condition prior to the flooding event.
- E-00295108: Not observed; no comment provided.

Photos

Figure 7: Neutralisation system pressure indicator in poor condition

Recovery Guidance

The following guidance is provided to support consideration of asset recovery or reuse, based on observed conditions and existing asset state. This guide is provided with reference to Section 2 of this report.

- Replace pressure indicators that were submerged where restoration of system monitoring is being considered.
- Inspect and verify function of any retained pressure indicators where continued use is being evaluated.
- Confirm pressure monitoring requirements for the chemical neutralisation system, noting pre-existing asset condition and availability.

3.2.4 Neutralisation System

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW002127	55-P035 Neutralisation Discharge Pump 1	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)
E-WEW002128	55-P036 Neutralisation Discharge Pump 2	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)
E-00295424	All Neutralisation Pipework	1. None (Expected to function)	8. N/A
E-00295423	All Neutralisation Valves	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The Neutralisation Discharge pumps were stainless steel submersible pumps. These pumps are intended for long term submersion with the depth of submergence within limits of the pump operation and are expected to remain mechanically functional with no notable impact on asset life. At the time of inspection, only one pump was installed within the pump well and two additional pumps were stored nearby.

The Neutralisation pipework and valving are of PVC construction. These assets were fully submerged and are expected to remain functional with no notable impact on asset life.

Justification for Damage Rating - Electrical Impacts

One pump was installed within the pump well and two pumps were observed to be decommissioned at the time of inspection. Site personnel advised that the pumps were reportedly operating during the flooding event and subsequently ceased operation; however, this information could not be independently verified at the time of assessment. As such, operational status during the event and the cause of failure cannot be confirmed based on observations alone.

Photos

Figure 8: Neutralisation Discharge Pumps (L) and installed Neutralisation Discharge Pump in the well (R)

Figure 9: Neutralisation system pipework

Recovery Guidance

The following guidance is provided for consideration of asset recovery, with reference to Section 2 of this report.

- Inspection and condition assessment of the pumps to determine the extent of any flood-related impact.
- Functional testing where reuse is being considered, noting reported operational history and exposure conditions.
- Replacement of the pumps where inspection or testing indicates continued operation cannot be reliably supported.

3.2.5 Odour Control Air Extraction

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294607	2-55-F001 Scrubber Extraction Fan 1	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)
E-00294608	2-55-F002 Scrubber Extraction Fan 2	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00294609	2-55-F003 Scrubber Extraction Fan 3	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Scrubber extraction fan housings and impellers are fibre reinforce plastic (FRP). No notable damage surface damage was identified on fans 1 and 3, however fan 2 has some minor damage (Figure 8) that may have resulted in water ingress of the FRP and lead to delamination (hence fan 2 has a worse mechanical rating in the stage 1 report).

Extraction fan shafts may experience some minor corrosion due to the submergence event, however this is likely to be minimal given the existing operating environment exposure and is not expected to affect fan operation.

Extraction fans have pillow block bearings and water ingress is likely to have occurred based on submergence and is expected to result in reduced bearing life. Extraction Fan 1 did not have bearings installed at the time of inspection. Bearing materials typically have low corrosion resistance and require oil or grease for lubrication and protection from corrosion. In the short term the bearings would continue to function, however these should be cleaned and regreased to minimise impacts of corrosion or alternatively commence planning for replacement.

Extraction fans are expected to be functional with some reduced life.

Justification for Damage Rating - Electrical Impacts

Based on the observed high-water level marks, it is considered that all extraction fan electric motors were fully submerged during the flooding event. Associated power cabling and termination boxes were also located below, or near, the recorded water level and are therefore considered to have been exposed to floodwater or moisture.

It is noted that water ingress can occur into electrical cables through exposed terminations or damaged insulation and may migrate internally along the cable length. Sections of cable tray were observed to be installed close to the high-water level, indicating potential moisture exposure to supported cabling.

Photos

Figure 10: Odour control extraction fans indicative level of submergence (L) and Scrubber Extraction Fan 2 housing damage where ingress is likely to occur (R)

Figure 11: Scrubber Extraction Fan Motor Cables and Terminal Box (L) and Scrubber Extraction Fan 2 Bearing (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replacement of extraction fan electric motors, noting inferred full submergence based on high-water level evidence.
- Inspection and assessment of termination boxes and cable ends to evaluate the potential for water ingress.
- Electrical testing of cables where reuse is being considered, noting the potential for internal moisture migration.
- Inspection or testing of cabling installed on trays located near the high-water level where moisture exposure is suspected.
- Replacement of pillow block bearings

3.2.6 Odour Control Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295094	All Odour Control Pressure Switches	8. N/A	4. Major (Expected to not function)
E-00295097	All Odour Control Position Switches	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00295084	AT-2860/2862 Odour Scrubber A Stage 2 pH/ORP indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295083	AT-2850 Odour Scrubber A Stage 1 pH Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295087	AT-2852 Odour Scrubber B Stage 1 pH Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295088	AT-2864/2866 Odour Scrubber B Stage 2 pH/ORP indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WEW002136	AT-2870 Odour Scrubber A Stage 3 pH indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WEW002135	AT-2872 Odour Scrubber B Stage 3 pH indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00296894	AT-2878 Odour Scrubber Room Chlorine Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295091	FT-2250 Odour Scrubber Outlet Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295096	All Odour Control Pressure Indicators	1. None (Expected to function)	8. N/A
E-00295093	All Odour Control Level Switches	8. N/A	4. Major (Expected to not function)
E-00295092	AT-2858 Odour Scrubber Outlet H2S Indicator Transmitter	8. N/A	7. UNKNOWN
E-WEW002147	AIT-2854 Odour Scrubber Inlet H2S Indicator Transmitter	7. UNKNOWN	7. UNKNOWN

Justification for Damage Rating - Mechanical Impacts

Five pressure gauges of the odour control system recirculation pumps were not installed at time of inspection. The installed seven pressure gauges were in fair condition and water ingress is likely to have occurred and would lead to premature failure.

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Almost all instruments located within the scrubber room were assessed as having been fully submerged for an extended period during the flooding event, based on their installed elevations relative to the observed high-water level. The majority of associated transmitters were observed to contain water, indicating likely internal water ingress.

Odour fan dampers within the scrubber room were identified as being installed above the high-water level; however, associated control devices were located below the flood level and are considered to have been submerged.

It is also noted that several assets could not be positively identified due to missing or detached asset tags. As a result, confirmation of exposure condition and asset identification for these items could not be undertaken at the time of inspection.

Photos

Figure 12: Scrubber analyser transmitter (L and R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replacement of instruments and transmitters that were subjected to extended submergence, where reliable operation is required.
- Inspection and testing of instruments installed near the high-water level where reuse is being considered, noting potential moisture exposure.
- Inspection, testing, or replacement of control devices associated with odour fan dampers that were submerged.
- Further assessment of unidentified assets once asset tagging and identification can be confirmed.

3.2.7 Odour Control Ducting

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295078	V-8195 Scrubber Extraction Fan 1 Actuated Damper	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)
E-00295079	V-8196 Scrubber Extraction Fan 2 Actuated Damper	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)
E-00295080	V-8197 Scrubber Extraction Fan 3 Actuated Damper	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)
E-00295081	All Other Odour Control Dampers	1. None (Expected to function)	8. N/A
E-00295073	Duct From Scrubber A Stage 1 to Stage 2	1. None (Expected to function)	8. N/A
E-00295075	Duct From Scrubber A Stage 2 to Stage 3	1. None (Expected to function)	8. N/A
E-00295074	Duct From Scrubber B Stage 1 to Stage 2	1. None (Expected to function)	8. N/A
E-00295076	Duct From Scrubber B Stage 2 to Stage 3	1. None (Expected to function)	8. N/A
E-00295072	Foul Air Ducting to Scrubber Inlets Header	1. None (Expected to function)	8. N/A
E-00295077	Scrubber Outlets to Fans Manifold	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

Foul air ducting to the scrubbers and between each scrubber stage and ducting of the extraction fans were approximately at the observed high-water level and were partially submerged. The ducting was of FRP construction, damage to the ducting is unlikely to have occurred.

The extraction fan dampeners and actuators were located above the water level. The dampeners are primarily of FRP construction and are expected to remain mechanically functional with no notable impact on asset life.

Justification for Damage Rating - Electrical Impacts

Scrubber extraction fan dampers were identified as being installed above the observed high-water level. However, due to their proximity to the inundation area, these components are considered to have been

exposed to elevated moisture and humidity during the flooding event. As a result, there remains a potential risk of water-related degradation and/or reduction in service life.

Local control switches associated with the scrubber extraction fan system were observed to be located below the high-water level and are considered to have been submerged. Based on this exposure, water ingress to these devices is considered likely.

The dampers were not readily accessible at the time of inspection; accordingly, close visual inspection of internal components and operating mechanisms could not be undertaken, and condition could not be confirmed based on observation alone.

Photos

Figure 13: Actuated odour control damper (L) and local control station (R)

Figure 14: Odour control ducting

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued serviceability, with reference to Section 2 of this report.

- Inspection of scrubber extraction fan dampers where access can be established, focusing on signs of corrosion, moisture ingress, or restricted operation.
- Functional testing of damper operation where continued use is being considered.
- Inspection, testing, or replacement of local control switches that were subjected to submergence, noting the likelihood of water ingress.
- Further assessment to determine whether observed exposure conditions may reasonably impact long-term reliability or service life.

3.2.8 Odour Control Plastic Pipework and Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295098	All Odour Control Pipework	1. None (Expected to function)	8. N/A
E-00295100	All Other Odour Control Valves	1. None (Expected to function)	8. N/A
E-00295099	All Actuated Odour Control Valves	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

The odour control pipework and manual valving of the recirculation pumping system are of PVC and ABS construction. These assets were fully submerged and are expected to remain functional with no notable impact on asset life.

The scrubber make-up solenoid valve was fully submerged during the flooding event, if water ingress has occurred this is likely to lead to corrosion of internal components and result in premature failure of the valves.

Justification for Damage Rating - Electrical Impacts

Scrubbers make-up solenoid valves were assessed as having been fully submerged during the flooding event, based on their installed elevation relative to the observed high-water level. Associated electrical junction boxes serving these valves were also located below the water level and are considered to have been fully submerged.

Given the extent of submergence, both the solenoid valves and associated junction boxes are considered to have been exposed to floodwater, with an increased likelihood of internal water ingress. As a result, operational condition and ongoing reliability cannot be confirmed based on visual inspection alone.

Photos

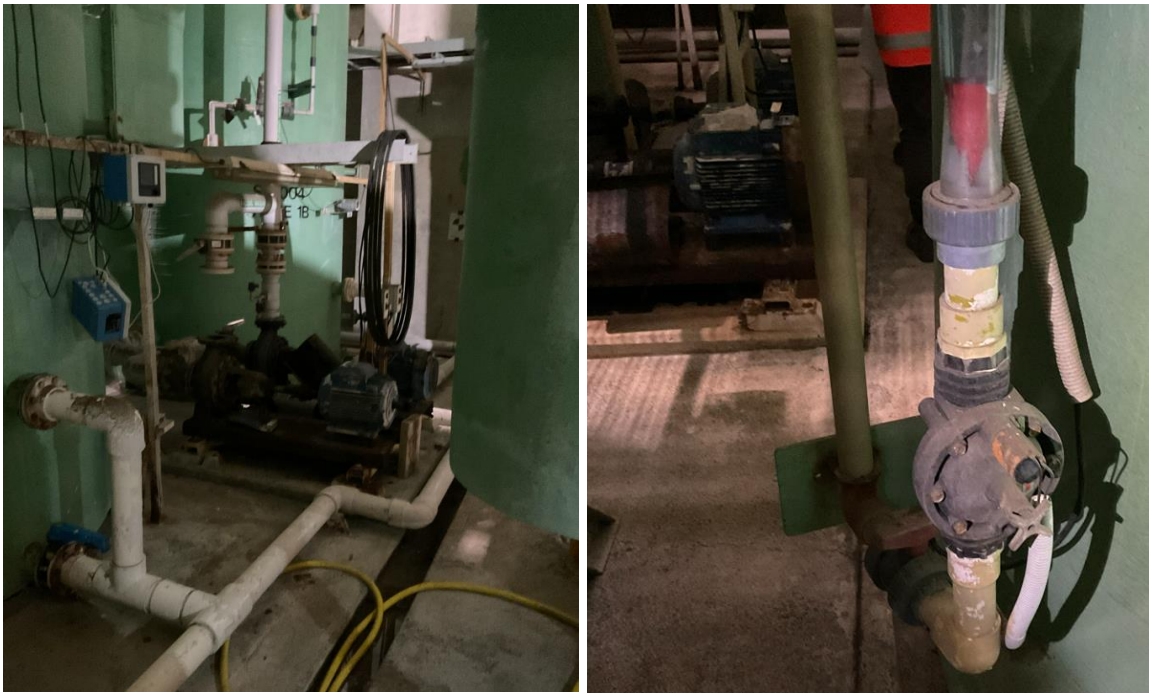

Figure 15: Odour scrubber piping and valves (L and R)

Figure 16: Odour scrubber piping and valves (electrical connection boxes)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replacement of scrubber make-up solenoid valves that were subjected to full submergence, where continued functionality is required.
- Inspection and testing associated electrical junction boxes to assess the extent of potential water ingress. Subject to results, replacement may be required.
- Functional testing of retained components where reuse is being considered, noting the exposure conditions and associated risk.

3.2.9 Odour Scrubbing (A & B)

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295060	2-55-P003 Odour Scrubber A Stage 1 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295061	2-55-P004 Odour Scrubber A Stage 1 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295062	2-55-P005 Odour Scrubber A Stage 2 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295063	2-55-P006 Odour Scrubber A Stage 2 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295064	2-55-P007 Odour Scrubber A Stage 3 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295065	2-55-P008 Odour Scrubber A Stage 3 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295066	2-55-P009 Odour Scrubber B Stage 1 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295067	2-55-P010 Odour Scrubber B Stage 1 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295068	2-55-P011 Odour Scrubber B Stage 2 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295069	2-55-P012 Odour Scrubber B Stage 2 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295070	2-55-P013 Odour Scrubber B Stage 3 Recirculation Pump 1	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295071	2-55-P014 Odour Scrubber B Stage 3 Recirculation Pump 2	4. Major (Expected to not function)	4. Major (Expected to not function)
E-00295054	2-55-SB001 Odour Scrubber A Stage 1 – Acid	1. None (Expected to function)	8. N/A
E-00295055	2-55-SB002 Odour Scrubber A Stage 2 - Caustic & Hypo	1. None (Expected to function)	8. N/A
E-00295056	2-55-SB003 Odour Scrubber A Stage 3 – Caustic	1. None (Expected to function)	8. N/A
E-00295057	2-55-SB004 Odour Scrubber B Stage 1 – Acid	1. None (Expected to function)	8. N/A
E-00295058	2-55-SB005 Odour Scrubber B Stage 2 - Caustic & Hypo	1. None (Expected to function)	8. N/A
E-00295059	2-55-SB006 Odour Scrubber B Stage 3 – Caustic	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

All six odour scrubbers are of FRP construction and were partially submerged. There was no surface damage of the FRP identified during the inspection with no indication of water ingress. Damage to the scrubbers is unlikely to have occurred and are expected to be functional.

All recirculation pumps were fully submerged. The existing conditions of the pumps appeared to be in either fair or poor condition, some pumps appeared to have not been in service with disconnected pipework and shaft couplings. The pump ends may experience some additional corrosion due to the submergence event, however this unlikely to have a notable impact on pump life given the existing asset conditions and operating environment exposure.

Justification for Damage Rating - Electrical Impacts

Recirculation pump electric motors were assessed as having been fully submerged during the flooding event, based on their installed elevation relative to the observed high-water level. Local control devices associated with these pumps were also located below the recorded flood level and are considered to have been fully submerged.

Given the extent of exposure, both the pump motors and associated local controls are considered to have been subjected to floodwater, with an increased likelihood of internal water ingress. As a result, operational condition and continued serviceability cannot be confirmed based on visual inspection alone.

Photos

Figure 17: Odour Scrubber Recirculation Pump (Stage 3B)

Figure 18: Odour Scrubber Recirculation Pump (Stage 2A)

Figure 19: Odour Scrubber Recirculation Pump (Stage 1B)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replacement of recirculation pump motors that were subjected to full submergence, where reliable operation is required.
- Inspection, testing, or replacement of local control devices exposed to floodwater, noting the likelihood of water ingress.
- Functional testing and condition assessment of retained components where reuse is being considered, considering the inferred extent of flooding exposure.

3.2.10 Safety Showers

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295107	Odour Control Safety Shower/Eyewash Station	4. Major (Expected to not function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The safety shower and eyewash station is of stainless steel construction and was fully submerged. Contamination of the safety shower and eyewash station is likely to have occurred. Heavy corrosion was observed on the eyewash fittings and the shower; the level of corrosion is likely to have been present prior to submersion.

Justification for Damage Rating - Electrical Impacts

No electrical components associated with this asset.

Photos

Figure 20: Safety shower and eyewash station

Recovery Guidance

The following guidance is provided for restoration of function:

1. Clean and test safety shower and eyewash station.
2. Replace safety shower and eyewash if flowrates achieved are not in accordance with national standards (e.g. AS4775:2007 or equivalent).

4 Damage Assessment Findings – Primary Sludge Pumps Technical Gallery and Mezzanine Floor

4.1 Asset Area and Flooding Impacts

The location of the Primary Sludge Pumps Technical Gallery is shown below in Figure 21.

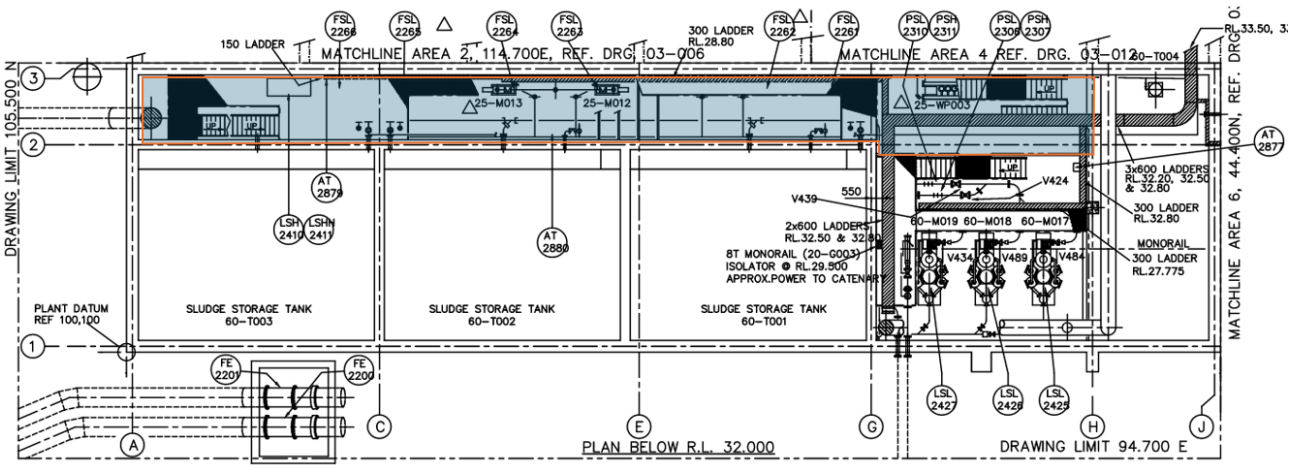

Figure 21: Location of the Primary Sludge Pumps Technical Gallery

The location of the Mezzanine Floor at the end of the sludge gallery is shown below in Figure 22. Most assets on the Mezzanine Floor where a part of the SMF project and are not covered in this report.

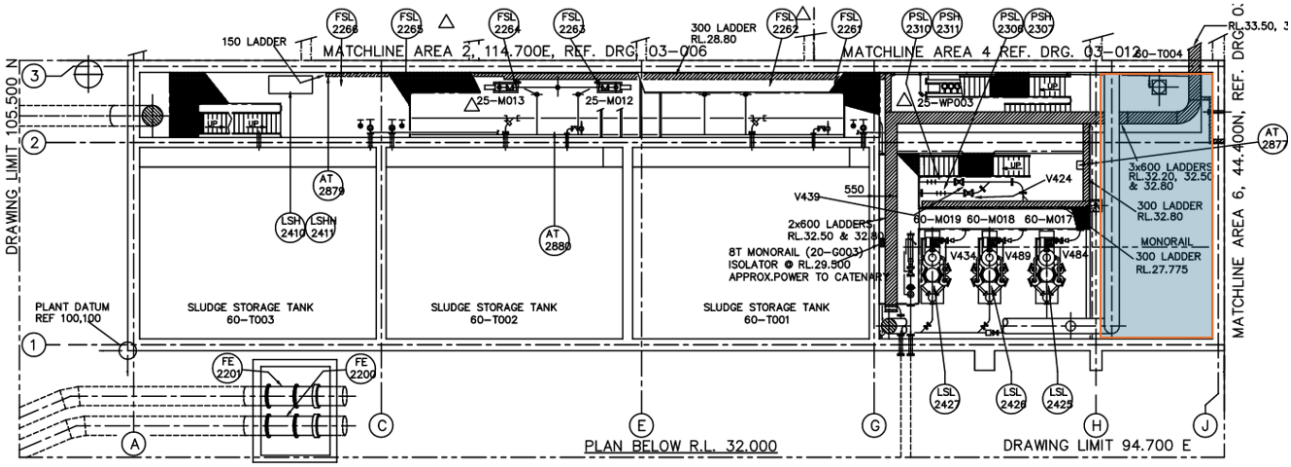

Figure 22: Location of the Mezzanine Floor

Beca was advised that the Primary Sludge Pumps Technical Gallery was submerged to a level of 3.0m above floor level. This impact is shown indicatively below in Figure 23.

