NW000-S0034 NS189 OIL CONTAINMENT FOR MAJOR SUBSTATIONS
ISSUE

For issue to all Ausgrid and Accredited Service Providers’ staff involved with the design of oil containment systems at major substations, and is for reference by field, technical and engineering staff.

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Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

DISCLAIMER

As Ausgrid’s standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

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All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid’s Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

Notes: 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2011 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid’s network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfill the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid’s interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid’s interpretation.

KEYPOINTS

This standard has a summary of content labelled “KEYPOINTS FOR THIS STANDARD”. The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.").
KEY POINTS OF THIS STANDARD

Scope and Risks Addressed

This standard details general design requirements for oil containment for major substations with the limitations as listed below and the associated risks as indicated:

- Applies to new and existing major substations with primary voltages of 33kV, 66kV and 132kV.
- Controls apply to both normal operations and during emergency situations.
- Maintenance and operation of oil containment facilities is specified separately in NS190 Oil Containment Operational Requirements for Major Substations.
- Consideration given to different types of oil containment plant for various situations found in major substations.
- All materials and equipment used in construction of Ausgrid assets must be asbestos free.
- Three main risks to be addressed:
  - Catastrophic failure causing prolonged fire.
  - Catastrophic failure large amounts oil spreading off-site.
  - Minimise oil pollution during normal operation.

Design Principles, Site and Regulatory Requirements

This section lists the basic design assumptions and principles used to design oil containment systems within Ausgrid:

- Basic design assumptions listed in Cl. 6.1
- New and existing systems reviewed in Cl. 6.2
- For existing major substations, all areas with any oil-filled equipment containing more than 1000 litres of oil will require oil containment facilities.
- For equipment less than 1000 litres or in areas designated low risk containment may not be necessary.
- For new substation sites all oil-filled equipment will be banded unless indicated otherwise.
- Due consideration to minimise contamination of stormwater.
- Principles for addressing three main risks.
- Selection criteria for oil containment systems based on Life Cycle Cost.
- Criteria for preferred designs indicated for greenfield sites.
- For brownfield retrofit sites the preferred oil containment system is a closed drainage PPS system.
- Drainage design philosophy for closed systems and gravity drainage reviewed.
- Some existing and temporary sites may adopt an alternative approach.
- Designer Safety Report required.
- Site selection criteria to limit impact of oil loss.
- Oil containment discharge to Stormwater and Sewer may have Regulatory requirements.

Typical Layouts, Bunding and Drainage

Specific design requirements are addressed as listed:

- Typical oil containment layouts given for CBD and suburban major substations.
- Bunding areas designed to minimise entry of clean stormwater.
- Bunding designed to prevent burning fuel spreading fire to adjoining equipment.
- Spray screens may be required if bund unable to contain spray discharge.
- Transformer roadways may have bunding requirements.
- Bunding design requirements identified.
- Secondary containment requirements determined by Ausgrid risk management assessment.
- Oil spill kits to be available for every major substation.
- Section 12 identifies requirements for oil water separators and oil containment tanks.
- Section 13 identifies requirements for drainage and associated structures including pits, pipework, flame traps, valves, and pumps.

Fire Fighting & Clean up

Specific design requirements are addressed as listed:

- For CBD and other major indoor substations fire-fighting water containment capacity shall be made for up to 90 minutes of expelled fire-fighting water.
- For both non-rural and rural sites, the minimum containment storage for non-fixed firefighting is 20 minutes of one hose with foam at 4 l/s.
- The required minimum storage can be inclusive of volume available in bunded areas plus any secondary storage or overflow areas.
- Burn down rates can be included in calculations for provisions of storage where a full bund oil fire occurs.
- Capacitors have specific containment provisions.
- After an emergency, oil containment and containment tanks must be emptied and remediation work undertaken.
- Clean up should comply with environmental guidelines and legislation.
- Requirements for decommissioning tanks are provided.

Where to for more information?

- Section 1, 2, 5, 7
- Section 6, 7, 8, 9
- Section 10, 11, 12, 13
- Annexures A, B, C and D

Tools and Forms

Annexures A, B, C and D

Where to for more information?