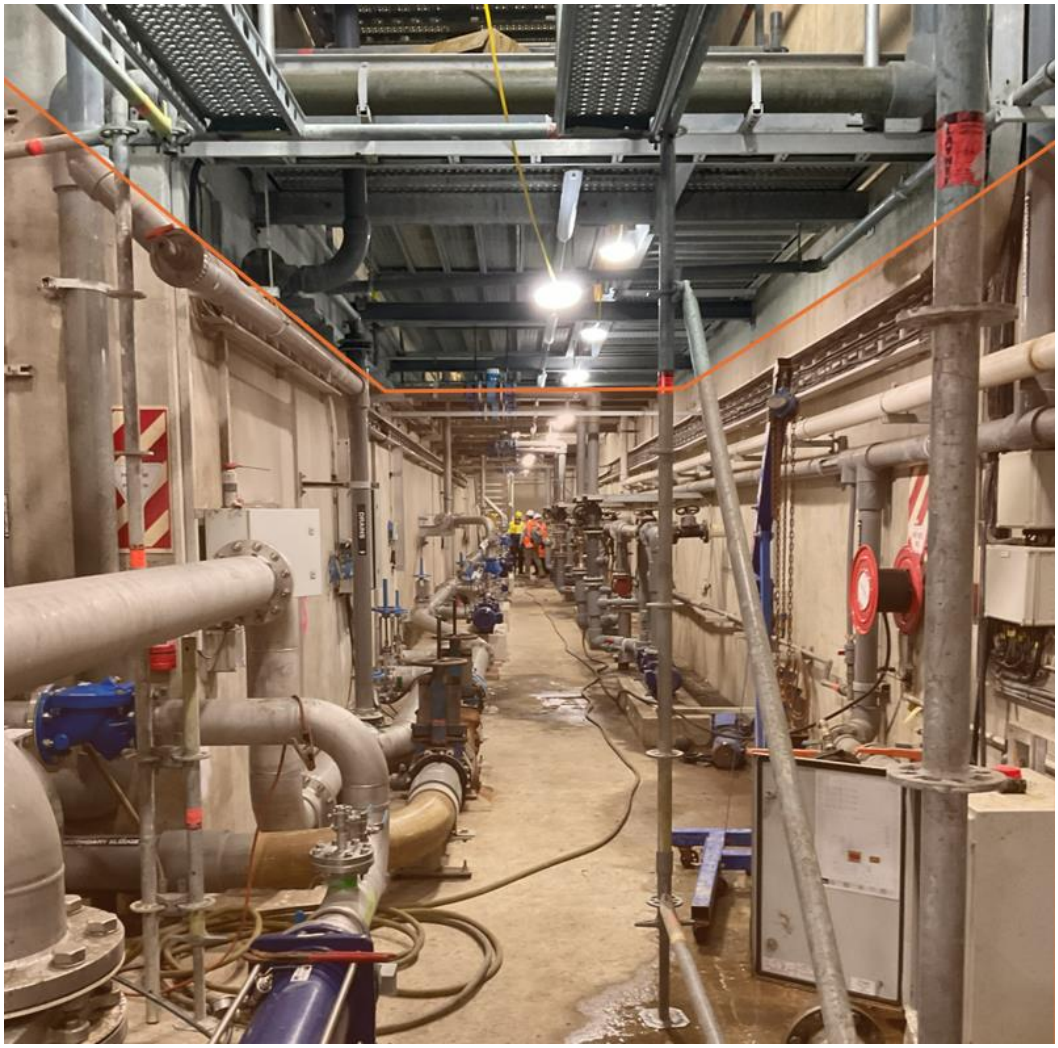

Figure 23: Primary Sludge Pumps Technical Gallery indication of the approximate level to which assets were submerged

Figure 24: Mezzanine floor indication of the approximate level to which assets were submerged

4.2 Assets

The assets in the Primary Sludge Pumps Technical Gallery are grouped by VAMP (asset register) Functional Group and summarised in Table 3 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 3: Summary of assets located in the Primary Sludge Pumps Technical Gallery grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Primary Settlement Analysis/Measurement	Primary Sludge Pump Flow Indicator Transmitter (6 of)		
Primary Settlement Pumping	Primary Sludge Pump (6 of)		
	25-T004 Primary Sludge Pump Relief Tank		
Primary Settlement Valving	Primary Sludge Pump Pressure Relief valve (6 of)		
RE Wash Water Analysis/Measurement	All RE Pressure Switches		
	PIT-2329 RE Wash Water Pumps Pressure Indicator Transmitter		
	All RE Pressure Indicators		
RE Wash Water Piping	All RE Strainers		
	All RE Plastic Pipework		
RE Wash Water Pumping	RE Wash Water Pumps 1-3		
	RE Wash Water Pump 4		
	MOA RE Wash Water Pump Control Centre		
RE Wash Water Valving	All RE Isolation Valves		
Sludge Storage Analysis/Measurement	H2S Sensor Sludge Gallery (3 of)		
Sludge Storage Piping	All Sludge Storage Pipework		
Sludge Transport Analysis/Measurement	FIT-2240 - Sludge Magflow Transmitter		
Sludge Transport Pumping	Muncher		
Sludge Transport Valving	All Other Sludge Pipeline Valves		
	All Other Sludge Pump Valves		
	All Sludge Pump Pulsation Dampening Valves		
RE Wash Water Piping	60-T004 RE Wash Water Accumulator Tank (Mezzanine Floor)		

Each functional group and its component assets are discussed in greater detail below.

4.2.1 Primary Settlement Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WCC00002	FIT-2241 Primary Sludge Pump 1 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WCC00003	FIT-2242 Primary Sludge Pump 2 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WCC00004	FIT-2243 Primary Sludge Pump 3 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WCC00005	FIT-2244 Primary Sludge Pump 4 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WCC00006	FIT-2245 Primary Sludge Pump 5 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-WCC00007	FIT-2246 Primary Sludge Pump 6 Flow Indicator Transmitter	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Endress+Hauser Promag flow transmitters were assessed as having been fully submerged during the flooding event, based on their installed elevation relative to the observed flood water level. Associated flow meters were observed to be installed near the high-water level and are considered to have been partially submerged, with evidence of splash exposure noted, including debris present on adjacent pipework.

The flow meters are rated to IP67; however, this rating does not necessarily account for extended exposure, contaminated water, or installation-specific configurations. Some corrosion was observed on the external surfaces and mounting hardware of the flow meters. It could not be determined whether this corrosion pre-dated the flooding event, noting that the flow meters are understood to be relatively recent installations.

It was also noted that certain flow meters were installed with electrical terminals oriented to the side, which may increase the likelihood of liquid ingress compared to installations where terminals are oriented vertically upward.

The flow transmitters are powered via a remote I/O panel located in the sludge gallery. This panel was observed to show signs consistent with water ingress, indicating potential exposure to floodwater.

Photos

Figure 25: Primary sludge flow meter and flow transmitter.

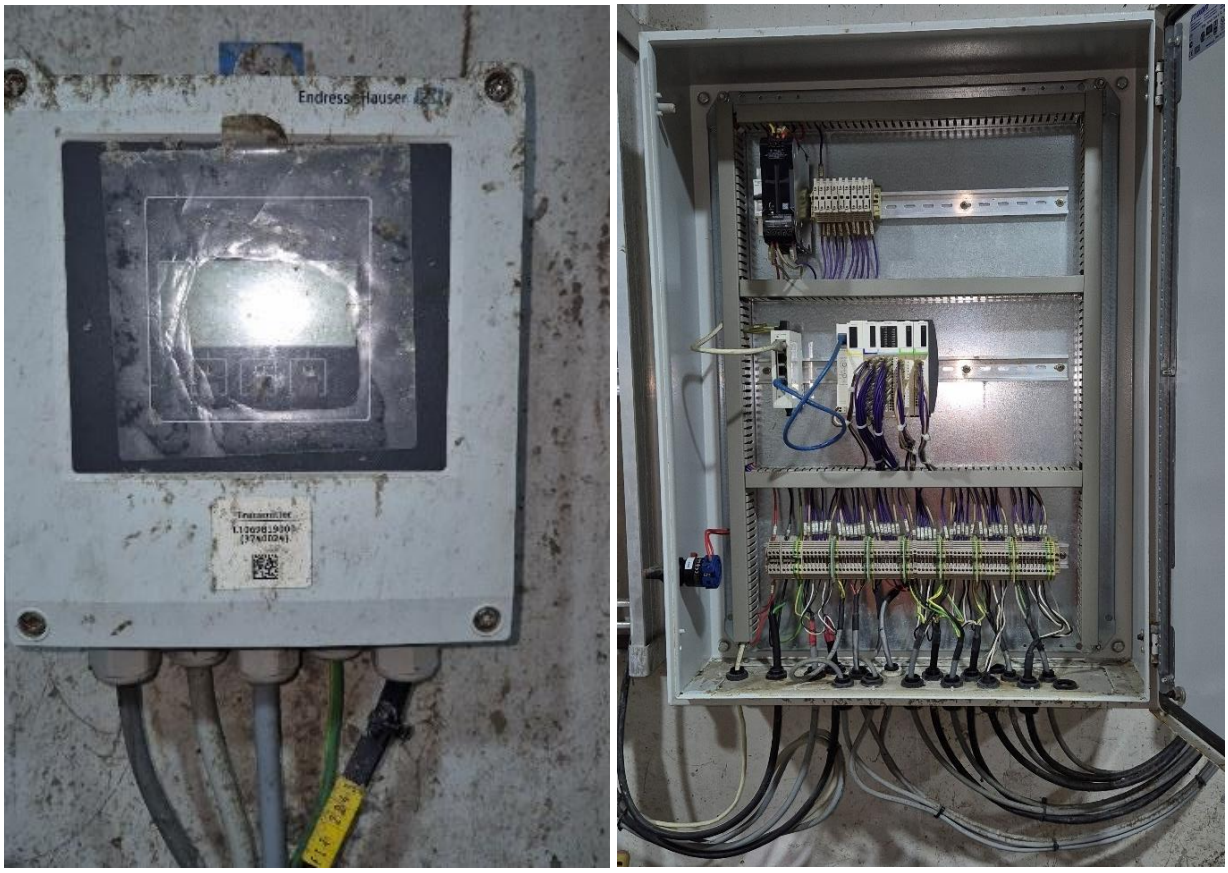

Figure 26: Primary sludge flow transmitter (L) and PLC remote IO cabinet and power supply for flow meter (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replacement or detailed inspection and testing of flow transmitters that were subjected to full submergence.
- Inspection and functional verification of flow meters located near the flood water level where reuse is being considered, with particular attention to terminal orientation and sealing integrity.
- Assessment of observed corrosion to determine potential impact on continued serviceability.
- Inspection, testing, or replacement of the associated remote I/O panel, noting observed indications of water ingress.

4.2.2 Primary Settlement Pumping.

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295168	25-P004 Primary Sludge Pump 1	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00295169	25-P005 Primary Sludge Pump 2	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00295170	25-P006 Primary Sludge Pump 3	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00295171	25-P007 Primary Sludge Pump 4	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00295172	25-P008 Primary Sludge Pump 5	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)
E-00295173	25-P009 Primary Sludge Pump 6	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

All primary sludge pumpsets (complete pump unit) were fully submerged. Primary Sludge Pump 4 was not installed at the time of inspection, however, was located in the sludge pumping gallery and would be similarly

impacted. These pumpsets are less the 1-year-old and surface coatings of each the pumpsets appeared to be in good condition and expected to protect the external surfaces from corrosion.

The pumpends are intended to be in contact with fluids and submergence is unlikely to have impacted on asset life or functionality of the pumpends.

The reduction gearboxes are IP66 rated and not intended for being submerged and water ingress is likely to have occurred through the breather/vent on top of the gearboxes. Water ingress to the gearboxes would be expected to lead to corrosion of the internal components (ie. bearings and gears) and eventually result in premature failure of the gearbox.

The motors are also not intended for being submerged and water ingress is likely to have occurred. Water ingress to the motors would be expected to lead to corrosion of the internal components (ie. bearings) and eventually result in premature failure of the motor.

Justification for Damage Rating - Electrical Impacts

Electric motors were assessed as having been fully submerged during the flooding event, based on their installed elevation relative to the observed flood water level. The motors are rated to IP66; however, this rating does not necessarily account for extended submergence, contaminated water exposure, or ageing effects.

Motor power cables were observed to be terminated within local terminal boxes located within the inundation area. These terminal boxes are considered likely to have been compromised by water ingress. Local motor control stations associated with the motors were also located below the flood water level and are considered likely to have experienced water ingress.

Each motor is fitted with a high-pressure switch. The pressure switch terminal boxes are rated NEMA 4X (IP67 equivalent); however, given their exposure to floodwater, internal ingress cannot be excluded. These switches are wired to junction boxes located at the entrance to the sludge gallery, which were observed to show signs consistent with water ingress.

Based on the above, the operational condition and continued serviceability of the motors, associated controls, and ancillary equipment cannot be confirmed through visual inspection alone.

Photos

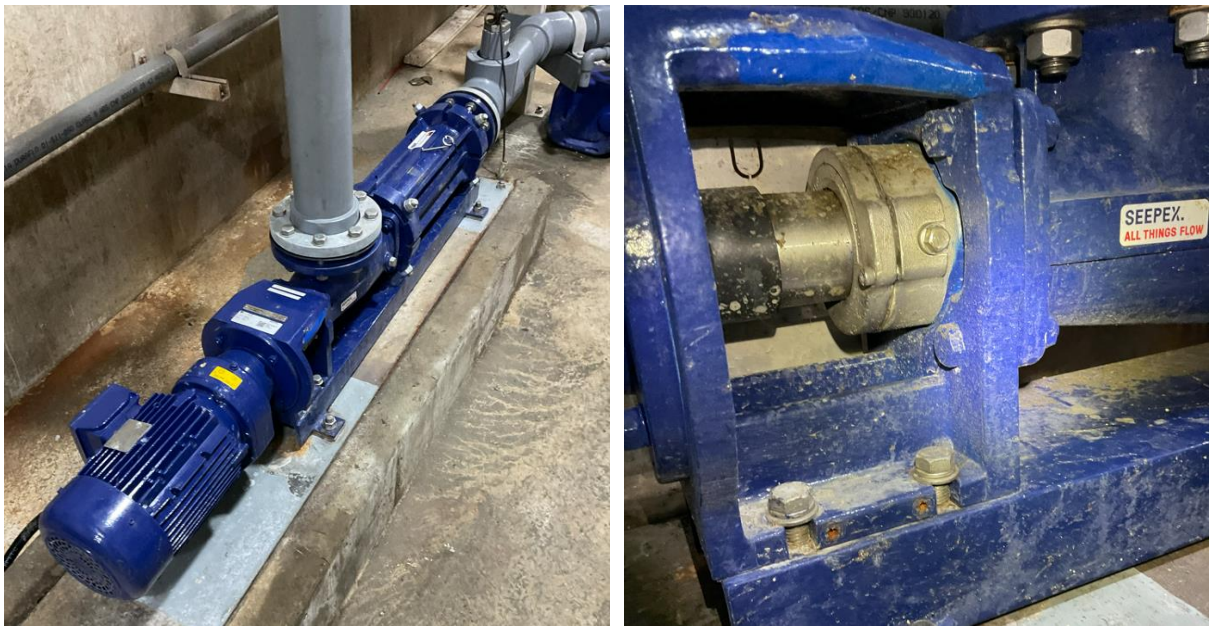

Figure 27: Primary Sludge Pump 6 (L) and pump shaft and seal (R)

Figure 28: Primary Sludge Pump motor (L) and local control station (R)

Figure 29: Primary sludge pump termination boxes (L). Pressure switches (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report. The options outlined reflect typical recovery pathways where reuse is being evaluated or where replacement is selected to support improved reliability and reduced residual risk.

Motors

- Detailed inspection, cleaning, drying, and electrical testing may be undertaken in accordance with the referenced sections where reuse is being considered. Alternatively, replacement of the motors may be considered to support improved reliability following full submergence.

Gearboxes

- Detailed cleaning, inspection and replacement of oil may be undertaken where reuse is being considered. Alternatively, replacement of the gearboxes may be considered to support improved reliability following full submergence.

Pump Local Control Stations

- Inspection and testing of local control stations may be undertaken to assess suitability for reuse following water exposure, consistent with the referenced sections. Where testing outcomes are unsatisfactory, or where long-term reliability is prioritised, replacement may be considered.

Local Termination Boxes and Cabling

- Assessment and electrical testing of local termination boxes and associated cabling may be undertaken to evaluate the extent of water ingress and potential moisture migration where reuse is proposed. Replacement may be considered where ingress is confirmed or where residual risk is not acceptable.

High-Pressure Switches, Associated Junction Boxes, and Cabling

- Inspection and functional verification may be undertaken in accordance with the referenced sections where continued use is being considered. Alternatively, replacement may be considered to mitigate the risk associated with floodwater exposure.

Sludge Gallery Junction Boxes

- Inspection, testing, and condition assessment may be undertaken where reuse is being evaluated, noting observed signs of water ingress. Replacement may be considered where testing results are inconclusive or where enhanced reliability is required.

4.2.3 Primary Settlement Piping & Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295157	V355 Primary Sludge Pump 1 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295158	V359 Primary Sludge Pump 2 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295159	V376 Primary Sludge Pump 3 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295160	V380 Primary Sludge Pump 4 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295161	V384 Primary Sludge Pump 5 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295162	V388 Primary Sludge Pump 6 Pressure Relief valve	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00294710	All Sludge Storage Pipework	1. None (Expected to function)	8. N/A
E-00295175	25-T004 Primary Sludge Pump Relief Tank	1. None (Expected to function)	3. Moderate (May not function, expected reduction in remaining life)

Justification for Damage Rating - Mechanical Impacts

The primary sludge pump pressure relief valves where fully submerged. There is a risk that water ingress has occurred that may lead to corrosion and premature failure or seizure of the internal components, preventing the relief valve from functioning correctly. The type of relief valves installed do not include an ability to test operation.

The primary sludge pump pipework is primarily of ABS construction with a small portion being stainless steel. The isolation valves are ductile iron valves and the surface coatings appeared in good condition, and the non-return valves are stainless steel. The pipework and valves were fully submerged and are expected to remain functional with no notable impact on asset life given the existing operating environment exposure.

The primary sludge pump relief tank was in fair condition, given the operating environment submergence is unlikely to have impacted on the life of this tank.

Justification for Damage Rating - Electrical Impacts

Two level switches associated with the primary sludge pump relief tank were identified as having been fully submerged during the flooding event, based on their installed elevation relative to the observed flood water level. Local instrument termination boxes serving these level switches were also located within the inundation area and are considered likely to have experienced water ingress.

Details of the specific level switch types and construction could not be confirmed at the time of inspection. As a result, the operational condition and continued serviceability of these devices and associated terminations cannot be confirmed based on visual inspection alone.

Photos

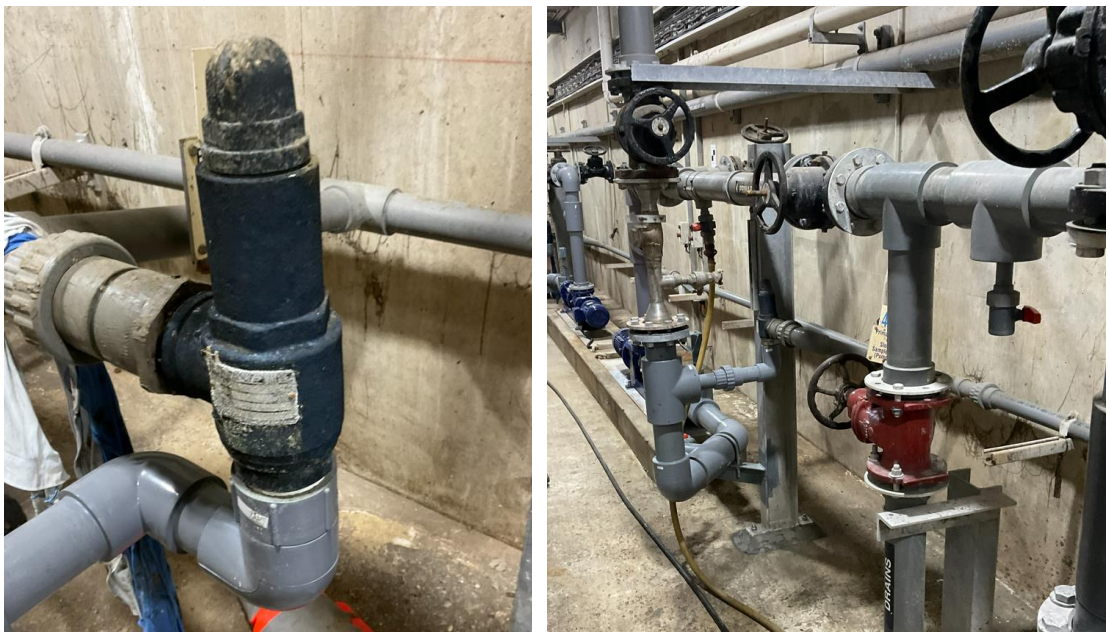

Figure 30: Primary Sludge Pump pressure relief valve (L) and Primary Sludge pipework and valves (R)

Figure 31: 25-T004 Primary Sludge Pump Relief Tank level switches and terminal box

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and testing of the level switches, associated instrument termination boxes, and cabling may be undertaken in accordance with the sections referenced above, to assess the extent of water ingress and functional condition.
- Inspection of associated pressure relief valves may also be undertaken to identify any evidence of floodwater ingress where continued use is being evaluated.
- Alternatively, replacement of the level switches, local instrument termination boxes, associated cabling back to the junction box, and pressure relief valves may be considered to support improved reliability and reduced residual risk following full submergence exposure.

4.2.4 RE Wash Water Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295001	All RE Pressure Switches	8. N/A	4. Major (Expected to not function)
E-00295374	PIT-2329 RE Wash Water Pumps Pressure Indicator Transmitter	8. N/A	4. Major (Expected to not function)
E-00295000	All RE Pressure Indicators	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

Most pressure gauges were fully submerged and are a vented type gauge. Water ingress is likely to have occurred and could lead to premature failure of the pressure gauges. Some pressure gauges appeared in poor condition, and we are unable to determine if these were functioning prior to submergence.

Justification for Damage Rating - Electrical Impacts

The RE pressure switch on the mezzanine floor was fully submerged. The Danfoss pressure switch was not rated for submergence so likely non-functional.

Photos

Figure 32: RE Pressure switch

Recovery Guidance

Refer Section 2 to general electrical recovery guidance

4.2.5 RE Wash Water Piping & Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295005	All RE Strainers	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00295004	All RE Plastic Pipework	1. None (Expected to function)	8. N/A
E-00295002	All RE Isolation Valves	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The RE wash water plastic pipework and isolation valves are of ABS construction. The RE strainers are ductile iron and the surface coatings appeared in generally good condition with some minor signs of corrosion. The pipework, isolation valves and strainers were fully submerged and are expected to remain functional with no notable impact on asset life given the existing operating environment exposure.

Justification for Damage Rating - Electrical Impacts

N/A

Photos

Figure 33: RE Wash Water strainers and pipework

Recovery Guidance

The following guidance is provided for restoration of function:

1. Clean and repair surface coating of strainers.

4.2.6 RE Wash Water Pumping

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294998	60-P013 RE Wash Water Pump 3	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)
E-WEW002129	60-P015 RE Wash Water Pump 1	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)
E-00294997	60-P016 RE Wash Water Pump 2	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)
E-00579863	MOA RE Wash Water Pump Control Centre	8. N/A	4. Major (Expected to not function)
E-00294999	60-P014 RE Wash Water Pump 4	7. UNKNOWN	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

The RE Wash Water pumps 1,2 & 3 were installed and fully submerged during the flooding event. The pumps are Grundfos vertical multistage pumps which utilise a sealed bearings, water ingress and damage to the pump bearings is likely to be minimal.

The motors are also not intended for being submerged and water ingress is likely to have occurred. Water ingress to the motors would be expected to lead to corrosion of the internal components (ie. bearings) and eventually result in premature failure of the motor.

The pumps and motors housings had some existing coating damage and surface corrosion. While the submergence event may lead to further corrosion, given the existing condition of the pumps and operating environment, it is unlikely to have any notable impact on the pump or motor housing life.

RE Wash Water Pump 4 was not installed at the time of inspection/event. Motor and pump were disassembled nearby. Pumpend appeared to be in poor or inoperable condition. Motor life likely reduced due to water ingress.

Justification for Damage Rating - Electrical Impacts

An electronic pump controller housed within a local cabinet was assessed as having been fully submerged during the flooding event, based on its installed elevation relative to the observed flood water level. The cabinet was observed to show visible signs consistent with water ingress, indicating likely internal exposure to floodwater.

All associated electric motors were assessed as having been fully submerged based on the recorded flood water line.

Pump E-00294999 was not installed at the time of the flooding event or subsequent inspection. The pump and motor were observed to be disassembled and located nearby. The motor component was identified as

being positioned below the recorded flood water line and is therefore considered to have been submerged during the event.

Based on the observed and inferred exposure conditions, the operational condition and continued serviceability of the electronic pump controller, motors, and associated equipment cannot be confirmed through visual inspection alone.

Photos

Figure 34: RE Wash Water pumpset (L) and controller (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection, testing, and condition assessment of the electronic pump controller and associated cabinet may be undertaken in accordance with the sections referenced above to evaluate the extent of water ingress and functional condition.
- Inspection and electrical testing of submerged motors may be undertaken where reuse is proposed, noting full submergence exposure.
- Inspection and assessment of the disassembled motor associated with pump **E-00294999** may be undertaken where reuse is being considered, taking into account its location below the flood water line.
- Alternatively, replacement of the electronic pump controller, motors, and associated components may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred following flood exposure.

4.2.7 RE Wash Water Piping

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW001781	60-T004 RE Wash Water Accumulator Tank	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The RE Wash Water Accumulator Tank was partially submerged. The surface coating of the tank was in very good condition, and the partial submergence is unlikely to have impacted on asset life or functionality. Associated pipework and valving is plastic and the partial submergence is unlikely to have impacted on asset life or functionality. The galvanised base frame is experiencing corrosion potentially due to submergence, however given that the tank will likely have H2S exposure in the operating environment, the base frame life is unlikely to be notably reduced for this submergence.

Justification for Damage Rating - Electrical Impacts

Mechanical assets only - not assessed for electrical impacts.

Photos

Figure 35: RE Wash Water Accumulator Tank

Recovery Guidance

The following guidance is provided for restoration of function:

1. Ensure galvanised base frame remains dry to minimise further corrosion.

4.2.8 Sludge Storage Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295145	AIT-2877 H2S Sensor Sludge Gallery South	8. N/A	4. Major (Expected to not function)
E-00295143	AIT-2879 H2S Sensor Sludge Gallery North	8. N/A	4. Major (Expected to not function)
E-00295144	AIT-2880 H2S Sensor Sludge Gallery Mid	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

All Draeger H2S sensors at ground level were fully submerged and open to atmosphere.

Photos

Figure 36: Draeger H2S sensor

Recovery Guidance

The following guidance is provided for restoration of function:

1. Replace all submerged H2S instruments and associated cabling

4.2.9 Sludge Transport Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00576759	FIT-2240 - Sludge Magflow Transmitter	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Endress+Hauser Promag flow meter and transmitter were fully submerged. Both are rated IP67. The flow transmitter is wired to the local sludge gallery remote IO panel for both signal and power. The panel was fully submerged (see above).

Photos

Figure 37: Flow meter (L)and transmitter (R)

Recovery Guidance

The following guidance is provided for restoration of function:

1. Replace flow meter, flow transmitter and associated cabling

4.2.10 Sludge Transport Pumping

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00303656	Muncher	3. Moderate (May not function, expected reduction in remaining life)	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

The Muncher was not in service during the submergence as the internals cutters, gearmotor and cutter drive gearbox where not installed at the time. The cutters and gearmotor were stored at ground level in the room and would have been fully submerged. The cutter drive gearbox was not identified during the inspection. Water ingress to both the motor and reduction gearbox of the gearmotor is likely to have occurred and likely lead to corrosion of the internal components (ie. gears and bearings).

Justification for Damage Rating - Electrical Impacts

The Muncher local control panel was assessed as having been fully submerged during the flooding event, based on its installed elevation relative to the observed flood water level. The panel enclosure was observed to show visible signs consistent with water ingress, indicating likely internal exposure to floodwater.

Associated terminal boxes serving the Muncher were also identified as having been fully submerged and were observed to show signs of ingress. The Muncher motor is powered via a flexible plug-in power lead, which was assessed as having been fully submerged during the flooding event.

Based on the extent of submergence and visible ingress indicators, the operational condition and continued serviceability of the local control panel, terminal boxes, flexible power connection, and associated equipment cannot be confirmed through visual inspection alone.

Photos

Figure 38: Muncher without motor installed (L) and Muncher cutters (R)

Figure 39: Mono Muncher electrical control panel (L) and gearmotor (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection, testing, and condition assessment of the Muncher local control panel and associated terminal boxes may be undertaken in accordance with the sections referenced above to evaluate the extent of water ingress and functional integrity.
- Inspection and electrical testing of the flexible plug-in power lead may be undertaken where continued use is being evaluated, noting full submergence exposure.
- Alternatively, replacement of the local control panel, terminal boxes, flexible power lead, and associated components may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred following flood exposure.

4.2.11 Sludge Transport Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294809	All Other Sludge Pipeline Valves	1. None (Expected to function)	8. N/A
E-00294812	All Other Sludge Pump Valves	1. None (Expected to function)	8. N/A
E-00294813	All Sludge Pump Pulsation Dampening Valves	1. None (Expected to function)	8. N/A

The motorised valves at the outlet of the sludge tanks were noted as having been removed prior to the flooding event as part of the SMF project and were therefore not subject to flood exposure.

Justification for Damage Rating - Mechanical Impacts

The sludge pipeline and sludge pump valves were fully submerged. The valves are coated cast iron and stainless steel construction. The valves appeared in generally good condition with some minor signs of corrosion and are expected to remain functional with no notable impact on asset life given the existing operating environment exposure.

The pulsation dampeners formed part of the sludge transport pumps and were full submerged. The coating of the pulsation dampeners appeared in good condition and are designed to have water internally. The submergence is not expected to have impacted the function or life of the pulsation dampeners.

Justification for Damage Rating - Electrical Impacts

N/A

Photos

Figure 40: Sludge pipeline valves (L). Sludge transfer pump valves (C). Sludge Transport Pump 1 pulsation dampener (R)

Recovery Guidance

N/A

5 Damage Assessment Findings – Sludge transport pumps chamber

5.1 Asset Area and Flooding Impacts

The location of the Sludge Transport Pumps Chamber is shown below in Figure 41.

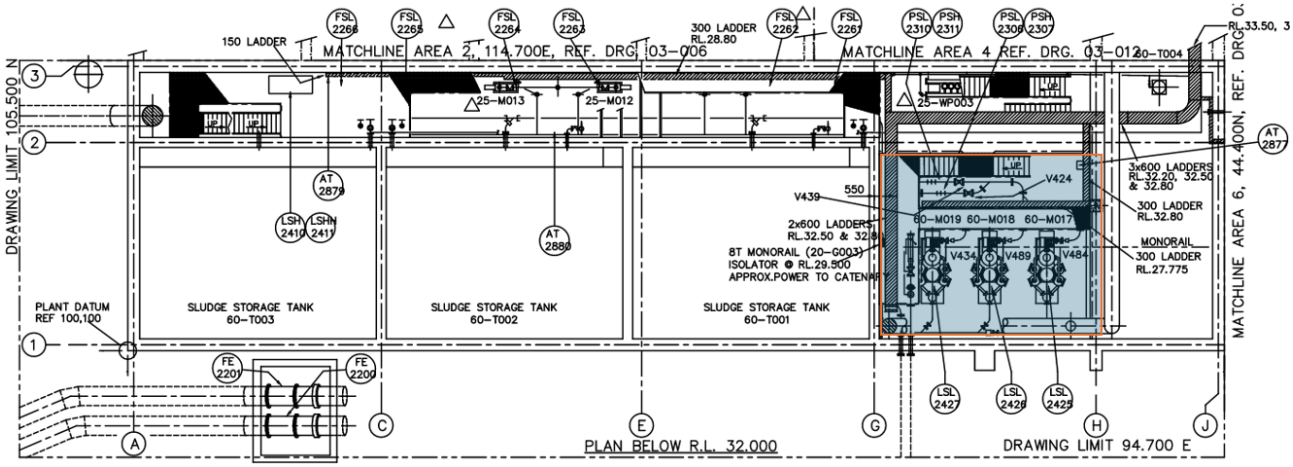

Figure 41: Location of the Sludge Pumps Chamber

Beca was advised that this location was submerged to a level of 6.0m above floor level. This impact is shown indicatively below in Figure 42.

Figure 42: Sludge Transport Pumps Chamber indication of the approximate level to which assets were submerged

5.2 Assets

The assets in the Sludge Transport Pumps Chamber are grouped by VAMP (asset register) Functional Group and summarised in Table 4 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 4: Summary of assets located in the Sludge Transport Pumps Chamber grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Fixed Lifting Equipment	20-G002 Sludge Gallery 5t Monorail Hoist		
Sludge Storage Analysis/Measurement	All Position Switches		
Sludge Transport Analysis/Measurement	All Sludge Transport Pressure Switches		
	All Sludge Transport Pressure Indicators		
	All Sludge Transport Level Switches		
	All Sludge Transport Position Switches		
Sludge Transport Pigging	Pig Launchers (Moa) (2 of)		
Sludge Transport Pumping	Sludge Transport Pumps (3 of)		
Sludge Transport Valving	All Sludge Pipeline Actuated Valves		
	Sludge Pipelines 1 & 2 Common Pressure Transmitter		

Each functional group and its component assets are discussed in greater detail below.

5.2.1 Fixed Lifting Equipment

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294945	20-G002 Sludge Gallery 5t Monorail Hoist	1. None (Expected to function)	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

The monorail hoist is located above the water submergence level and not expected to have been impacted by the flooding event.

Justification for Damage Rating - Electrical Impacts

The sludge gallery hoist motor was observed to be installed well above the recorded flood water level and is not considered to have been directly exposed to floodwater. However, the associated remote-control equipment was identified as having been fully submerged during the flooding event.

Photos

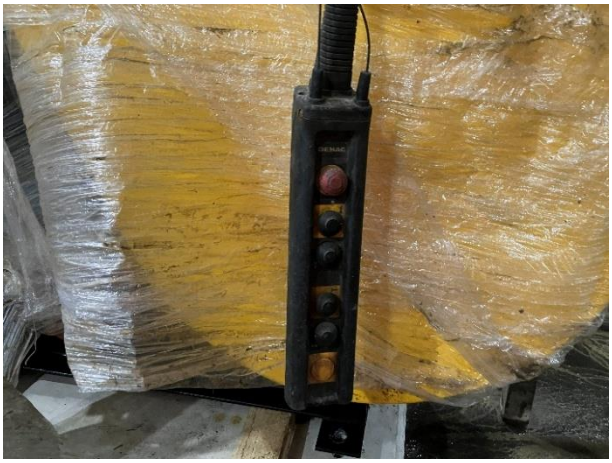

Figure 43: Sludge gallery hoist remote control

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Inspection and testing of the sludge gallery hoist remote control and hoist control pendant may be undertaken to determine suitability for continued service where reuse is proposed.
- Verification of the hoist motor condition may be undertaken notwithstanding its location above the flood water level, to confirm no secondary impacts through connected controls or cabling.

5.2.2 Sludge Transport Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294777	All Sludge Transport Pressure Switches	8. N/A	4. Major (Expected to not function)
E-00294776	All Sludge Transport Pressure Indicators	3. Moderate (May not function, expected reduction in remaining life)	8. N/A
E-00297788	All Sludge Transport Level Switches	8. N/A	7. UNKNOWN
E-00294775	All Sludge Transport Position Switches	8. N/A	7. UNKNOWN

Justification for Damage Rating - Mechanical Impacts

The pressure gauges of the sludge transport system were fully submerged by the flood event. The gauges appeared to be in good condition, however, water ingress is likely to have occurred through the gauge vent and lead to premature failure.

Justification for Damage Rating - Electrical Impacts

Two transmitters, PIT2312A and PIT2312B, were identified as having been fully submerged.

Four pressure switches were identified within the affected area. These devices were observed to be aged and exhibiting visible signs of corrosion. The pressure switches appear to be of a similar type to Danfoss RT200 units, typically rated to IP66; however, given their age, observed corrosion, and flood exposure environment, the effectiveness of environmental protection cannot be confirmed.

Based on the observed condition, the operational status and continued serviceability of these pressure switches cannot be confirmed through visual inspection alone.

Photos

Figure 44: Sludge transport pressure switches and gauges

Figure 45: Sludge transport pressure gauge

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and functional testing of the pressure switches may be undertaken in accordance with the sections referenced above to assess the extent of corrosion and potential water ingress.
- Alternatively, replacement of the pressure switches may be considered where testing outcomes are inconclusive, or where improved reliability and reduced residual risk are preferred given the observed age and condition.
- Where reuse is being considered, inspection, testing, and condition assessment of submerged position switches, pressure switches, actuated valves, transmitters, control cabling, and remote control devices may be undertaken in accordance with the sections referenced above to assess functionality and potential water ingress.

5.2.3 Sludge Transport Pigging

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294755	60-PL001 Pig Launcher 1 (Moa)	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A
E-00294756	60-PL002 Pig Launcher 2 (Moa)	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The sludge transport pigging launch system was fully submerged. The system consists of coated steel pipework and stainless steel valves. The coating system of the pipework appeared to be in generally good condition with some minor corrosion on the hinged sealing flange. The valves are of stainless steel construction and had some minor pitting corrosion. The submergence of the pigging system may lead to a minor increase in surface corrosion, however given the existing condition of the valves and pipework of the pigging system and the operating environment, it is unlikely to have any notable impact on the asset life.

Justification for Damage Rating - Electrical Impacts

N/A

Photos

Figure 46: Sludge transport pig launcher arrangement

Recovery Guidance

The following guidance is provided for restoration of function:

1. Clean pipework and fittings of residual material from flooding

5.2.4 Sludge Transport Pumping

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294767	60-P017 Sludge Transport Pump 1	4. Major (Expected to not function)	6. Exposure to multiple components included against this asset item
E-00294768	60-P018 Sludge Transport Pump 2	4. Major (Expected to not function)	6. Exposure to multiple components included against this asset item
E-00294769	60-P019 Sludge Transport Pump 3	4. Major (Expected to not function)	6. Exposure to multiple components included against this asset item

Justification for Damage Rating - Mechanical Impacts

All three sludge transfer pumpsets were fully submerged. Sludge transfer pump 2 was brand new and had not yet been installed. Each pumpset has multiple components which includes the electric motors, hydraulics (oil), cylinder, eccentric drive, and valving.

The pump 1 & 2 diaphragm pumps and valves are sealed to prevent ingress and external coating for pumps appear to be in fair condition with some surface coating damage and corrosion. However, given to existing condition and operating environment, no notable reduction in diaphragm pump or valving life would be expected.

The electric motors for the diaphragm pumps and hydraulic oil system are not intended to be submerged. Water ingress to the bearings is likely to have occurred and may lead to premature failure.

Each pumpset has a hydraulic oil reservoir for oil lubrication of the diaphragm pumps. Water ingress is likely to occurred through the oil reservoir vent and may lead to corrosion and premature failure of the internal components of the hydraulics system, including the hydraulic pump.

The sludge transport pumpsets required compressed air for operation. Components of the compressed air system where fully submerged and water ingress is likely to have occurred and lead to premature failure of the compressed air solenoids.

The water storage tanks of pumps 1 & 2 were open, which would lead to debris that may result in blockage of the water system.

Justification for Damage Rating - Electrical Impacts

Sludge transport pumps and associated equipment were identified as being located well below the observed flood water line and are therefore considered to have been fully submerged during the flooding event. Local junction boxes serving the pumps were observed to show signs consistent with water ingress.

Based on their location within the inundation area, all associated electrical components, including, but not limited to, motors, cabling, instruments, controls, and junction boxes, are considered to have been exposed to floodwater. As a result, the operational condition and continued serviceability of these components cannot be confirmed through visual inspection alone.

Photos

Figure 47: Sludge Transport Pumps

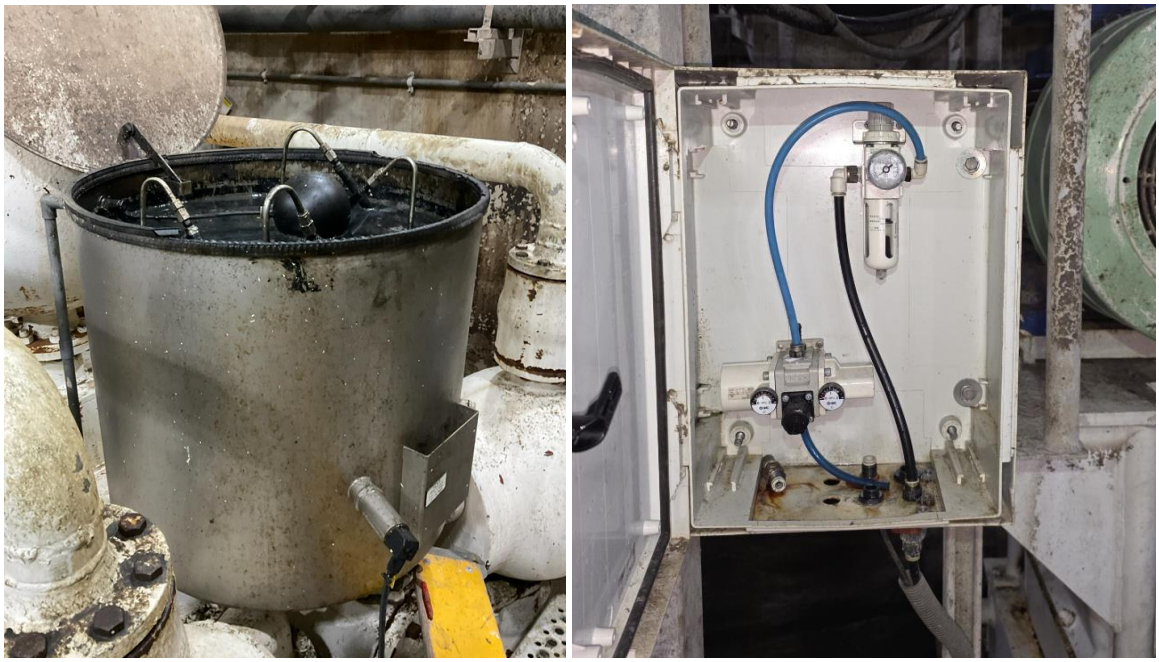

Figure 48: Sludge Transport Pump water storage tank (L). Compressed air system regulator and solenoid. (R)

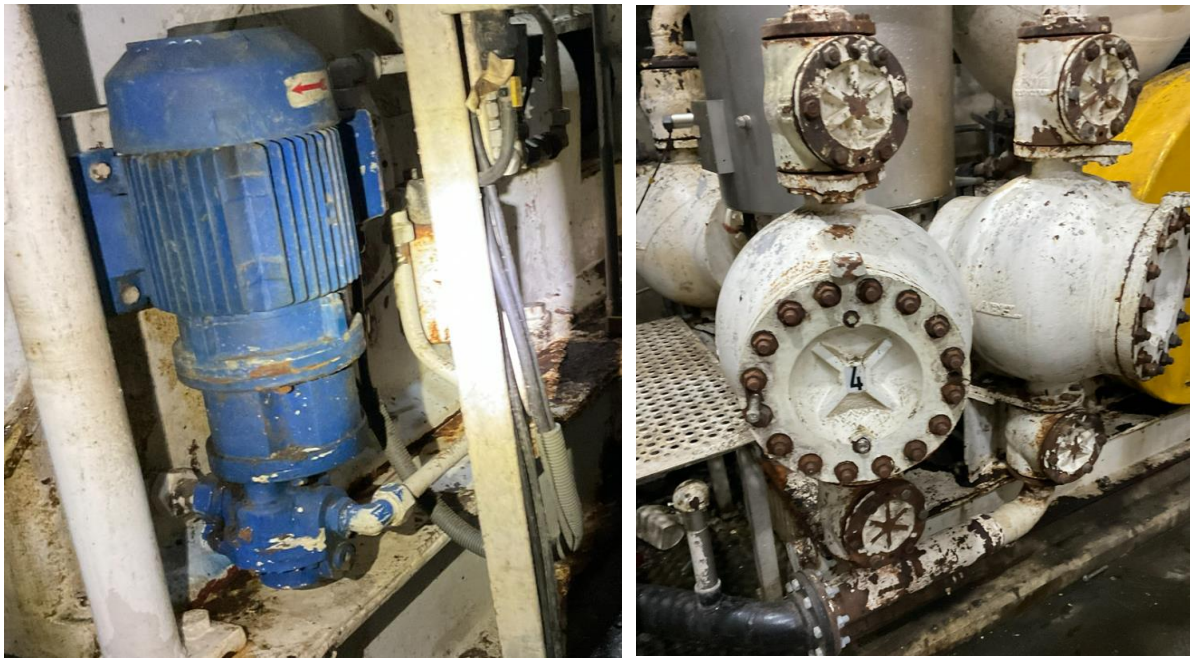

Figure 49: Sludge Transport Pump hydraulic pump & motor (L). Sludge Transport Pump diaphragms and non-return valves (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Sections 2 of this report.