Section 14, 15, 16, 17

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1.0 PURPOSE

Network Standard NS189 details the general requirements for oil containment for major substations. The objective of this standard is to specify the design requirements for oil containment on site during the day to day operation of major substations as well as in emergency situations. This standard also aims to provide consistency of design and to minimise the spread of fire.

2.0 SCOPE

This Standard covers the design of oil containment systems for new and existing major substations with primary voltages of 132, 66 and 33 kV.

This Standard also considers the different types of treatment plant for the various situations found in major substations.

This Standard also defines the performance criteria of a containment system based on discussions between the Environment Protection Authority (EPA) and Ausgrid.

Maintenance and operation of oil containment facilities is specified in NS190 Oil Containment Operational Requirements for Major Substations.

This Standard does not include provisions for pole top transformers and capacitors, distribution and customer substations, kiosks, regulators, tap changer auto transformer substations, reclosers or oil filled cables and their associated pressure vessels.

3.0 RELATED DOCUMENTS

3.1 General

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards. Current Network Standards are available on Ausgrid's Internet site at www.ausgrid.com.au.

3.2 Ausgrid documents

- Company Form (Governance) - Network Technical Document Endorsement and Approval
- Company Procedure (Governance) - Network Document Endorsement and Approval
- Company Procedure (Network) - Production / Review of Engineering Technical Documents within BMS
- Division Workplace Instruction (Network) – Production /review of Network Standards
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- NS171 Firestopping in Substations.
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS187 Passive Fire Mitigation Design of Substations.
- NS190 Oil Containment Operational Requirements for Major Substations
- NS210 Documentation and Reference Design Guide for Major Substations
- NS211 Working with Asbestos Products
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS261 Requirement for Design Compliance Framework for Network Standards
3.3 Other standards and documents

- Australian Rainfall and Runoff; The Institution of Engineers, Australia.
- Austroads 92’ Bridge Design Code.
- AS 1170 Loading Code.
- AS 1646 Elastomeric seals for waterworks purposes.
- AS 1657 Fixed platforms, walkways, stairways and ladders - Design construction and Installation.
- AS 1940 The Storage and handling of flammable and combustible liquids.
- AS 2067 Substations and high voltage installations exceeding 1kV a.c.
- AS 2865 Confined Spaces
- AS 3000 Electrical installations (known as Australian/New Zealand Wiring Rules)
- AS 3500 National plumbing and drainage code – Stormwater drainage.
- AS 3600 Concrete structures.
- AS 3610 Formwork for concrete.
- AS 3735 Concrete structures retaining liquids.
- AS 4100 Steel structures

3.4 Acts and regulations

- Building Code of Australia.
- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014
- Protection of the Environment and Operations Act 1997
- Work Health and Safety Act 2011 and Regulation 2011

3.5 Literature

- EG 100: Oil Handling and Spill Response Guideline.
### 4.0 DEFINITIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accredited Service Provider (ASP)</td>
<td>An individual or entity accredited by the NSW Department of Industry, Division of Resources and Energy, in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).</td>
</tr>
<tr>
<td>Approved Equivalent</td>
<td>Equipment or materials approved in writing by Ausgrid.</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval. This is the long-term number of years between the occurrence of a flood as big as or larger than a selected event.</td>
</tr>
<tr>
<td>Bund</td>
<td>A wall/barrier of sufficient height constructed around fluid filled equipment to contain spillage of liquids.</td>
</tr>
<tr>
<td>Business Management System (BMS)</td>
<td>An Ausgrid internal integrated policy and procedure framework that contains the approved version of documents.</td>
</tr>
<tr>
<td>Butterfly valve</td>
<td>The valve used to close the outlet of an oil containment tank.</td>
</tr>
<tr>
<td>Closed Drainage</td>
<td>A drainage system designed to retain liquids within a bunded area for treatment or disposal as required.</td>
</tr>
<tr>
<td>Document control</td>
<td>Ausgrid employees who work with printed copies of document must check the BMS regularly to monitor version control. Documents are considered “UNCONTROLLED IF PRINTED”, as indicated in the footer.</td>
</tr>
<tr>
<td>EGOWS</td>
<td>Enhanced Gravity Oil and Water Separator. An oil containment tank developed by the UNSW. The tank contains stainless steel baffles and flow retarding devices.</td>
</tr>
<tr>
<td>Fire Sprinklers</td>
<td>Low flow rate water discharge nozzles not generally used on transformers.</td>
</tr>
<tr>
<td>First Flush</td>
<td>1 in 1 year ARI of 5 minutes duration plus 10mm/m² of the catchment.</td>
</tr>
<tr>
<td>Flame trap</td>
<td>A pit with a down turned pipe used as a fire quenching mechanism.</td>
</tr>
<tr>
<td>FRC</td>
<td>Fibre reinforced concrete.</td>
</tr>
<tr>
<td>FSW</td>
<td>Fire Separation Wall.</td>
</tr>
<tr>
<td>Gravity Drainage</td>
<td>A drainage system designed to remove liquids to a remote location, such as an oil containment tank, for retention and/or treatment prior to discharge.</td>
</tr>
<tr>
<td>Gravity separation</td>
<td>Oil-water separation without the use of chemicals or mechanical means ie using gravity only based on Stokes law. Single, double, triple stage separators and all PPSs use gravity separation.</td>
</tr>
<tr>
<td>High Velocity Water Spray</td>
<td>A high velocity fire water sprinkler with a typical flow rate of 50 to 90 L/s, usually surrounding transformers.</td>
</tr>
<tr>
<td>Infiltration trenches</td>
<td>Trench filled with gravel used to discharge stormwater into groundwater.</td>
</tr>
<tr>
<td>Major Substation</td>
<td>For the purpose of this document, major substation means zone and sub-transmission substations with primary voltages of 132, 66 and 33 kV.</td>
</tr>
<tr>
<td>Neat Oil</td>
<td>Where the flow of liquid through the system is predominantly oil.</td>
</tr>
<tr>
<td>Network Standard</td>
<td>A document, including Network Planning Standards, that describes the Company’s minimum requirements for planning, design, construction, maintenance, technical specification, environmental, property and metering activities on the distribution and transmission network. These documents are stored in the Network Category of the BMS repository.</td>
</tr>
<tr>
<td>Non Return Valve</td>
<td>Also called a flap valve, it is a one way valve that prevents flow back up into the pipe.</td>
</tr>
<tr>
<td>Normal operation</td>
<td>Day to day operation precluding major rainfall events.</td>
</tr>
<tr>
<td>Oil containment</td>
<td>The oil containment system refers to the transformer bunds, together with a suitable combination of flame traps, pipes, oil containment tank and Parallel Plate Separator</td>
</tr>
</tbody>
</table>
system as required. The oil containment system is not designed as an oil storage system. It is designed for emergency situations and the treatment of minor oil contamination from transformer bunds.

Passive system A system that operates without automatic or manual intervention.

PCBs Polychlorinated biphenyls.

Parallel Plate Separator (PPS) Parallel Plate Coalescing Separator also known as a PPS. PPSs are gravity separation separators.

PPM Parts per million. An oil-water concentration of 10ppm equals 10mg/l which is equivalent to a mixture that is visibly free of oils and greases, i.e. no visible oil.

Review date The review date displayed in the header of the document is the future date for review of a document. The default period is three years from the date of approval. However a review may be mandated at any time where a need is identified due to changes in legislation, organisational changes, restructures, occurrence of an incident or changes in technology or work practice.

Secondary Containment An overflow area used to capture firefighting water.

Sensitive environment Any parcel of land or waterway that has environmental attributes that contribute to the retention and or creation of wildlife habitat, soils stability, or other vital ecological functions. Examples of sensitive environment are national parks, wetlands and nature reserves.

Surcharge A condition where the hydraulic capacity of the drain system is temporarily exceeded and the amount of liquid that enters the system exceeds the conveyance capacity.

Tank Refers to a vessel made from concrete or masonry that is usually wholly or partially buried, that provides containment of lost oil and can also be an oil/water separator.

Surfactants A substance which emulsifies, disperses, dissolves other substances eg a detergent.

Waste Captured oil and sediment within the oil containment system.