- Where reuse is being considered, inspection, testing, and condition assessment of motors, instruments, controls, cabling, and junction boxes may be undertaken in accordance with the sections referenced above to evaluate the extent of water ingress and functional integrity.
- Alternatively, replacement of submerged electrical and control components, including local junction boxes and associated cabling, may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred following full submergence.
- Undertake testing of the sludge transport pump hydraulic oil for evidence of water ingress. Drain and replace hydraulic oil from the hydraulic system.
- Detailed cleaning, inspection and repair or replacement of hydraulic pumps.
- Cleaning of compressed air system and replacement of pneumatic valves and fittings.
- Each water storage tank should be drained and cleaned, to remove any potential debris that may have entered
- Note: Sludge Transfer Pump 2 had not been installed or commissioned and may have unknown operating issues.

5.2.5 Sludge Transport Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294801	All Sludge Pipeline Actuated Valves	2. Minor (Expected to function, potential reduction in remaining life)	4. Major (Expected to not function)
E-WEW002078	Sludge Pipelines 1 & 2 Common Pressure Transmitter	8. N/A	4. Major (Expected to not function)
E-00294707	All Position Switches	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Both sludge pipeline actuated valves were fully submerged. Valve bodies are of stainless steel construction and not expected to have been impacted by the submergence, The actuators are likely to have water ingress, which may lead to corrosion internal components (e.g. bearings and gears) and premature failure of the actuator.

Justification for Damage Rating - Electrical Impacts

All sludge pipeline actuated valves were assessed as having been fully submerged during the flooding event, based on their installed elevation relative to the observed flood water line. These components are typically rated to IP65; however, given full submergence, this rating does not account for extended immersion or contaminated water exposure. All associated cabling connected to the actuated valves was also located within the inundation area and is considered to have been exposed to floodwater.

Based on the above observations, the condition and continued serviceability of submerged equipment and associated controls cannot be confirmed through visual inspection alone.

Photos

Figure 50: Sludge Pipeline Actuated Valves

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection, testing, and condition assessment of sludge pipeline actuated valves, associated actuators, cabling, and transmitters may be undertaken in accordance with the sections referenced above to assess functional integrity and potential water ingress.
- Inspection and testing of position switches on motorised valves V424 and V439 may be undertaken where continued use is being evaluated.
- Alternatively, replacement of submerged actuated valves, position switches, transmitters, and associated cabling may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred following flood exposure.

6 Damage Assessment Findings – Service Gallery

6.1 Asset Area and Flooding Impacts

The location of the Service Gallery is shown below in Figure 51.

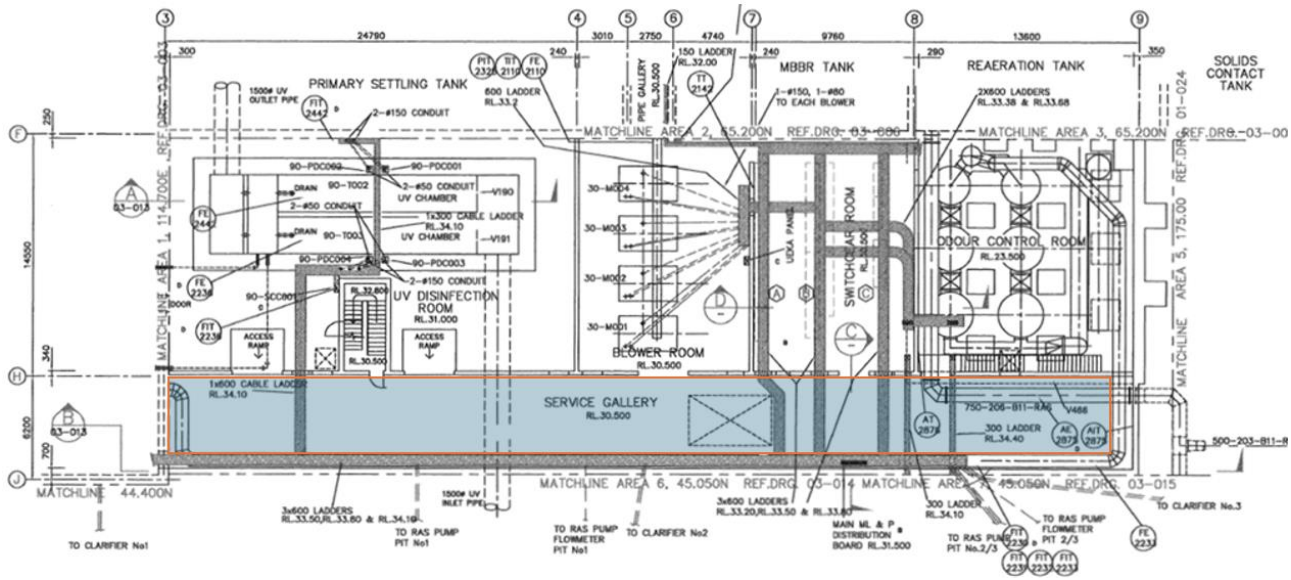

Figure 51: Location of the Service Gallery

Beca was advised that this location was submerged to a level of 0.65m above floor level. This impact is shown indicatively below in Figure 52.

Figure 52: Service Gallery indication of the approximate level to which assets were submerged

6.2 Assets

The assets in the Service Gallery are grouped by VAMP (asset register) Functional Group and summarised in Table 5 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 5: Summary of assets located in the Service Gallery grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Portable Lifting Equipment	Pallet Truck		
Potable Water Valving	Plant Services Backflow Preventer (sludge gallery)		
Primary Settlement Analysis/Measurement	AIT-2875 Primary Settlement H2S Detector North		
RAS & WAS Analysis/Measurement	FIT-2233 - WAS Magflow Transmitter		
	AIT2824 RAS Line Sludge Density Indicator/Transmitter		
	RAS Pump Flow Meters (3 of)		
RAS & WAS Valving	All WAS Actuated Valves		
	All Other RAS Valves		

Each functional group and its component assets are discussed in greater detail below.

6.2.1 Portable Lifting Equipment

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294948	Pallet Truck	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

One Bishamon-branded hand pallet truck was in the service gallery at the time of the inspection, which would have been submerged to just under the level of the handle. Steel construction with baked enamel finish would be resistant to corrosion but uncoated portions would be susceptible. Hydraulic lifting assembly would be fully sealed, but water ingress is possible.

Justification for Damage Rating - Electrical Impacts

No electrical components associated with this asset.

Photos

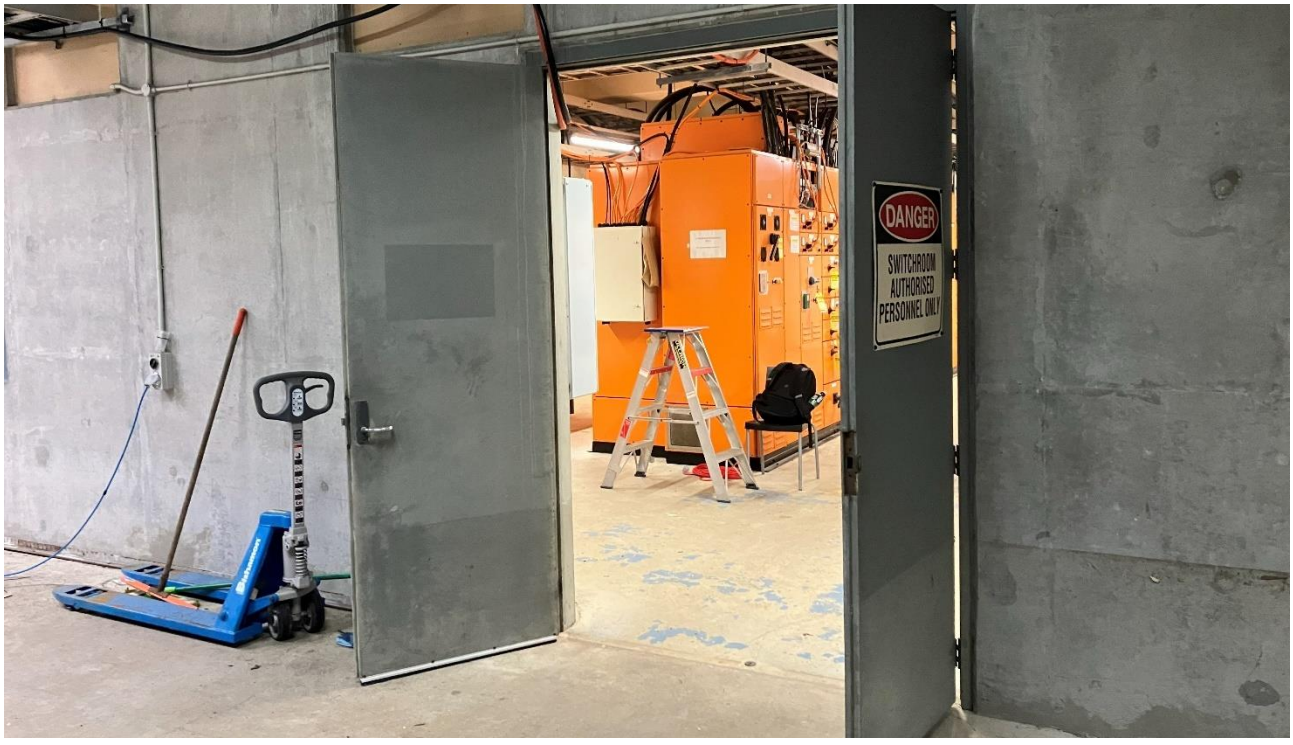

Figure 53: Location of pallet truck in service gallery

Recovery Guidance

The following guidance is provided for restoration of function:

1. Clean surfaces and regrease all pivot points.
2. Inspect hydraulic assembly, checking seals and rebuild if ingress is likely/suspected.

6.2.2 Potable Water Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW002069	Plant Services Backflow Preventer (sludge gallery)	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

A Zurn Wilkins RPZ backflow preventer is installed in the service gallery and is supported off the ground at a level above the water level in the room at the time of the event. The exposed components of the backflow preventer are the housing, which is reinforced nylon, the stainless steel plate, and the cast bronze fittings. The cast bronze surfaces are showing a blue-green patina which may need to be closely inspected to determine if it is the stable oxide layer, providing a protective barrier, or progressive corrosion causing material loss. The housing containing the is expected to be resistant to the environment, protecting the internal components are sealed and are expected to function.

Justification for Damage Rating - Electrical Impacts

No electrical components associated with this asset.

Photos

Figure 54: RPZ Backflow Preventer in Service Gallery

Recovery Guidance

The following guidance is provided for restoration of function:

1. Clean surfaces
2. Conduct backflow preventer testing to prove function.
3. Inspect bronze corroded surfaces and replace fittings if required.

6.2.3 Primary Settlement Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00296897	AIT-2875 Primary Settlement H2S Detector North	5. Unable to assess	5. Unable to assess
E-00296898	AIT-2876 Primary Settlement H2S Detector South	5. Unable to assess	5. Unable to assess

Justification for Damage Rating - Mechanical Impacts

Refer to Electrical Impacts.

Justification for Damage Rating - Electrical Impacts

Drawings indicate that this instrument is within blower room side gallery, but the sensor and instrument could not be located during the inspection.

6.2.4 RAS & WAS Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295194	FIT-2233 - WAS Magflow Transmitter	3. Moderate (May not function, expected reduction in remaining life)	3. Moderate (May not function, expected reduction in remaining life)
E-00295193	AIT2824 RAS Line Sludge Density Indicator/Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295190 E-00295191 E-00295192	RAS Pump Flow Meters (3 of)	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)

Justification for Damage Rating - Mechanical Impacts

RAS pump flowmeters were not in the service gallery, as they are outside, at the RAS pump station. Only the transmitters were mounted in service gallery on panel, above water level (refer E&IC comment).

The WAS flowmeter body and flanges were completely submerged in water, and according to the magflow specification are constructed from carbon steel, which has poor corrosion resistance.

The WAS flowmeter pipe and flanges are constructed from carbon steel according to the specification. There is a visible white oxide layer on these, as carbon steel has poor corrosion resistance. The flowmeter pipe and flanges were submerged in water, but it is not clear if the corrosion can be purely attributed to the flooding event, as the environment is moist and corrosive, being a coastal wastewater treatment plant. The grounding rings appear to be 316 stainless steel, so remain in good condition. Refer EI&C comment for condition of electrical components.

Justification for Damage Rating - Electrical Impacts

FIT-2233 – WAS Magflow:

The flow transmitter FIT-2233 was observed to be installed well above the recorded flood water level and mounted on a common panel within the service gallery alongside the RAS flow transmitters. Based on observed flood levels within the room, water is assessed to have reached most of the height of the associated flow element (FE), with approximately 100 mm remaining above the water level. Critically, the transmitter itself is considered to have remained above the flood water level.

The flow element is rated to IP66/67, which provides limited protection against short-duration immersion under controlled conditions. This rating does not account for extended immersion or contaminated water exposure. While continued operation may be possible, a reduction in service life cannot be excluded based on the inferred exposure conditions.

AIT-2824 – RAS Line Sludge Density Indicator/Transmitter:

The sludge density indicator/transmitter AIT-2824 was observed to be not fully commissioned at the time of inspection and is understood to be a recent installation. Loose cabling was observed. The operational status and flood exposure condition could not be confirmed based on observation alone.

Photos

Figure 55: Top: 3x RAS and 1x WAS Flow Transmitters on Panel, Bottom Left: WAS flowmeter, Bottom Right: RAS Sludge Density Transmitter (not in service).

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and testing of the flow element associated with FIT-2233 may be undertaken to assess the effects of partial submergence and potential impairment to sealing or insulation.
- Verification of the cable route between the flow transmitter and flow element may be undertaken, with inspection and testing where flood or moisture exposure is suspected.
- Inspection and confirmation of cabling integrity, terminations, and commissioning status for AIT-2824 may be undertaken where continued use is being evaluated.
- Alternatively, replacement of affected instruments or cabling may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

6.2.5 RAS & WAS Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295255	All WAS Actuated Valves	2. Minor (Expected to function, potential reduction in remaining life) (upgraded from rating of 1 in Stage 1 report)	3. Moderate (May not function, expected reduction in remaining life)
E-00295256	All Other RAS Valves	2. Minor (Expected to function, potential reduction in remaining life)	8. N/A

Justification for Damage Rating - Mechanical Impacts

There is only one actuated WAS diaphragm valve, V-466. This is located in the service gallery. The valve was fully submerged at the time of the event, but the actuator was above water level. The valve is expected to be functional as the internals are water-tight, but the valve body may have a reduced life, as it is cast iron construction, which relies on the paint system for corrosion protection. The coating was damaged in some areas, likely due to age of the asset. Motorised actuator for V-466 was above water level and is likely to be functional, though life would be reduced due to moist environment, with visible corrosion on name plate and unclear if it has any IP-rating (refer EI&C comment).

Assuming 'All Other RAS Valves' includes the manual WAS valves too, V-465, V-466, V-467, V-481 are manual diaphragm valves on the WAS line which are located in service gallery too. V-466, V-467, V-481 were fully submerged. Only flange of V-465 submerged. These valves are the same model and construction as V-466, so same assessment can be made on the condition of these valves.

Justification for Damage Rating - Electrical Impacts

The actuator associated with valve V-466 was observed to be installed within the service gallery and positioned above the recorded flood water level. As such, direct submergence exposure is not considered to have occurred.

However, given the presence of floodwater within the service gallery, the actuator may have been exposed to elevated moisture levels and high humidity conditions during the flooding event. As a result, the potential for moisture-related impacts to electrical or mechanical components cannot be excluded based on visual inspection alone.

Photos

Figure 56: WAS pipework in service gallery

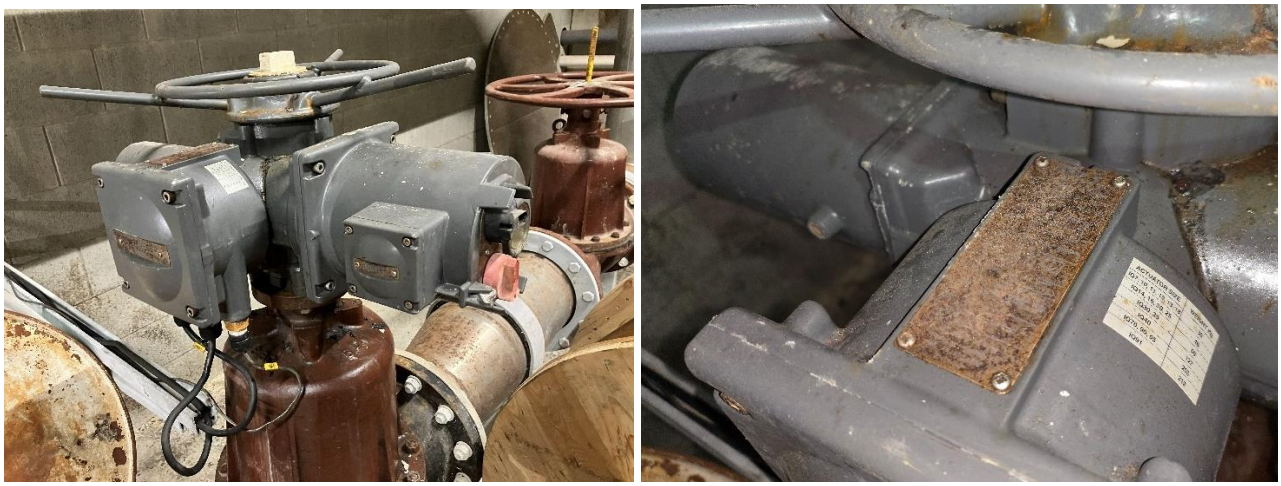

Figure 57: WAS pipework in service gallery

Recovery Guidance

The following guidance is provided for consideration of restoration of function or continued serviceability of the actuator, with reference to Section 2 of this report.

- Cleaning of external surfaces may be undertaken to remove debris and localised corrosion where present.
- Localised paint repair or coating reinstatement may be undertaken in areas where protective finishes appear to have degraded.
- Removal and inspection of actuator cable glands may be undertaken to assess for evidence of moisture or water ingress.
- Functional testing of the actuator through its full range of movement may be undertaken to confirm operational performance.

Where inspection and testing outcomes are satisfactory, continued use may be considered. Alternatively, replacement of the actuator may be considered where testing results are inconclusive or where improved reliability and reduced residual risk are preferred.

7 Damage Assessment Findings – Blower room

7.1 Asset Area and Flooding Impacts

The location of the Blower Room is shown below in Figure 58.

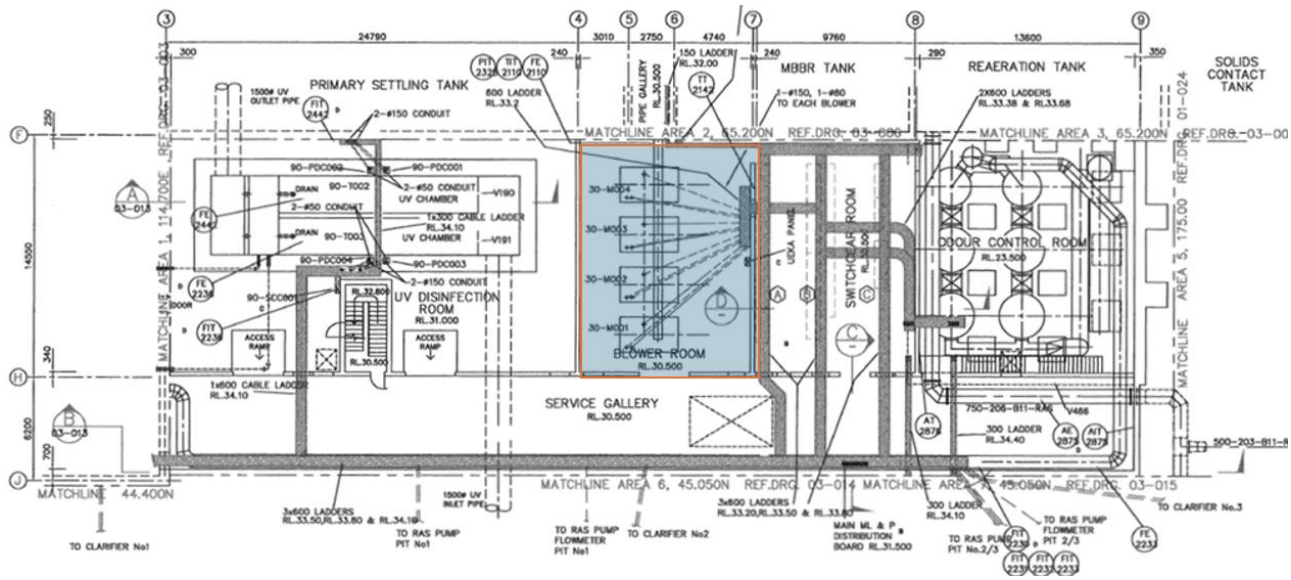

Figure 58: Location of the Blower Room

Beca was advised that this location was submerged to a level of 0.55m above floor level. This impact is shown indicatively below in Figure 59.

Figure 59: Blower Room indication of the approximate level to which assets were submerged - Blower room water level (L) and Blower 1 base frame water level (R)

7.2 Assets

The assets in the Blower Room are grouped by VAMP (asset register) Functional Group and summarised in Table 6 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 6: Summary of assets located in the Blower Room grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Exhaust Air Silencing	Exhaust Air Silencer (2 of)		
	55-S002 Exhaust Air Silencer 2		
Primary Settlement Analysis/Measurement	AIT-2876 Primary Settlement H2S Detector South		
Process Air Blower System	Blower (4 of)		
	All Blower Oil System Pipework		
	All Blower Oil System Valves		
Process Air Blower System Analysis/Measurement	All Blower Temperature Switches		
	All Blower Pressure Switches		
	All Blower Position Switches		
	Blower Inlet/Discharge Pressure Transmitters (5 of)		
	Blower Inlet Temperature Transmitters (3 of)		
	All Blower Level Indicators		
	All Blower Pressure Indicators		
	All Blower Flow Indicators		
	Blower Inlet Pressure/Temp Transmitters (4 of)		
Process Air Transfer	All Other Valves		
	Blower to Process Air Main Duct (4 of)		
	300-329-D31-PA Process Air Main Duct		
Process Air Transfer Analysis/Measurement	PIT 2325 Process Air Pressure Indicator/Transmitter (2 of)		
	TIT 2110 Process Air Temperature Indicator/Transmitter		

Each functional group and its component assets are discussed in greater detail below.

7.2.1 Exhaust Air Silencing

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295333	55-S001 Exhaust Air Silencer 1	1. None (Expected to function)	8. N/A
E-00295334	55-S002 Exhaust Air Silencer 2	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The blower exhaust silencers were located above the blower enclosures and the observed high-water level. The exhaust silencers are not expected to have been impacted.

Justification for Damage Rating - Electrical Impacts

Mechanical assets only - not assessed for electrical impacts.

Photos

Figure 60: Blower Exhaust Air Silencer

Recovery Guidance

N/A

7.2.2 Process Air Blower System

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294651	30-F001 Blower 1	2. Minor (Expected to function, potential reduction in remaining life)	3. Moderate (May not function, expected reduction in remaining life)
E-00294653	30-F002 Blower 2	2. Minor (Expected to function, potential reduction in remaining life)	3. Moderate (May not function, expected reduction in remaining life)
E-00294655	30-F003 Blower 3	2. Minor (Expected to function, potential reduction in remaining life)	3. Moderate (May not function, expected reduction in remaining life)
E-00294656	30-F004 Blower 4	2. Minor (Expected to function, potential reduction in remaining life)	3. Moderate (May not function, expected reduction in remaining life)
E-00295223	All Blower Oil System Pipework	1. None (Expected to function)	8. N/A
E-00295224	All Blower Oil System Valves	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The water level in the blower room was just under the motor and blower mounting feet, water ingress not expected to have occurred. Blowers are expected to be functional.

The blower base frame has an oil reservoir incorporated and was partially submerged. There is very low likelihood that water ingress may have occurred, which could lead to internal corrosion of the hydraulic components. Testing of the oil could determine if water ingress has occurred.

The blower enclosure and intake louvers are of galvanised steel construction and have experienced some corrosion due to submergence, evident by the white discolouration along the water level. Given that the operating environment is will likely to have some H2S exposure and the age of the asset, the enclosure is unlikely to be notably reduced for this submergence.

The intake louvers have filter elements (foam sheet type), of which the lower ones would have soaked up water. These should be either dried out or replaced.

Justification for Damage Rating - Electrical Impacts

Motor terminal boxes were observed to be inadequately sealed, which would allow the potential for moisture ingress. The recorded flood water level was observed to be at the base of the terminal boxes, indicating a credible risk of moisture entry during the flooding event.

Motor power and control cabling to the individual blowers was routed via embedded floor ducts. These ducts were observed to contain standing liquid at the time of inspection, indicating prolonged moisture exposure to the installed cabling.

The blower motors were installed marginally above the recorded flood water level. While direct submergence was not observed, the proximity of the motor base to the water level indicates the potential for intermittent contact or capillary moisture exposure from below. As a result, moisture-related degradation or reduction in service life cannot be excluded, even in the absence of clear physical damage.

Based on the above observations, the condition and continued serviceability of the motors, terminal boxes, and associated cabling cannot be confirmed through visual inspection alone.

Photos

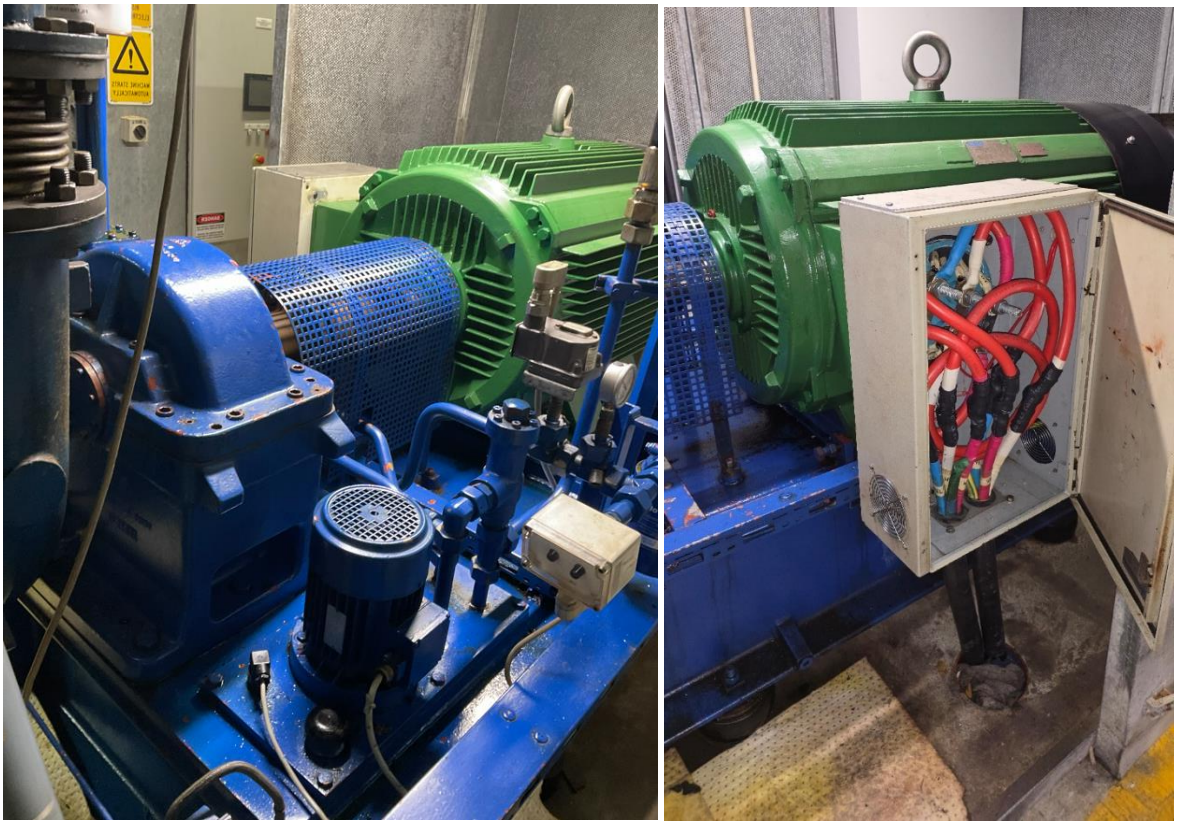

Figure 61: Blower Motor (L) and Termination Box (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and electrical testing of motors may be undertaken to assess the effects of moisture exposure, particularly at the motor base and terminal box interfaces.
- Inspection of motor terminal boxes may be undertaken to assess sealing integrity and evidence of moisture ingress.
- Inspection and testing of power and control cables routed through embedded floor ducts may be undertaken to evaluate moisture exposure and insulation condition.
- Alternatively, replacement of motors, terminal boxes, and associated cabling may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

7.2.3 Process Air Blower System Control Systems

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
	Common Blower	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00294651	30-F001 Blower 1	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00294653	30-F002 Blower 2	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00294655	30-F003 Blower 3	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00294656	30-F004 Blower 4	8. N/A	3. Moderate (May not function, expected reduction in remaining life)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

The recorded flood water level was observed to be at the base of electrical cabinets. Localised rusting and watermarking were noted at the lower sections of some cabinets; however, it could not be determined whether these indicators pre-dated the flooding event or were flood-related.

Power and control cables were observed to enter cabinets via bottom-entry glands. Not all unused gland openings were sealed, which would have allowed moisture to enter the cabinet enclosures. As a result, moisture ingress into the cabinets and potential impact to internal components cannot be excluded. In addition, as cabling was submerged up to the base of the cabinets, the potential for moisture tracking upward along cable conductors or insulation is considered possible.

Motor power and control cabling to the individual blowers was routed through embedded floor ducts. These ducts were observed to contain standing liquid at the time of inspection, indicating sustained exposure of the installed cabling to moisture. Prolonged water retention within these ducts may contribute to further deterioration of cabling insulation and is also noted as presenting a potential health and safety risk within the area.

Based on the above observations, the condition and continued serviceability of affected cabinets, internal components, and cabling cannot be confirmed through visual inspection alone.

Photos

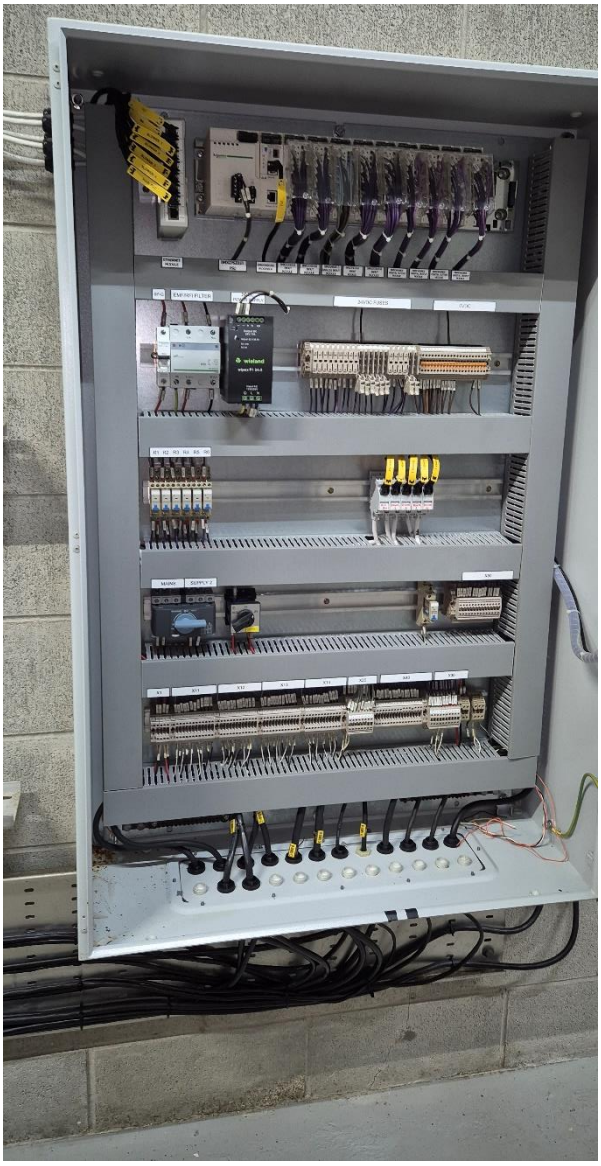

Figure 62: Main Blower control panel with PLC and controls for common equipment

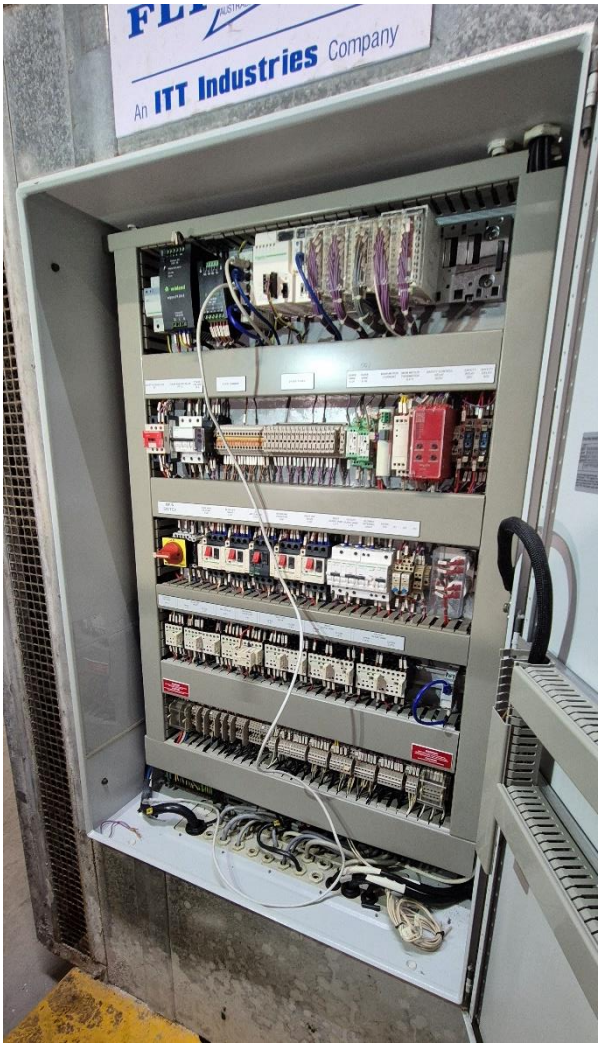

Figure 63: Individual blower control panel with PLC and controls (one of four)

Figure 64: Blower control panel showing unsealed gland holes.

Figure 65: Blower motor cables, power cables and control cables through ducting in floor to individual blowers

Figure 66: Blower motor cables ducting with liquid still inside.

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and internal assessment of electrical cabinets may be undertaken to evaluate evidence of moisture ingress, corrosion, or component degradation.
- Inspection and verification of cable gland sealing, including closure of unused entries, may be undertaken to restore enclosure integrity.
- Inspection and testing of power and control cabling routed through embedded floor ducts may be undertaken to assess moisture exposure and insulation condition.

- Assessment and management of standing liquid within floor ducts may be undertaken to address continued deterioration risk and health and safety considerations.
- Alternatively, replacement of affected cabinets, internal components, and cabling may be considered where inspection or testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

7.2.4 Process Air Blower System Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295526	All Blower Temperature Switches	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00295213	All Blower Pressure Switches	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-00295527	All Blower Position Switches	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295201	PT-2380 Blower 1 Discharge Pressure Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295204	PT-2385 Blower 2 Discharge Pressure Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295207	PT-2390 Blower 3 Discharge Pressure Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295210	PT-2395 Blower 4 Discharge Pressure Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295209	PT-2399 Blower 4 Inlet Pressure Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295203	TT-2114 Blower 1 Inlet Temperature Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295206	TT-2121 Blower 2 Inlet Temperature Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295214	TT-2128 Blower 3 Inlet Temperature Transmitter	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295529	All Blower Level Indicators	8. N/A	8. N/A
E-00295528	All Blower Pressure Indicators	1. None (Expected to function)	8. N/A
E-00295212	All Blower Flow Indicators	8. N/A	8. N/A
E-00295202	PT-2384 Blower 1 Inlet Pressure Transmitter	5. Unable to assess	5. Unable to assess
E-00295205	PT-2389 Blower 2 Inlet Pressure Transmitter	5. Unable to assess	5. Unable to assess
E-00295211	TT-2135 Blower 4 Inlet Temperature Transmitter	5. Unable to assess	5. Unable to assess
E-00295208	TT-2394 Blower 3 Inlet Pressure Transmitter	5. Unable to assess	5. Unable to assess

Justification for Damage Rating - Mechanical Impacts

All blower pressure indicators were located above the water level and not expected to have been impacted.

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Instrument-Specific Observations

PT-2380 – Blower 1 Discharge Pressure Transmitter

- Mounted approximately 1.5 m above the recorded flood water level within an enclosure. The associated cable is assessed as having been partially submerged; however, the transmitter terminals were located above the water level.

PT-2384 – Blower 1 Inlet Pressure Transmitter

- Located above the flood water level. Due to inaccessible areas, a detailed physical inspection could not be undertaken, and the IP rating could not be verified. Moisture-related damage cannot be excluded.

TT-2114 – Blower 1 Inlet Temperature Transmitter

- Located above the flood water level. Moisture-related impacts remain possible. Associated cabling may have been partially submerged.

PT-2385 – Blower 2 Discharge Pressure Transmitter

- Located above the flood water level. Moisture-related impacts remain possible. Associated cabling may have been partially submerged.

PT-2389 – Blower 2 Inlet Pressure Transmitter

- Due to access limitations, detailed inspection was not possible, and IP rating could not be verified. Although installed above the flood water level, moisture-related damage remains possible.

TT-2121 – Blower 2 Inlet Temperature Transmitter

- Located above the flood water level. Moisture-related impacts cannot be excluded. Cabling may have been partially submerged.

PT-2390 – Blower 3 Discharge Pressure Transmitter

- Located above the flood water level. Moisture exposure remains possible. Cabling may have been partially submerged.

PT-2394 – Blower 3 Inlet Pressure Transmitter

- Installed above the flood water level. Due to inaccessible mounting, physical condition and IP rating could not be verified. Moisture-related impacts remain possible. (Note: Asset type verified as PT, not TT.)

PT-2399 – Blower 4 Inlet Pressure Transmitter

- Located above the flood water level. Moisture-related impacts remain possible. Cabling may have been partially submerged.

PT-2395 – Blower 4 Discharge Pressure Transmitter

- Located above the flood water level. Moisture-related impacts remain possible. Cabling may have been partially submerged.

TT-2135 – Blower 4 Inlet Temperature Transmitter

- Located above the flood water level. Physical assessment and IP verification could not be undertaken due to access constraints. Moisture-related damage cannot be excluded.

PIT-2325 – Process Air Pressure Indicator/Transmitter

- Installed at a high elevation within the blower room and assessed as being well above the flood water level. Based on location, this device is not considered to have been directly exposed to floodwater.

TIT-2110 – Room Temperature Transmitter

- Installed at a similar elevation to PIT-2325 and assessed as being well above the flood water level. Direct flood exposure is not indicated.

Photos

Figure 67: Blower instruments

Figure 68: Blower instruments

Recovery Guidance

The following guidance is provided for consideration of instrument recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and testing of affected instruments and associated instrument cabling may be undertaken to assess the extent of moisture exposure, potential water ingress, and functional condition.
- Inspection of instrument enclosures, cable glands, and terminations may be undertaken to evaluate sealing integrity and the potential for moisture ingress.
- Electrical testing of instrument cabling that was partially submerged or exposed to standing water within conduits may be undertaken to assess insulation condition and suitability for continued use.
- Alternatively, replacement of affected instruments and associated cabling may be considered where inspection or testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

7.2.5 Process Air Transfer

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295233	All Other Valves	1. None (Expected to function)	1. None (Expected to function)
E-00295225	300-325-D31-PA Blower 1 to Process Air Main Duct	1. None (Expected to function)	8. N/A
E-00295226	300-326-D31-PA Blower 2 to Process Air Main Duct	1. None (Expected to function)	8. N/A
E-00295227	300-327-D31-PA Blower 3 to Process Air Main Duct	1. None (Expected to function)	8. N/A
E-00295228	300-328-D31-PA Blower 4 to Process Air Main Duct	1. None (Expected to function)	8. N/A
E-00295229	300-329-D31-PA Process Air Main Duct	1. None (Expected to function)	8. N/A

Justification for Damage Rating - Mechanical Impacts

The blower ductwork and valve were located above the blower enclosures and the observed high-water level. The blower ductwork and valves are not expected to have been impacted.