Waterway Any river, stream, lake, lagoon, swamp, wetlands, unconfined surface water, natural or artificial watercourse, dam or tidal waters (including the sea), or Any water stored in artificial works, any water in water mains, water pipes or water channels, or any underground or artesian water.

5.0 ASBESTOS

All materials and equipment used for construction of Ausgrid’s assets are to be free from Asbestos and or Asbestos related products. Suppliers are expected to comply with the Work Health and Safety Act 2011 (NSW) together with the Work Health and Safety Regulation 2011 (NSW) and confirm in writing that all products supplied to Ausgrid contain no Asbestos related materials.

At existing substation sites, a site contamination and hazardous materials audit may be required prior to work commencing on site.

Particular care shall be exercised when handling or working in the vicinity of existing asbestos products. Items containing asbestos shall be disposed of properly. Ausgrid’s Asbestos Product / Location Register shall be consulted prior to work commencing to identify relevant plant and equipment. Asbestos related work shall only be carried out by suitably trained personnel and in accordance with Ausgrid Network Standard NS211 Working with Asbestos Products.
6.0 INTRODUCTION

6.1 General

This document outlines Ausgrid’s minimum requirements for oil containment at major substations.

This Standard does not document sections from the relevant Australian Standard or requirements of these standards unless a specific departure from the standard is required for major substation specific purposes.

The provision of oil containment at major substations is based on the following basic assumptions:

- Only one transformer will rupture at the one time releasing its entire contents into the oil containment tank or into the bunded area where there is no gravity drainage.
- No major rain event occurs simultaneously with an emergency situation.
- The oil containment system is appropriately maintained and is free of excessive residual oil in the tank i.e., less than 10% volume of the largest transformer.
- Oil filled equipment is in good working order and does not continually leak significant amounts of oil.
- Oil containment tanks are designed for short term emergency oil retention only. The tanks do not meet the design and legislative requirements for long term oil storage.
- Replacement transformers and other oil filled equipment will not increase the volume of oil requiring containment;
- Major substations are generally not staffed, requiring the oil containment system to operate automatically or to be a passive system wherever possible;
- Oil-water concentration of 10ppm is equivalent to a mixture that is visibly free of oils and greases, i.e. no visible oil.
- The oil containment system is assumed to have a maintenance regime and operational performance that is in accordance with NS190.
- Gravity separation will not separate oil and foam contaminated water. In such cases, secondary containment will be used.
- Gravity separation systems will not work with oil degreasers or surfactants.
- The oil water separator does not retain any contaminants other than transformer oil, e.g. it will not remove dissolved pollutants or particles.
- The use of a secondary containment area or emergency response process to manage the flow of water when firefighting.
- For all sites except CBD substations, a minimum of 20 minutes firefighting medium containment is required by AS 1940. The flow rates shall be a minimum of 4 L/s (using foam) but the overall volume shall be rounded up to 5,000 litres. Refer also to Section 14.
- CBD sites shall have 90 minutes of firefighting water containment at the flow rate of the high velocity water spray system. Refer also to Section 14.
- For all sites, a risk assessment shall be undertaken to determine if greater containment volumes are needed and shall consider the cost/ease of providing the additional containment and the benefit from a risk reduction perspective.
- Controlled overflow or surcharge into other bunds, or into secondary containment areas on the site, are both acceptable under the application of firefighting medium. Refer also to Section 14 and Annexure A.
- Foam is corrosive and therefore potentially damaging to other assets where overflow or surcharge is allowed to occur.
6.2 **Typical oil containment systems**

There are several different oil containment systems used in the Ausgrid franchise area as summarised below:

1. Generally, older sites (pre 1990) have single, double or triple stage tank systems. Some ex-Electricity Commission of NSW sites use a PPS system.

2. A few older sites have early PPS systems installed and were purposely used as trial sites to determine the most appropriate system to install.

3. For new substation sites, one type of oil containment system uses a closed drainage design with bund storage and a PPS system.

4. An alternative EGOWS gravity drainage system and tank uses a delayed release principle to separate the oil and water.

5. Retrofit substation sites normally use a closed drainage PPS system with bund storage.

7.0 **OIL CONTAINMENT PRINCIPLES**

7.1 **Where is oil containment required?**

Oil containment systems shall be designed to meet the requirements of this Network Standard and the relevant parts of AS 2067 and AS 1940. Where a conflict occurs, the requirements of this Network Standard shall prevail.

For existing major substations, all areas with any piece of oil filled equipment containing more than 1000 litres of oil generally require oil containment facilities. If the piece of equipment has less than 1000 litres or if the location with this piece of equipment is designated low risk by Ausgrid, then containment may not be necessary. In this case, the equipment should be located such that it is not in a drainage path to a waterway, or such that any oil lost will not create a hazardous situation to the public, neighbouring buildings or equipment in accordance with AS 1940.

Due consideration must be made to minimise the potential for stormwater to become contaminated with oil.

For new substation sites, all oil filled equipment shall be bunded, unless indicated otherwise by this Network Standard.

High voltage capacitors generally do not require oil containment because they are sealed units that contain minimal free oil. Refer also to Section 15 of this Standard.

The following principles shall be adopted to address the three main risks identified:

1. **Catastrophic failure causing prolonged fire.**
   a. **Closed drainage PPS systems**
      - In a catastrophic failure, the oil containment system shall reduce the risk of fire spread off site by containing the oil in the bund.
      - The PPS shall be designed to shut down upon neat oil flow through the separator. This can be achieved by diverting the neat oil directly to the waste oil tank, filling it, and triggering a shut-down of the equipment and the waste oil tank high level alarm.
b. **Gravity drainage systems**

- In a catastrophic failure, the oil containment system shall reduce the risk of prolonged fire (hence fire spread) by containing oil spillage and/or providing a quick draining route for oil.
- Oil containment bunds shall have a floor slope of 1% and pipes designed for the flow rate of the firefighting water, which also facilitates the quick removal of oil from the bund. Each oil containment bund is drained via a flame trap reducing the potential for fire to reach the oil containment tank.
- The oil containment tank provides an oil spill retention area away from the fire.

2. **Catastrophic failure causing large amounts of oil spreading off site.**

a. **Closed drainage PPS systems**

- Bunds shall have capacity for the contents of the transformer plus approximately 5000 litres of firefighting medium. Some sites may require more than 5000 litres of additional containment.
- Oil shall be removed from the bund as soon as possible to avoid the risk of leakage to other parts of the site.

b. **Gravity drainage systems**

- Bunds shall contain oil in the area of loss thus preventing burning oil migrating off-site. The oil containment bunds are designed to hold 100% of the oil volume to provide adequate drainage time in the event that the pipes are partially blocked.
- The bund shall be drained to an oil containment tank. The tank is designed to retain 110% volume of oil from one transformer.
- EGOWS oil containment systems shall be fitted with a manual or automatic shut-off valve at the outlet of the tank to facilitate the closing of the oil containment system to prevent discharge of the firefighting medium. Overflow from the oil containment shall be managed by directing it to a secondary containment area or by the emergency response process.

3. **Minimise oil pollution during normal operation.**

a. **Closed drainage PPS systems**

- Providing oil filled equipment is maintained in good working order and is not continually leaking, the system shall minimise the day to day loss of oil to the environment.
- During normal operation a stormwater discharge less than 10ppm of oils and greases shall be achieved in all storm events. Larger storm events will cause the water to rise inside the bunds while treated discharge from the PPS will continue at a constant rate. Compliance of PPS discharges is dependent on proper maintenance in accordance with NS 190.

b. **Gravity drainage systems**

- Providing oil filled equipment is maintained in good working order and is not continually leaking, the system shall minimise the day to day loss of oil to the environment.
- During normal operation a stormwater discharge less than 10ppm of oils and greases shall be achieved. In some higher rainfall events higher oil and water discharges may be experienced.
### 7.2 Selection criteria for oil containment systems

Selection of the preferred oil containment system shall be based on a Life Cycle Cost (LCC) analysis together with an assessment of site constraints, site risks, environmental aspects and impacts upon the project schedule.

The LCC analysis shall capture all site specific capital costs and include O&M costs that accurately reflect the activities required to maintain the functional performance of the equipment.