Justification for Damage Rating - Electrical Impacts

N/A

Recovery Guidance

N/A

7.2.6 Process Air Transfer Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295215	PIT 2325 Process Air Pressure Indicator/Transmitter	8. N/A	1. None (Expected to function)
E-00295216	PIT 2325A Process Air Pressure Indicator/Transmitter	8. N/A	1. None (Expected to function)
E-00295221	TIT 2110 Process Air Temperature Indicator/Transmitter	8. N/A	1. None (Expected to function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Assets not affected by flooding.

Recovery Guidance

N/A

8 Damage Assessment Findings – Switchboard room

8.1 Asset Area and Flooding Impacts

The location of the Switchboard Room is shown below in Figure 69.

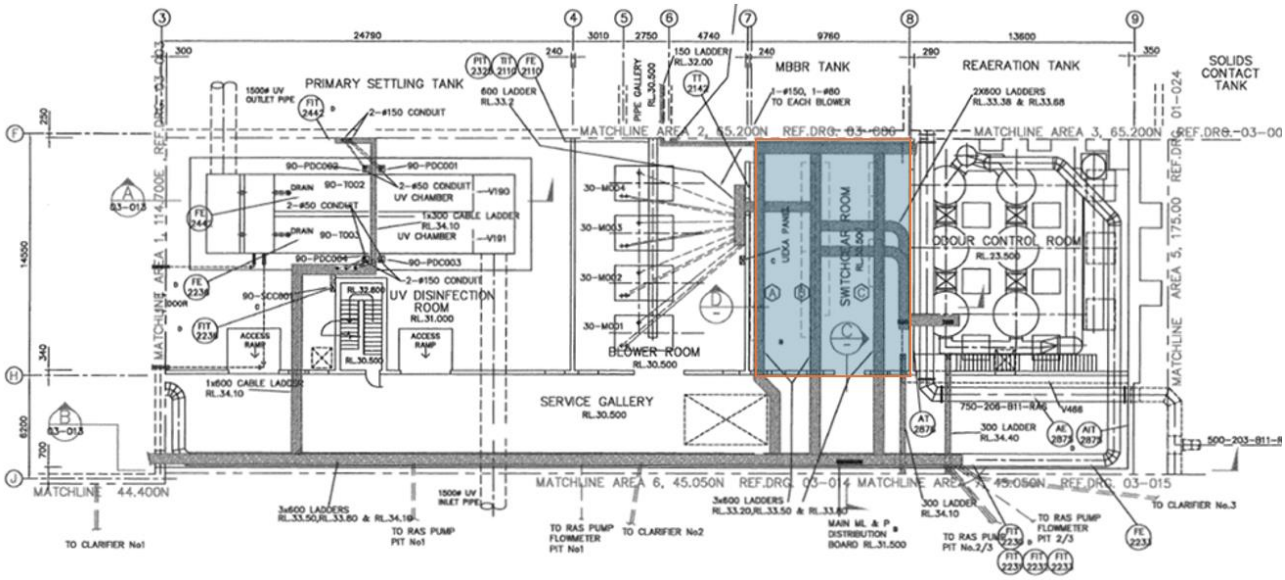

Figure 69: Location of the Switchboard Room

Beca was advised that this location was submerged to a level of 0.55m above floor level. This impact is shown indicatively below in Figure 70.

Figure 70: Indication of the approximate level to which MCCs were submerged

8.2 Assets

The assets in the Switchboard Room are grouped by VAMP (asset register) Functional Group and summarised in Table 7 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 7: Summary of assets located in the Switchboard Room grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
Motor Control Centre	All MCCs		
Power Factor Correction	Power Factor Correction Control Cabinet		
Lighting and Power Distribution Switchboards	All Lighting and Power Distribution Switchboards		
Motor Control Centre	All MCCs		
PLCs	All Other Moa PLCs		
	Moa Main PLC		
SCADA	Moa 3 SCADA Computer		
Uninterruptable Power Supply	Power distribution, power supply (1 of), MCC UPS 3, UPS 3 MCC		
	Power distribution, power supply (2)		

Each functional group and its component assets are discussed in greater detail below.

8.2.1 Motor Control Centre

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294951	All MCCs	8. N/A	6. Exposure to multiple components included against this asset item
E-00296661	Power Factor Correction Control Cabinet	8. N/A	4. Major (Expected to not function)
E-00294956	All Lighting and Power Distribution Switchboards	8. N/A	6. Exposure to multiple components included against this asset item

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

Flood water line marks were recorded at approximately 580 mm above finished floor level. For assessment purposes, a consistent reference (virtual water line) has been applied across all switchboards and associated panels within the affected area.

Based on this reference level, components installed below or intersecting the recorded water line are considered to have been fully or partially submerged. These include, but are not limited to: terminals, variable speed drives (VSDs), circuit breakers, cabling, space heaters, board cells, power factor correction capacitors, and busbars.

Components identified as having been fully submerged, particularly electronic equipment such as VSDs, are considered to have a high likelihood of internal water ingress. For these items, functional integrity and reliability cannot be confirmed through visual inspection alone. Visible wastewater contamination and dirt deposition were observed on lower busbar sections, indicating direct floodwater contact. The presence of moisture combined with potentially corrosive gases, including hydrogen sulphide (H_2S), may contribute to accelerated corrosion of metallic components.

Cabling installed at or below the water line is considered to have been partially submerged. As a result, moisture ingress into cable insulation or shielding, including longitudinal moisture tracking, cannot be excluded. The condition of these cables cannot be confirmed through visual inspection alone.

Equipment installed above the recorded flood water line was not assessed as having been directly submerged. However, given the presence of floodwater within the switchboard rooms, these components may have been exposed to elevated humidity and corrosive atmospheres, including a mixture of moisture and H_2S gas. Such exposure may affect printed circuit boards, electronic assemblies, and internal connections without producing immediately visible signs of damage.

Distribution boards (DBs) located above the flood water line are also considered potentially affected by moisture and corrosive gas exposure. The same considerations apply to lighting systems and other electrical equipment installed within the affected rooms.

Based on the above observations, the condition, safety, and continued serviceability of the switchboards, internal components, cabling, and associated downstream circuits cannot be confirmed through visual inspection alone.

Photos:

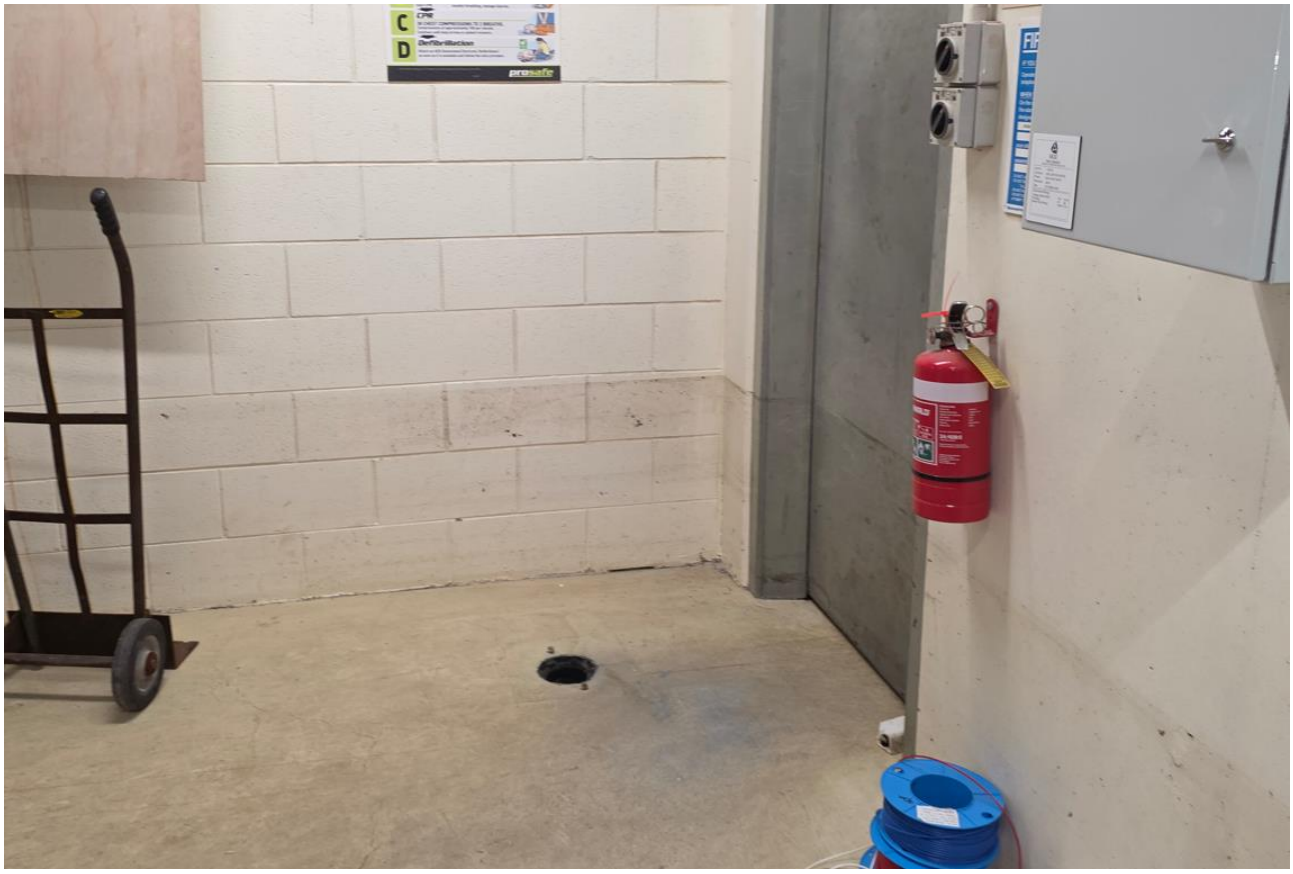

Figure 71: Waterline mark in Switch Room

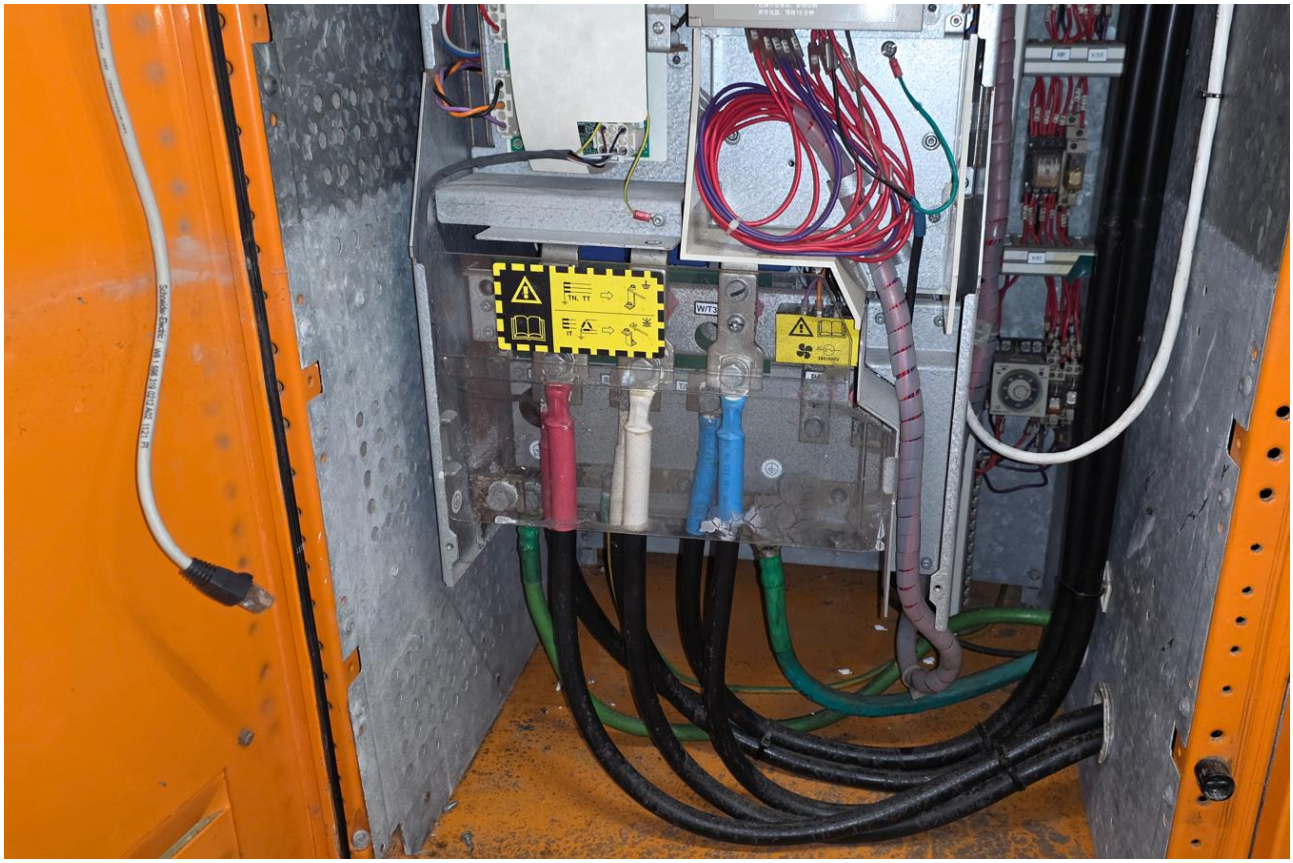

Figure 72: Scrubber Extraction Fan 1 VSD terminals and waterline mark

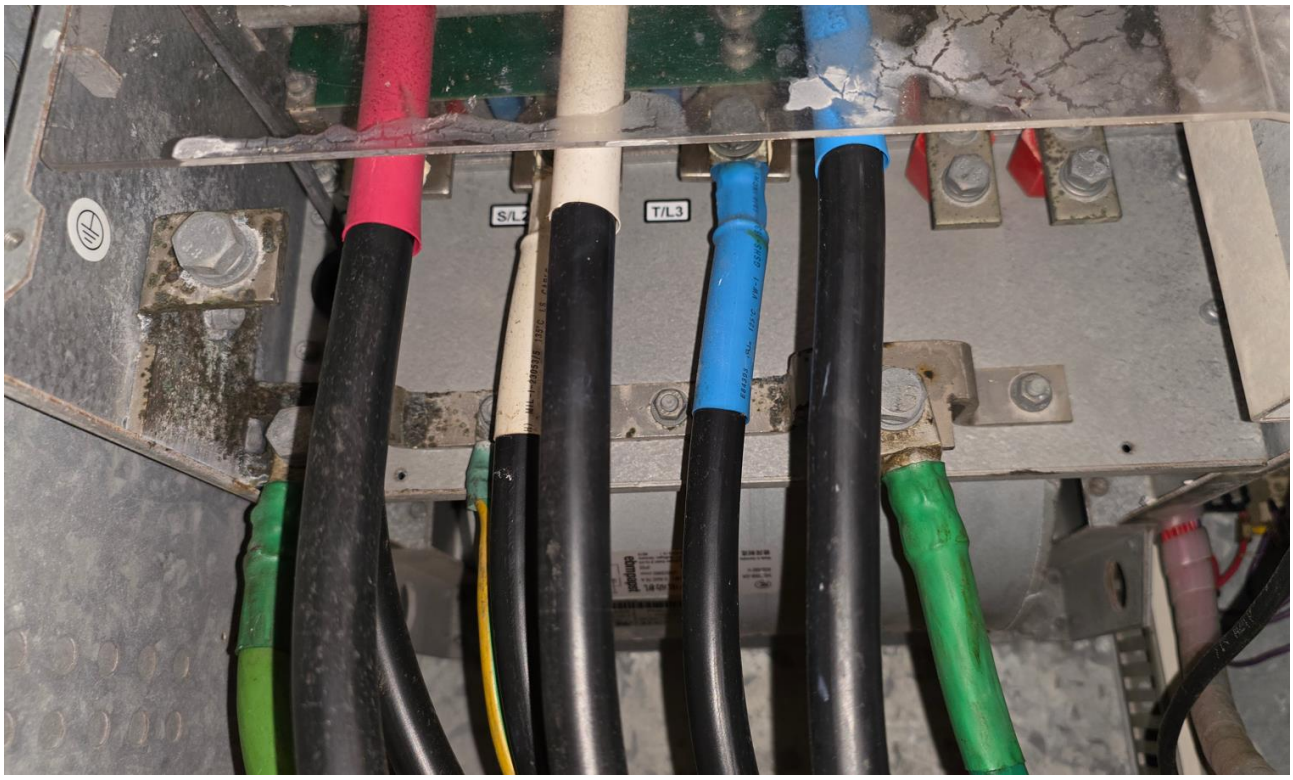

Figure 73: Scrubber Extraction Fan 1 VSD terminals

Figure 74: Waterline height and VSD terminals

Figure 75: Affected cable showing evidence of submergence in water

Figure 76: Affected MCC Cells, Isolators

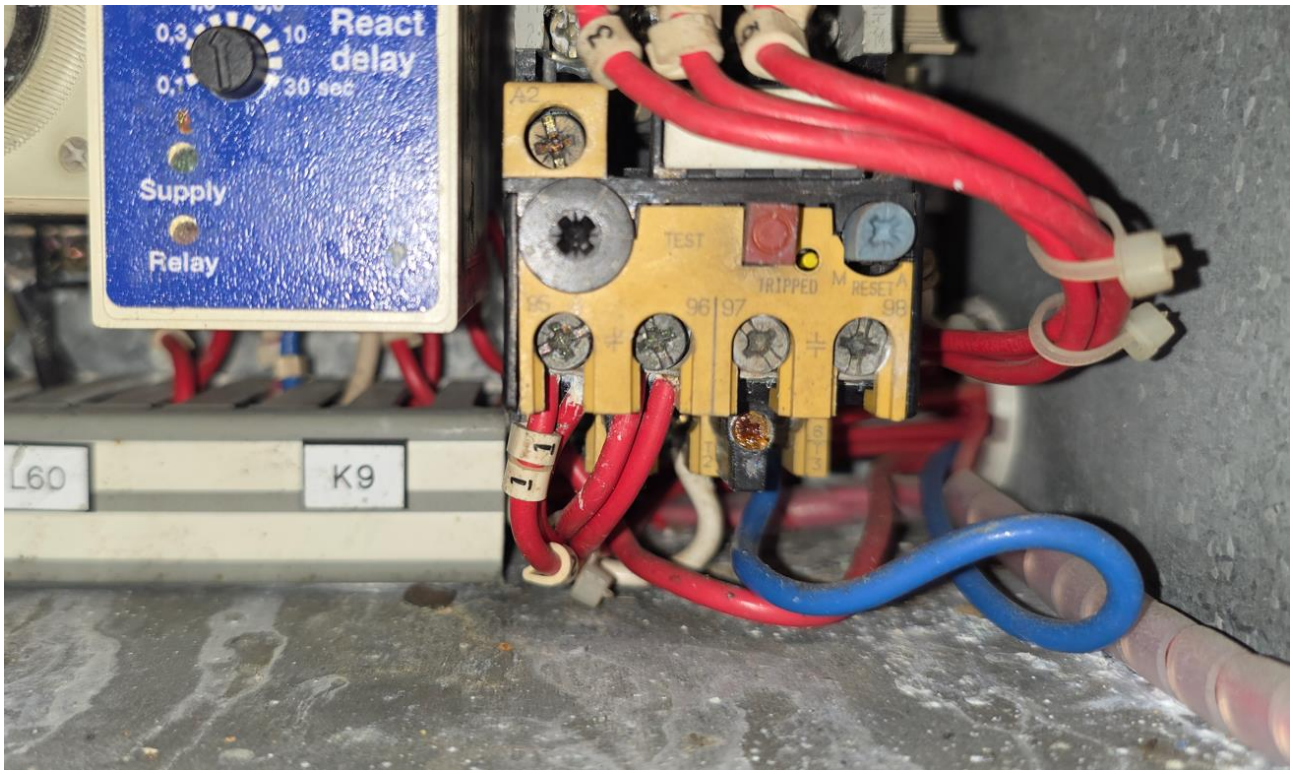

Figure 77: Partial electronics submerged with fresh rust visible

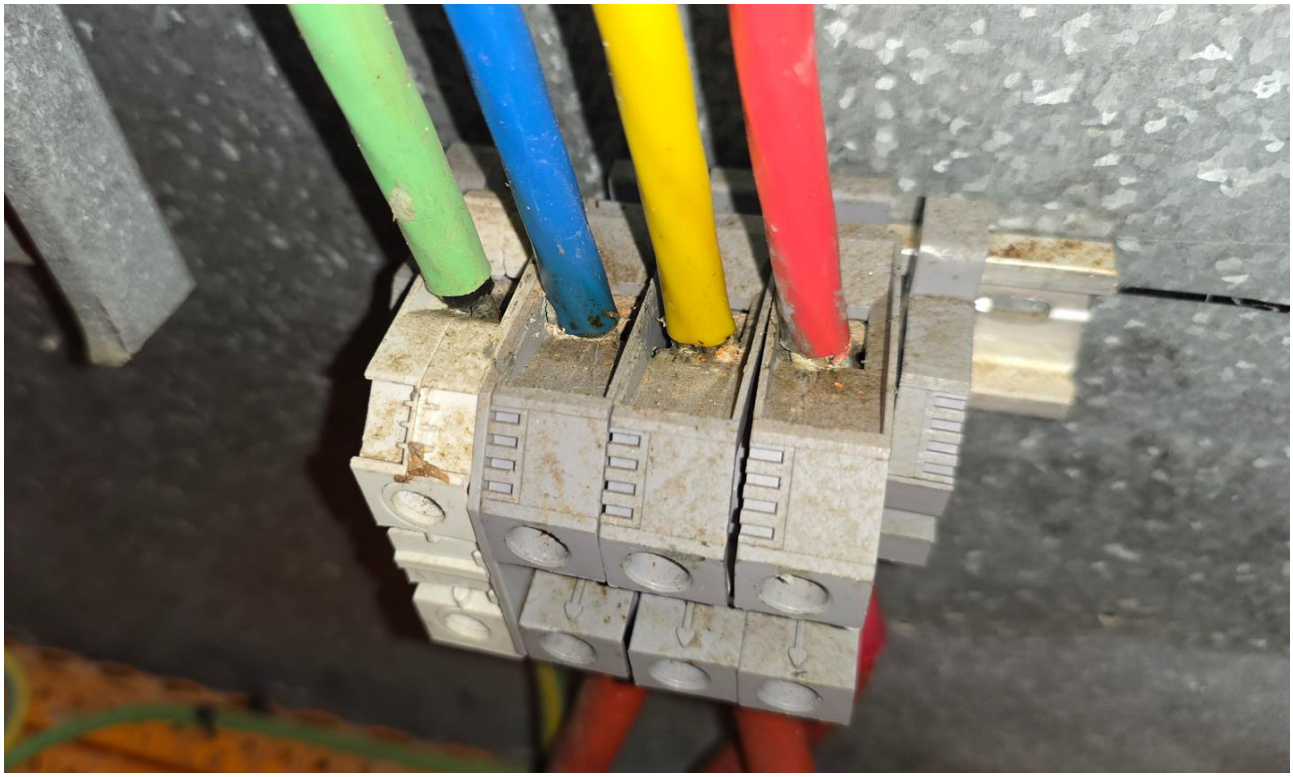

Figure 78: Affected terminals and cables

Figure 79: Electronics partially submerged

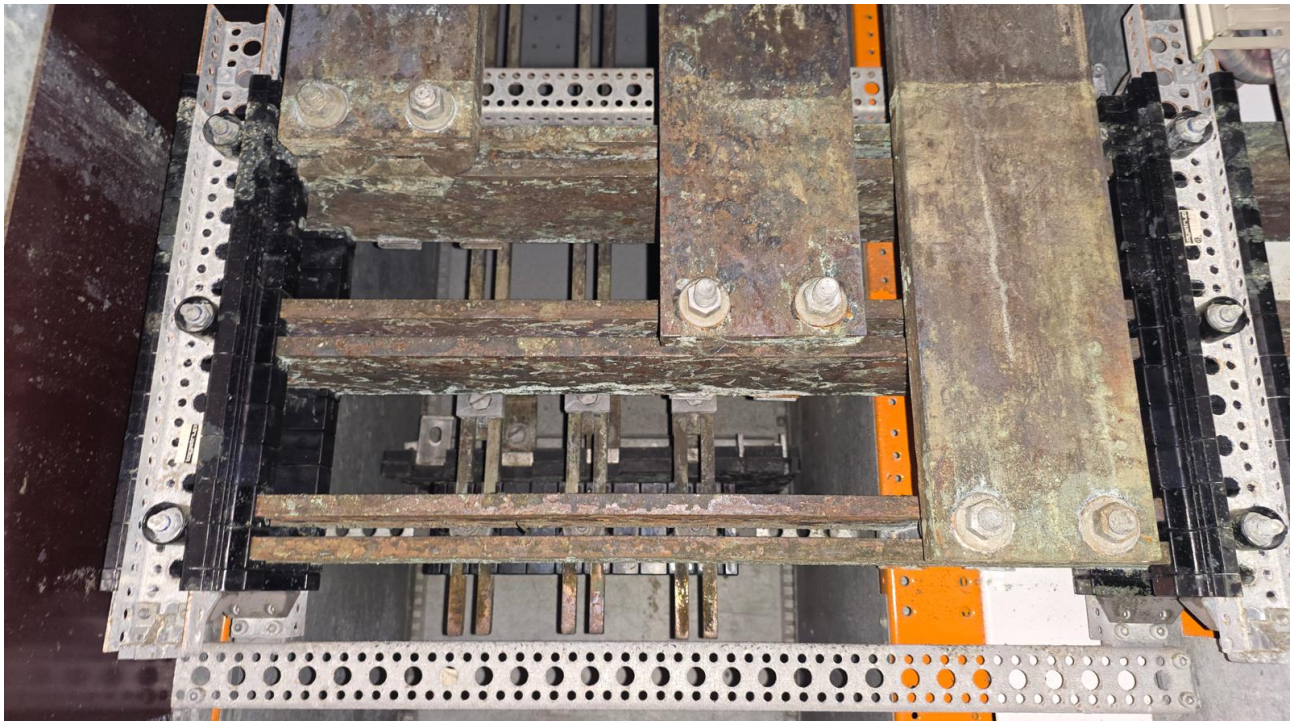

Figure 80: Partially submerged busbars

Figure 81: Residual wastewater in Power Factor Correction panels

Figure 82: Fully submerged power supply

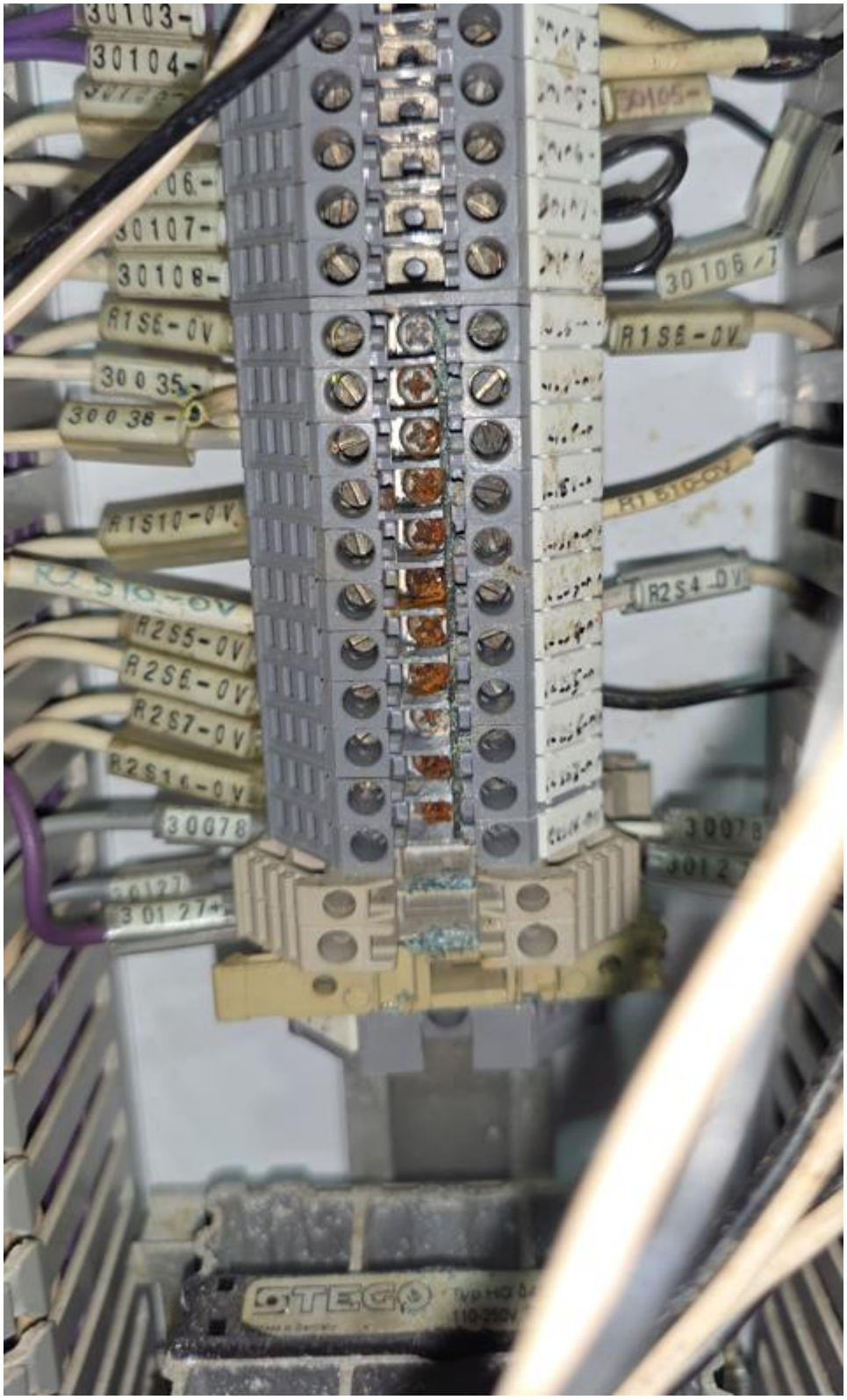

Figure 83: Submerged terminals in PLC panel

Recovery Guidance (Indicative)

- Recovery actions and options are provided in Section 2 of this report.
- Where continued use is being considered, cleaning, inspection, drying, and appropriate electrical testing may be undertaken in accordance with the referenced sections to assess the impact of

floodwater, moisture, and corrosive exposure. This may include assessment of submerged and non-submerged components where latent damage cannot be visually confirmed.

- Alternatively, replacement of affected switchboards, internal components, cabling, and downstream equipment may be considered where testing outcomes are inconclusive or where improved reliability, safety, and reduced residual risk are preferred following flood exposure.

8.2.2 Motor Control Centre Cells

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW001933	Primary Settlement 3 Wash Plate Pump Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001931	Primary Settlement 1 Wash Plate Pump Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001932	Primary Settlement 2 Wash Plate Pump Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001934	Primary Sludge Pump 1 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001935	Primary Sludge Pump 2 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001936	Primary Sludge Pump 3 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001937	Primary Sludge Pump 4 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001938	Primary Sludge Pump 5 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001939	Primary Sludge Pump 6 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001940	RAS Pump 1 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001941	RAS Pump 2 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001942	RAS Pump 3 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001943	RAS Pump 4 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001944	RAS Pump 5 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001945	RAS Pump 6 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001946	Sludge Transport Pump 1 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001947	Sludge Transport Pump 2 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001948	Sludge Transport Pump 3 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001955	Sodium Hydroxide Dosing Pump 7 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001956	Sodium Hydroxide Dosing Pump 8 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW001949	Sodium Hydroxide Dosing Pump 1 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001950	Sodium Hydroxide Dosing Pump 2 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001951	Sodium Hydroxide Dosing Pump 3 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001952	Sodium Hydroxide Dosing Pump 4 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001953	Sodium Hydroxide Dosing Pump 5 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001954	Sodium Hydroxide Dosing Pump 6 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001959	Sodium Hypochlorite Dosing Pump 3 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001960	Sodium Hypochlorite Dosing Pump 4 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001957	Sodium Hypochlorite Dosing Pump 1 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001958	Sodium Hypochlorite Dosing Pump 2 Motor Control Unit	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001911	Anti Scaling Pump Motor Control Unit	8. N/A	5. Unable to assess
E-WEW001940	RAS Pump 1 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001941	RAS Pump 2 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001942	RAS Pump 3 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001943	RAS Pump 4 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001944	RAS Pump 5 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001945	RAS Pump 6 Motor Control Unit	8. N/A	4. Major (Expected to not function)
E-WEW001927	Grit Pump 1 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001928	Grit Pump 2 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001929	Grit Pump 3 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW001930	Grit Pump 4 Motor Control Unit	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
E-WEW001913	Neutralisation Discharge Pump 1 Motor Control Unit	8. N/A	7. UNKNOWN
E-WEW001914	Neutralisation Discharge Pump 2 Motor Control Unit	8. N/A	7. UNKNOWN
E-WEW001915	Odour Scrubber A Stage 1 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001916	Odour Scrubber A Stage 1 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001917	Odour Scrubber A Stage 2 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001918	Odour Scrubber A Stage 2 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001919	Odour Scrubber A Stage 3 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001920	Odour Scrubber A Stage 3 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001921	Odour Scrubber B Stage 1 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001922	Odour Scrubber B Stage 1 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001923	Odour Scrubber B Stage 2 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001924	Odour Scrubber B Stage 2 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001925	Odour Scrubber B Stage 3 Recirculation Pump 1 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW001926	Odour Scrubber B Stage 3 Recirculation Pump 2 MCU	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)

Note, the above table lists MCC cells included in the asset register. There are additional cells that do not have a separate entry in the register.

8.2.3 Switchroom PLCs

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00297845	Moa Main PLC	8. N/A	4. Major (Expected to not function)
	▪ Main PLC Rack 1		3. Moderate (May not function, expected reduction in remaining life)
	▪ Main PLC Rack 2		4. Major (Expected to not function)
	▪ PLC power supplies		4. Major (Expected to not function)
	▪ PLC panel active electrical components (low)		4. Major (Expected to not function)
	▪ PLC panel active electrical components (high)		3. Moderate (May not function, expected reduction in remaining life)
	▪ PLC panel passive electrical components (low)		4. Major (Expected to not function)
	▪ PLC panel passive electrical components (high)		2. Minor (Expected to function, potential reduction in remaining life)
	▪ PLC panels		2. Minor (Expected to function, potential reduction in remaining life)
	▪ PLC Ethernet network switches		2. Minor (Expected to function, potential reduction in remaining life)
	▪ PLC Modbus+ hardware		3. Moderate (May not function, expected reduction in remaining life)
E-00294979	All Other Moa PLCs:	8. N/A	3. Moderate (May not function, expected reduction in remaining life)
	▪ MEM PLC Rack		2. Minor (Expected to function, potential reduction in remaining life)
	▪ MEM PLC Gateway		2. Minor (Expected to function, potential reduction in remaining life)
	▪ Temp PLC Rack (Flex5000)		2. Minor (Expected to function, potential reduction in remaining life)
	▪ PLC panel active electrical components (low)		4. Major (Expected to not function)

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
	▪ PLC panel active electrical components (high)		3. Moderate (May not function, expected reduction in remaining life)
	▪ PLC panel passive electrical components (low)		4. Major (Expected to not function)
	▪ PLC panel passive electrical components (high)		2. Minor (Expected to function, potential reduction in remaining life)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

The PLC cabinets in the switchroom were flooded to a depth of approximately 55 cm, with components below the flood line rendered unserviceable, and components just above the flood line also potentially unserviceable due to the high moisture levels and liquid tracking up instrument and control cabling. The cabling has also been exposed to high H2S levels accelerating the damage. The PLCs were in operation at the time so may have suffered electrical surge damage (they have not been tested). In addition, the UPS and battery were inundated and are deemed unserviceable.

Moa Main PLC:

The main Moa Modicon Quantum PLC top rack was well clear of the water and may be serviceable, but the lower rack was very close to the limit with wire looms partly submerged so expected to have suffered damage.

Note, there are components of the main PLC such as remote racks located high in the MCCs. While they were well clear of the flood level, the power supply to them and the communications may have been damaged.

Other PLCs in switchroom:

The Schneider M340 MEM PLC was well clear of the flooding and was reinstated at the time of inspection via a temporary supply, along with the PLC Ethernet network switch, Modbus gateway and temporary PLC remote IO rack.

The plant operator is using the temporary Rockwell PLC to allow visibility on the plant SCADA of some non-damaged instruments and some basic control functions. The PLC processor is in the communications room adjacent to the control room so not affected. The remote IO rack in the PLC cabinets was at a high level so while operational, may have suffered damage potentially reducing its expected life.

Photos

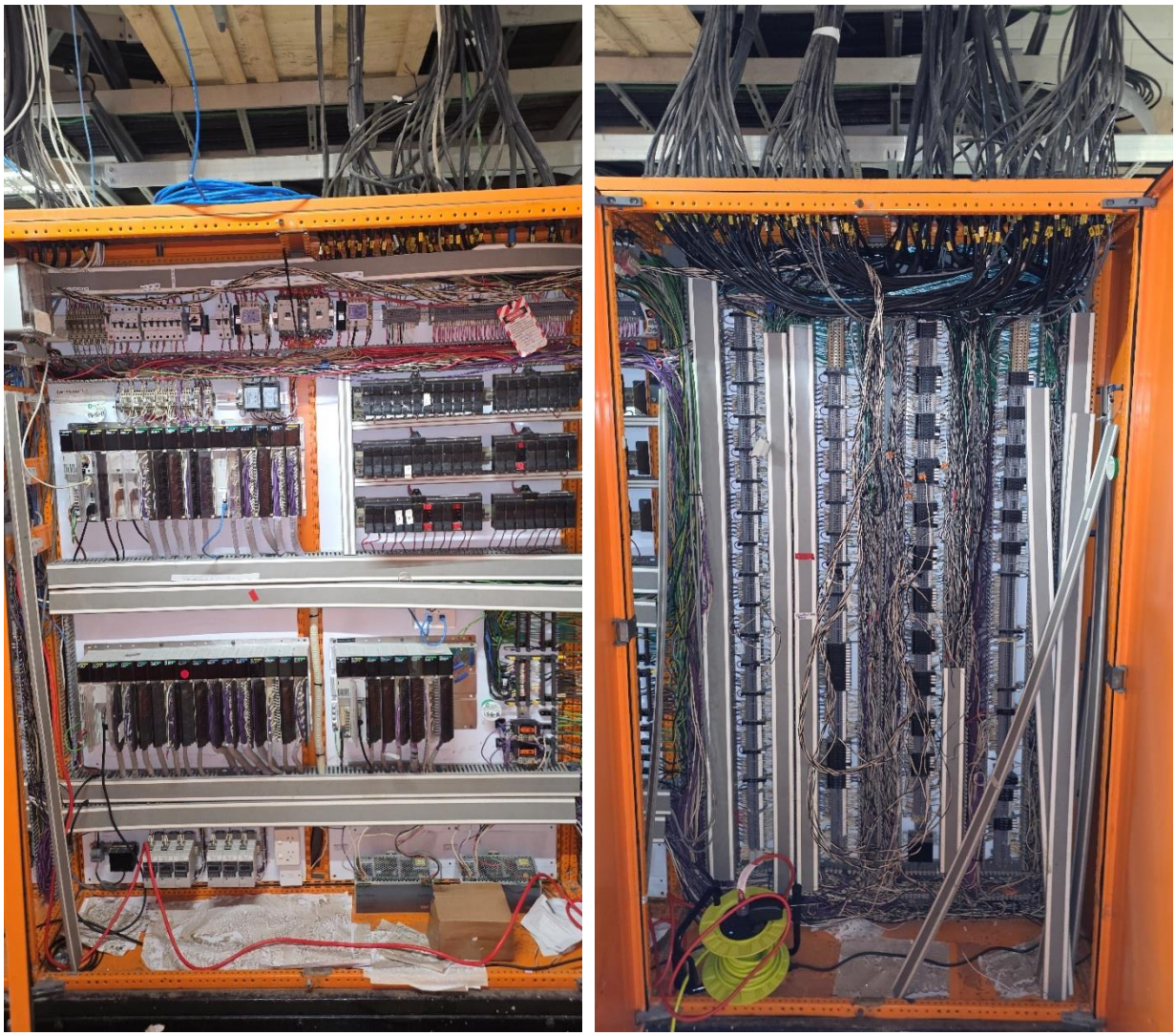

Figure 84: Main Moa PLC racks, PLC power supplies, 230VAC distribution and other electrical components (L) and Field IO terminations (R)

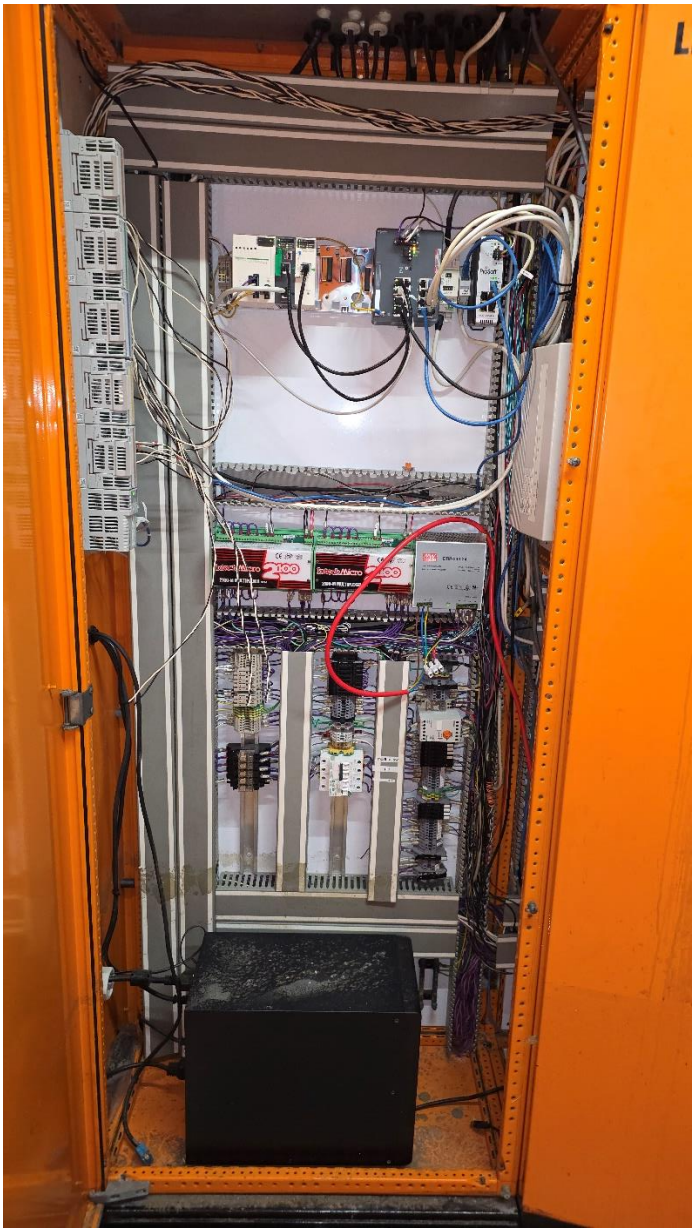

Figure 85: Main MEM PLC, Ethernet network switch, modbus gateway, temporary PLC IO rack, temporary power supply and other electrical components. UPS visible in bottom of cabinet

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- All electrical components below or close to the observed water line should be replaced due their observed damage and due to electrical safety considerations.
- Components well clear of the observed water line would require detailed testing to confirm electrical integrity, and only then if operational. Noting that even if deemed operational they are expected to have a shortened life due to the environment they were exposed to.