For Greenfield sites the following criteria will typically determine the preferred oil containment system when assessed in conjunction with a LCC analysis;

**a. Closed drainage PPS systems may be preferred for** -

- Urban locations in the vicinity of Ausgrid’s Services Maintenance depots where response and travel times are low and operation and maintenance costs are reduced.
- Locations where effective gravity drainage is difficult or costly to achieve.
- Congested sites where a gravity system either cannot be readily accommodated, or would constrain an efficient site layout for plant and equipment.
- Sites where the EGOWS tank cannot be located adjacent to, or in close proximity (10m to 15m) of, the transformer bunds.
- Sites where the EGOWS tank requires extra strengthening to support mobile crane outrigger loadings (e.g. in the vicinity of TX bays).
- Locations where difficult site conditions such as rock, low soil strength, high water table, restricted access etc. adds significant costs to the civil works.
- Locations where early civil works for gravity systems are an expected critical path item and a significant project benefit can be realised through reduced program duration and site costs.
- Environmentally sensitive areas where strict discharge limits cannot be satisfied by gravity systems under all conditions (e.g. high flowrates).

**b. Gravity drainage systems may be preferred for** -

- Rural locations where response and travel times are high and O&M costs are increased for PPS systems.
- Sites where sufficient space is available to locate the gravity system without significant impact on the efficient site layout of plant and equipment.
- Sites where the EGOWS tank can be optimally located, namely;
  a) adjacent to, or nearby (10m to 15m), the transformer bunds, and
  b) with minimal gravity drainage pipework, and
  c) without additional strengthening of the tank to support mobile crane outrigger loadings.
- Locations with suitable geotechnical conditions and good site access that enable low cost civil construction
- Locations where the civil works for gravity systems will have minimal impact on the program duration.
- High hazard locations where the continuous removal of fuel by gravity drainage may provide a reduced fire risk following a major oil spill.
- CBD and other locations which require a high velocity water spray system for the transformer area.
- Sites where significant LCC benefits can be realised by combining the functions of an EGOWS with required On-Site Stormwater Detention (OSD) into one tank unit.
For a generic Greenfield site, a closed drainage PPS system using bund storage can be comparable, on a LCC basis, with a gravity drainage system using an EGOWS tank. Selection of the preferred oil containment system should therefore be based on the site specific criteria indicated above, together with a LCC analysis.

For existing Brownfield retrofit sites the preferred oil containment system is typically a closed drainage PPS system. The alternative gravity drainage system is generally less favourable and can incur significant additional costs and construction risk due to existing underground services, together with increased site disturbance and site works duration.

For all oil containment systems, the design should be optimised for each site. This will generally require:

- Early incorporation into the substation site layout design to optimise all aspects of the substation design and associated works.
- A system design that is as compact as possible.
- Innovation in design to take advantage of any multi-use functions (e.g. combined EGOWS and OSD where possible).

### 7.3 Drainage design philosophy

Where a closed drainage system is adopted, using bund storage and a PPS, suitable pumps and above ground pipework shall be provided as part of the oil containment system.

For gravity drainage systems, all drainage shall be accomplished by gravitational action where possible. In cases where gravity systems are required but complete gravity drainage is not possible (e.g. CBD substations), fixed pumps may be used at the outlet of an oil containment tank or storage tank.

### 7.4 Existing or temporary major substations

An alternative oil containment approach may be adopted for existing or temporary major substations. At a minimum these sites will generally require a bund around each transformer. However the bunds will need to be monitored and emptied after rain events. The bunds shall be designed for 100% of the oil volume plus secondary containment as described in Clause 11.6.

Allowance should be made for run-off from a significant rainfall event for the region. The retained water may be contaminated and require disposal off-site.

The use of a PPS system on a temporary basis should be considered. The PPS can be reused at another site upon decommissioning of the temporary installation.

### 7.5 Structural and other design considerations

All components of the oil containment system must be designed for the expected loading conditions.

Effects of differential settlement shall be incorporated into the design.

The design of the oil containment system shall consider the relevant WHS requirements for construction, operation and maintenance of the system.

### 7.6 Designer safety reports

For structures and plant, including equipment, pipelines and containers, the WHS Regulation 2011 requires a written safety report to be provided by the designer of a structure or plant, or any part of a structure or plant, to the person who commissioned the design.

The Designer Safety Report shall comply with the requirements of NS 210 and shall be prepared at the completion of the design development process.
8.0 SITE SELECTION CRITERIA

Consideration shall be given to the following requirements when evaluating a substation site to assist in reducing the potential impact of oil loss from site:

- Proximity of waterways and sensitive environments;
- Ground conditions eg, sandy soils and/or high water table allow oil to be migrated easily. Areas that have been filled or experience excessive heave can provide large differential settlements which may damage watertight structures;
- Sites with some slope are preferred to facilitate a gravity system; and
- The level of the site should be higher than the 1 in 100 year flood level.

9.0 REGULATORY REQUIREMENTS

9.1 Sewer

For oil containment discharge to sewer:

- A Trade Waste Agreement (TWA) is required and may have specific monitoring and discharge requirements. Refer to relevant authorities for all TWA requirements and conditions.
- Ausgrid currently adopts a discharge requirement of 10ppm for oils and greases. Refer to the TWA for the relevant criteria.

Discharge of treated water to sewers is not preferred and shall only be done so when connection to stormwater is not practical.

9.2 Stormwater

For oil containment discharge to stormwater:

- Ausgrid currently adopts a discharge requirement of 10ppm for oils and greases.
- No licence is required for connection to stormwater in accordance with the current environmental management strategy, EMS 350.
- Ensure appropriate Approvals are sought for new connections to Local Council, Sydney Water or Hunter Water Corporation Stormwater Systems.

9.3 Local council requirements

Local council stormwater codes of practice or guidelines shall be reviewed and adopted where practicable.
10.0 **TYPICAL OIL CONTAINMENT LAYOUT FOR NEW SUBSTATIONS**

10.1 **CBD major substation with high velocity water spray**

A CBD major substation is fully contained within a building and no or limited stormwater enters the substation during day to day operations. The transformers are typically protected by a high velocity water spray fire protection system.

Each transformer has a bund which is drained to a storage tank or designated overflow area. The tank is designed to take a minimum of 90 minutes of high velocity water spray from one of the transformer bays and 110% of the oil volume of the largest transformer. The tank may overflow into the cable basement or other area in the event of high velocity water spray operation greater than a minimum of 90 minutes. The overflow is taken from the bottom of the tank.

Where stormwater can enter the system, the contents of the tank are pumped to a PPS and treated prior to discharge to stormwater or sewer.

During emergency situations in existing CBD substations with PPS systems, the PPS is designed to be shut down by the operation of the transformer protection system and activation of the high velocity water spray system.

Refer to Clause 12.1 for a description of PPS shut down modes under emergency operation.

CBD capacitor bays containing capacitors with oil shall also have bunds and may be fitted with sprinklers. Where sprinklers are fitted, the bunded areas shall be connected to an independent storage tank designed for 90 minutes of sprinkler discharge. The contents of this tank are not treated. Any waste collected, is taken and disposed of off-site. A tank pump out point is provided for tanker access.

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**Figure 1 - Typical CBD substation with high velocity water spray**

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10.2 Suburban major substation

10.2.1 General

A new suburban major substation generally consists of switching equipment (indoor or outdoor), outdoor transformers and a control building. High volumes of stormwater run-off are expected from these substations.

The management of stormwater, and of any potential oil contamination, will vary depending on whether a closed or gravity drainage system is adopted for oil containment.

10.2.2 Closed drainage PPS system

The closed drainage PPS system, using bund storage and a PPS oil/water separator, can compare favourably as a low cost option for oil containment. PPS systems shall be considered for all suitable Ausgrid sites based on the selection criteria outlined in Clause 7.2.

The transformers are individually banded and any discharge points are kept normally closed. Automatically operated pumps are provided within the bunds together with suitable bund sumps and above ground pipes constructed to the requirements of Clause 13.1.1. All liquids are pumped to a PPS oil/water separator and treated prior to discharge to stormwater. Further details of the PPS system are provided in Clause 12.1.