8.2.4 PLC Uninterruptable Power Supply

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW001784	MCC Room UPS	8. N/A	4. Major (Expected to not function)
E-WEW001783	MCC Room UPS Battery Pack	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

The PLC UPS located in the base of the PLC cabinet and the battery located between the PLC cabinets and the power factor correction cabinets were both fully submerged and not expected to function. The manual changeover switch for the UPS was not affected.

Photos

Figure 86: PLC UPS (L) and Battery Pack (R)

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Sections 2 of this report.

- The UPS and battery should be replaced with no attempt to recondition the UPS due to electrical safety considerations.

8.2.5 Switchroom SCADA

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00294978	Moa 3 SCADA Computer	8. N/A	4. Major (Expected to not function)

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

The SCADA client in the switchroom was located on a cupboard adjacent to the PLC cabinets. The PC located in the cupboard and its power supply were fully submerged so not expected to function. The PC monitor on the cupboard was above the high-water level and while it may be operational it will likely have a shortened life.

Photos

Figure 87: Switchroom SCADA client PC, power supply and monitor

Recovery Guidance

The following guidance is provided for consideration of asset recovery or reuse, with reference to Section 2 of this report.

- Replace the SCADA PC, monitor and power supply.
- Replace the GPO and cabling from the UPS supply

9 Damage Assessment Findings – UV room

9.1 Asset Area and Flooding Impacts

The location of the UV Room is shown below in Figure 88.

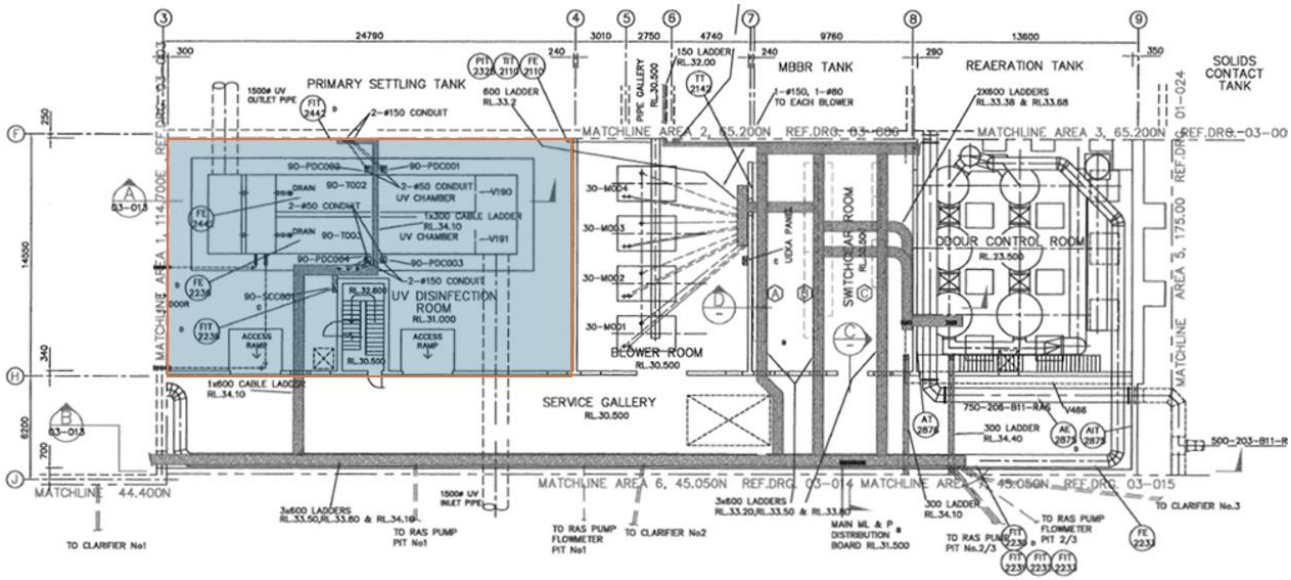

Figure 88: Location of the UV Room

Beca was advised that this location was submerged to a level of 0.6 m above floor level at the doors and with water flow originating from the UV channels. This impact is shown indicatively below in Figure 89 and Figure 90.

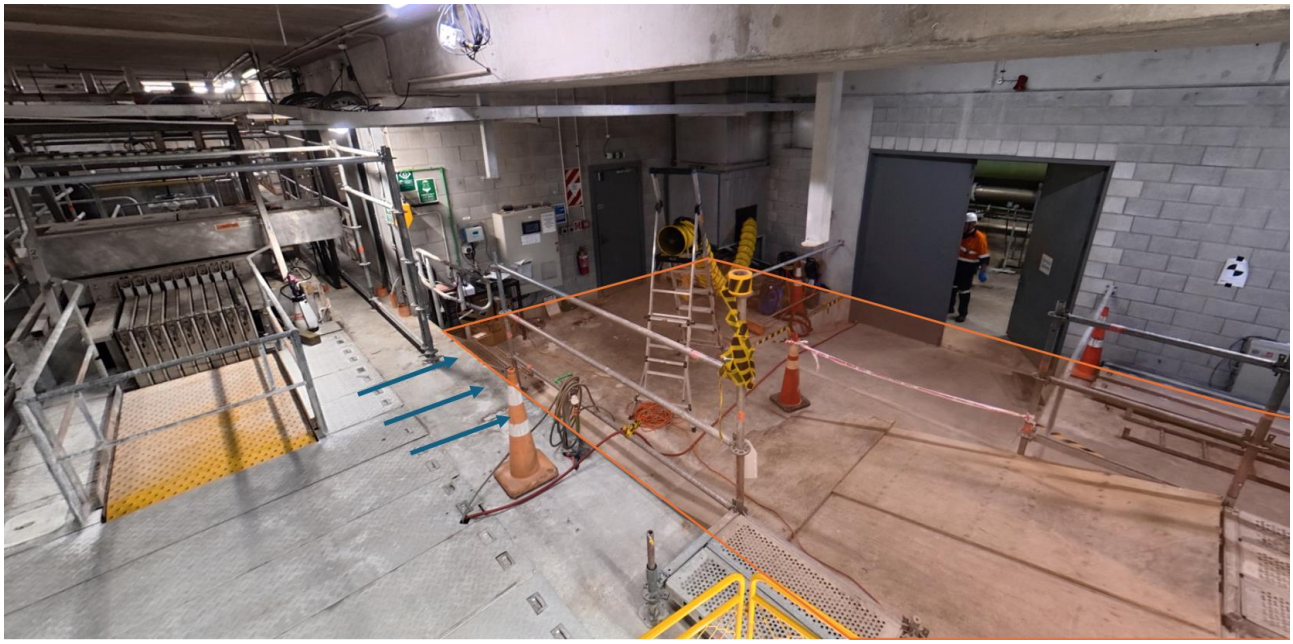

Figure 89: UV Room indication of the approximate level to which assets were submerged

Figure 90: UV Room indication of the approximate level to which assets were submerged

9.2 Assets

The assets in the UV Room are grouped by VAMP (asset register) Functional Group and summarised in Table 8 below based on their mechanical and electrical damage assessment rating from the Stage 1 report. Refer to Table 1 for details on mapping of colours to different damage assessment ratings.

Table 8: Summary of assets located in the UV Room grouped by VAMP Functional Group

Functional Group	Description	Mech Rating	Elec Rating
UV Analysis/Measurement	UV Auto Sampler		
	UV Tank Flow Indicator Transmitter (2 of)		
	UV Transmittance Analyser		
UV Channel & Piping	UV Channel Low Level Switch (2 of)		
UV Treatment	90-PDC003 UV Power Distribution Centre (3 of)		
	90-PDC001 UV Power Distribution Centre (2 of)		
UV Valving	UV Channel Inlet Penstock Valve (2 of)		

Each functional group and its component assets are discussed in greater detail below.

9.2.1 UV Analysis/Measurement

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-WEW002125	UV Auto Sampler	1. None (Expected to function)	2. Minor (Expected to function, potential reduction in remaining life)
E-00295199	FIT2236 UV Tank 2 Flow Indicator Transmitter	8. N/A	1. None (Expected to function)
E-00295198	FIT2442 UV Tank 1 Flow Indicator Transmitter	8. N/A	1. None (Expected to function)
E-00297848	UV Transmittance Analyser	5. Unable to assess	5. Unable to assess

Justification for Damage Rating - Mechanical Impacts

The UV Auto Sampler was installed at the upstream end of the UV channel. There was no evidence of submergence of the auto sampler. The sampler cabinet would provide some splash protection of the equipment. No mechanical issues expected to impact the sampler due to the overflow event.

Justification for Damage Rating - Electrical Impacts

UV Autosampler

The flood water line was observed to be below the UV autosampler enclosure, indicating that direct submergence did not occur. However, the presence of floodwater within the UV area, combined with elevated moisture and potential hydrogen sulphide (H_2S) gas exposure, may adversely affect the autosampler over time. As a result, the operational condition and continued serviceability cannot be confirmed based on visual inspection alone.

E-00295199 – Flow Transmitter

Flow transmitter E-00295199 was observed to be installed at a high level, above the recorded flood water line. The associated flow sensor receives level input from an elevated position and was not assessed as having been submerged. An additional temperature sensor is associated with this installation. While direct flood exposure is not indicated, potential impacts from moisture and H_2S exposure within the UV area cannot be excluded.

E-00295198 – Flow Transmitter

Flow transmitter E-00295198 was also observed to be installed at a high level, above the recorded flood water line. The associated flow sensor receives level input from an elevated position. It is noted that the sensor may not have been in service at the time of inspection due to the UV project, although the transmitter itself is expected to be active. An additional temperature sensor is associated with this installation. Moisture- or gas-related impacts cannot be excluded based on visual inspection alone.

E-00297848 UV Transmittance Analyser

Asset E-00297848 could not be located at the time of inspection and was therefore not assessed. Its exposure condition and operational status could not be confirmed.

Photos

Figure 91: UV Auto Sampler

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and functional testing of the UV autosampler, flow transmitters, associated sensors, and cabling may be undertaken to assess the effects of moisture and potential H_2S exposure.
- Verification of commissioning status and connectivity of associated sensors may be undertaken, particularly where assets were not fully in service at the time of inspection.
- Further investigation may be required to locate and assess asset E-00297848 once access or identification can be confirmed.
- Alternatively, replacement of affected instruments or components may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

9.2.2 UV Treatment

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00295240	90-PDC003 UV Power Distribution Centre Channel 2A Inlet	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295241	90-PDC004 UV Power Distribution Centre Channel 2B Outlet	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295242	90-SCC001 UV System Control Centre	8. N/A	2. Minor (Expected to function, potential reduction in remaining life)
E-00295238	90-PDC001 UV Power Distribution Centre Channel 1A Inlet	8. N/A	8. N/A
E-00295239	90-PDC002 UV Power Distribution Centre Channel 1B Outlet	8. N/A	8. N/A

Justification for Damage Rating - Mechanical Impacts

Electrical assets were not assessed for mechanical impacts.

Justification for Damage Rating - Electrical Impacts

UV Channel 1 control panel was decommissioned at the time of inspection and was not assessed for flood-related impacts or operational condition.

The UV System Control Centre and the UV Channel 2 control panels were observed to be installed well above the recorded high-water level. No visible signs of water ingress were identified at the time of inspection. However, given the operating environment within the UV room, including the presence of elevated moisture and potential hydrogen sulphide (H_2S) gas, the possibility of longer-term degradation to internal electronic components cannot be excluded. Such impacts may not be immediately evident through visual inspection alone.

As a result, the condition and continued serviceability of the UV control equipment cannot be fully confirmed based solely on observed physical condition.

Photos:

Figure 92: UV Control Panel

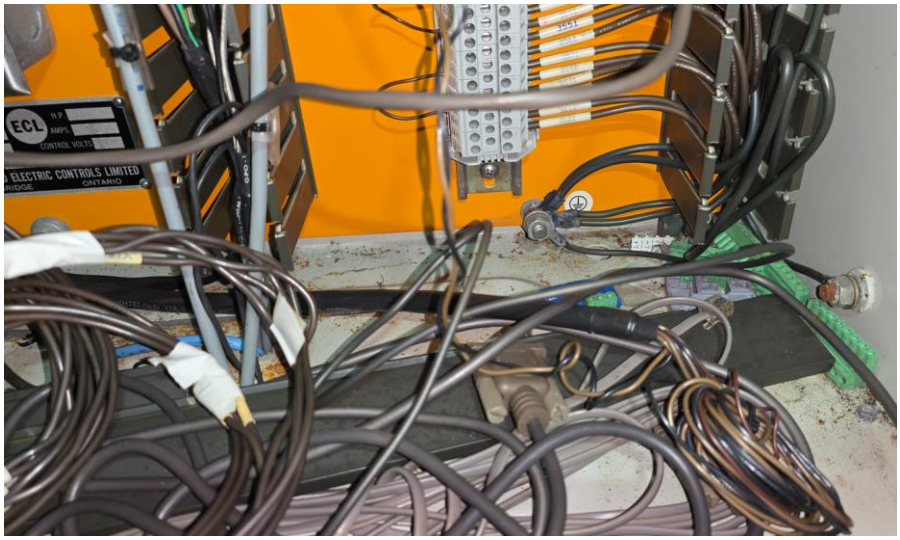

Figure 93: UV Control Panel Interior

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report (not limited to these sections).

- Where reuse is being considered, inspection and functional testing of the UV System Control Centre and UV Channel 2 control panels may be undertaken to assess the effects of moisture and potential H_2S exposure.
- Inspection of enclosures, seals, and internal components may be undertaken to identify any latent corrosion or electronic degradation not apparent through visual inspection.
- Alternatively, replacement of affected control equipment may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

9.2.3 UV Valving

Specific assets in this asset Functional Group include:

Asset Tag	Description	MECHANICAL Predicted damage class	ELECTRICAL Predicted damage class
E-00297782	V190 UV Channel 1 Inlet Penstock Valve	1. None (Expected to function)	2. Minor (Expected to function, potential reduction in remaining life)
E-WEW002137	V191 UV Channel 2 Inlet Penstock Valve	1. None (Expected to function)	2. Minor (Expected to function, potential reduction in remaining life)

Justification for Damage Rating - Mechanical Impacts

The UV channel penstocks would have experienced an increased level of submergence than normal operation. The penstocks would be suitable for submergence and the water level increase due to the event would not be expected to have impacted the penstock life.

The motorised actuator of the penstock was mounted above water level and not expected to have a notable mechanical impact on the actuator life or functionality.

Justification for Damage Rating - Electrical Impacts

The actuators were observed to be installed above the recorded flood water level and are not considered to have been directly submerged during the flooding event. No visible signs of water ingress were identified at the time of inspection.

However, the actuators are located within the UV room environment, where elevated moisture levels and potential hydrogen sulphide (H_2S) gas were present during and following the flooding event. As a result, longer-term degradation of electrical or mechanical components due to corrosive or humid conditions cannot be excluded. Such impacts may not be readily identifiable through visual inspection alone.

Accordingly, the operational condition and continued serviceability of the actuators cannot be fully confirmed based solely on observed physical condition.

Photos

Figure 94: UV System Actuated Penstock Valves

Recovery Guidance

The following guidance is provided for consideration of asset recovery or continued use, with reference to Section 2 of this report.

- Where reuse is being considered, inspection and functional testing of the actuators may be undertaken to assess the effects of potential moisture and H_2S exposure.
- Inspection of actuator enclosures, seals, cabling, and terminations may be undertaken to identify any latent corrosion or degradation.
- Verification of full operational movement and response may be undertaken to confirm continued suitability for service.
- Alternatively, replacement of actuators may be considered where testing outcomes are inconclusive or where improved reliability and reduced residual risk are preferred.

10 Miscellaneous Issues

This section includes discussion of miscellaneous issues encountered during preparation of the Stage 2 Report including:

- Missing Assets
- Changed Ratings (from Stage 1)

10.1 Assets Not Assessed

The following assets were listed in the VAMP Asset Register but were unable to be located/identified for assessment and hence no ratings are provided. Note that some of these assets were unknown at the Stage 1 report and have been confirmed missing and ratings revised for this report (refer to Section 0).

Table 9: Summary of assets which were unable to be assessed

Asset Tag	Description	Functional Group
E-00294928	Emergency Lighting System	Site Lighting
E-00294931	All Fire Detection & Alarm Equipment	Fire Detection Systems
E-00295092	AT-2858 Odour Scrubber Outlet H2S Indicator Transmitter	Odour Control Analysis/Measurement
E-00295108	AT-2856 Neutralisation pH Indicator Transmitter	Neutralisation Analysis/Measurement
E-00295202	PT-2384 Blower 1 Inlet Pressure Transmitter	Process Air Blower System Analysis/Measurement
E-00295205	PT-2389 Blower 2 Inlet Pressure Transmitter	
E-00295208	TT-2394 Blower 3 Inlet Pressure Transmitter	
E-00295211	TT-2135 Blower 4 Inlet Temperature Transmitter	
E-00295212	All Blower Flow Indicators	
E-00295370	55-T004 Neutralisation storage Tank	Neutralisation Storage
E-00295529	All Blower Level Indicators	Process Air Blower System Analysis/Measurement
E-00296897	AIT-2875 Primary Settlement H2S Detector North	Primary Settlement Analysis/Measurement
E-00296898	AIT-2876 Primary Settlement H2S Detector South	
E-00297848	UV Transmittance Analyser	UV Analysis/Measurement
E-WCC00018	UV Channel 1 Low Level Switch	UV Channel & Piping
E-WCC00019	UV Channel 2 Low Level Switch	
E-WEW001911	Anti Scaling Pump Motor Control Unit	Anti Scaling Pumping
E-WEW001912	Diesel Transfer Pump Motor Control Unit	Diesel Generator
E-WEW001913	Neutralisation Discharge Pump 1 Motor Control Unit	Neutralisation Pumping
E-WEW002147	AIT-2854 Odour Scrubber Inlet H2S Indicator Transmitter	Odour Control Analysis/Measurement

10.2 Damage Assessment Revised Ratings

In the process of preparing this Stage 2 Assessment Report and reviewing notes and available information the damage assessment ratings have been revised for several assets. The changes are summarised below including the previous (Stage 1) and revised (Stage 2) ratings. The Stage 2 rating is highlighted blue to indicate where the change has occurred. Refer to the relevant Functional Group section of this report for commentary to support the rating.

Table 10: Summary of assets where damage assessment ratings from the Stage 1 Assessment have been revised

Asset Tag	Description	Functional Group	Stage 1 Assessment Rating		Stage 2 (Revised) Assessment Rating	
			Mech.	Elec.	Mech.	Elec.
E-00295101	Anti Scalant Storage Tank	Anti Scalant Storage	6	4	1	4
E-00295084	AT-2860/2862 Odour Scrubber A Stage 2 pH/ORP indicator Transmitter	Odour Control Analysis/Measurement	1	4	8	4
E-00295093	All Odour Control Level Switches	Odour Control Analysis/Measurement	8	3	8	4
E-00295094	All Odour Control Pressure Switches	Odour Control Analysis/Measurement	4	4	8	4
E-00295097	All Odour Control Position Switches	Odour Control Analysis/Measurement	4	3	8	3
E-WEW002069	Plant Services Backflow Preventer (sludge gallery)	Potable Water Valving	1	8	2	8
E-00295526	All Blower Temperature Switches	Process Air Blower System Analysis/Measurement	2	3	8	3
E-00295528	All Blower Pressure Indicators	Process Air Blower System Analysis/Measurement	2	8	1	8
E-00295194	FIT-2233 - WAS Magflow Transmitter	RAS & WAS Analysis/Measurement	8	3	3	3
E-00295256	All Other RAS Valves	RAS & WAS Valving	2	2	2	8
E-00303656	Muncher	Sludge Transport Pumping	2	4	3	4
E-WEW001912	Diesel Transfer Pump Motor Control Unit	Diesel Generator	8	7	5	5
E-00295108	AT-2856 Neutralisation pH Indicator Transmitter	Neutralisation Analysis/Measurement	8	7	5	5
E-WEW001913	Neutralisation Discharge Pump 1 Motor Control Unit	Neutralisation Pumping	8	7	5	5
E-00295370	55-T004 Neutralisation storage Tank	Neutralisation Storage	8	8	5	5
E-00295092	AT-2858 Odour Scrubber Outlet H2S Indicator Transmitter	Odour Control Analysis/Measurement	8	7	5	5
E-WEW002147	AIT-2854 Odour Scrubber Inlet H2S Indicator Transmitter	Odour Control Analysis/Measurement	7	7	5	5

Asset Tag	Description	Functional Group	Stage 1 Assessment Rating		Stage 2 (Revised) Assessment Rating	
			Mech.	Elec.	Mech.	Elec.
E-00295212	All Blower Flow Indicators	Process Air Blower System Analysis/Measurement	8	8	5	5
E-00295529	All Blower Level Indicators	Process Air Blower System Analysis/Measurement	2	8	5	5
E-00297848	UV Transmittance Analyser	UV Analysis/Measurement	7	7	5	5
E-WCC00018	UV Channel 1 Low Level Switch	UV Channel & Piping	7	7	5	5
E-WCC00019	UV Channel 2 Low Level Switch	UV Channel & Piping	7	7	5	5