The bund storage is sized to retain all oil spills, with a suitable margin for rainwater and/or firefighting medium. Any overflow from the bund area will be directed to a secondary containment storage area or managed by the emergency response process. Secondary containment storage areas shall be designed to the requirements of Clause 11.6 or as specified by a risk management approach, determined by Ausgrid.
10.2.3 Gravity drainage system with oil containment tank

The transformers are individually bunded and drained to an Enhanced Gravity Oil Water Separator (EGOWS). The treated stormwater is discharged to stormwater.

The EGOWS is manually closed by a butterfly valve at the tank outlet upon application of firefighting water. The overflow from the oil containment tank shall be directed to a secondary containment area or managed by the emergency response process. Secondary containment areas shall be designed to the requirements of Clause 11.6 or as specified by a risk management approach, determined by Ausgrid.

Elevation

Figure 3 - Typical suburban major substation - Gravity drainage system

Elevation

Figure 4 - Typical cross-section for Figure 3
11.0 OIL CONTAINMENT BUNDING

11.1 General
Oil containment bunded areas shall be designed to minimise the entry of clean stormwater. All sub-soil drainage, yard run-off and roof drainage shall be excluded from the bunded areas. All bunds are to be designed to AS 1940.

11.2 Transformer bunding
At existing sites where a retrofit system is being installed, each transformer containing greater than 1000 litres of oil shall be bunded unless a risk assessment indicates this is not required.

At new substation sites all oil filled transformers shall be bunded.

The extent of bunds shall be such that burning fuel cannot propagate the spread of fire to adjoining transformers, structures and adjacent premises and shall meet the requirements of AS 1940.

11.3 Spray screens
Bunding shall be designed to capture a 1:2 (Horizontal:Vertical) spray discharge to AS 1940 requirements. Where the bund cannot be placed to meet the spray discharge, then screens may need to be installed.

Where the transformer radiators are positioned in very close proximity to the transformer roadway, spray screens need only be placed to a maximum height of 1.5 m above the bund wall.

Spray screens near the transformer radiators shall be louvered to allow sufficient air flow around the radiators. These spray screens are to be removable to allow access for maintenance.

11.4 Transformer roadways
For new sites, transformer roadways shall be bunded by the use of speed humps where required. The drainage is to be to stormwater via an easily accessible and identifiable butterfly valve which is to be left open except when oil filled equipment is parked on the roadway, or when operations are underway that involve the transferring of oil.

At existing sites, this requirement also applies, but only where it is practicable without the need for laying of new drainage pipes.

For sites of restricted size, it may be viable to use smaller transformer bay areas and drain the transformer roadway within the 1:2 spray zone directly to an oil containment tank. The required tank size may increase as a result due to higher stormwater inflows. A risk assessment and LCC analysis shall be provided to evaluate the alternative oil containment arrangements and site layouts.

11.5 Bunding design requirements
All bunded areas shall have a 1% floor slope. Where drainage from the bund is required for gravity drainage systems it shall be via a flame trap. The use of gravel as a fire quenching medium is not permitted for new sites.

All bunded areas shall be finished with a non-slip surface.

Permanent bunds shall be constructed from reinforced concrete. In instances where the bunds will be temporary, earthen bunds are permitted.

All bunds shall be able to take loading from a spray screen. This allows flexibility for placing larger transformers in bunds and maintaining AS 1940 requirements.
Removable bund walls may need to be provided at some locations as specified by Ausgrid. Generally, these locations will be limited to sites with raised transformer plinths.

Any openings in the bund floor for power cables shall be raised above the bund floor, or otherwise the floor sloped away from the opening to avoid ponding. All seals to the openings shall be gas tight. Refer to drawing A4-190509 for typical design details.

Where secondary cables pass through a bund floor opening, the opening shall be raised using internal bunding to a minimum 50 mm above the bund wall height. Refer to drawing A3-225716 for typical design details.

Access to the bund shall meet the requirements of AS 1657.

11.6 Secondary containment

11.6.1 General
The secondary containment for major substations shall be designed to the requirements specified by a risk management approach determined by Ausgrid. The form of secondary containment can vary depending on the site location and site constraints.

11.6.2 Secondary containment area requirements
Permeable or unpaved secondary containment areas shall not be located on areas with a high water table or sandy soils or close to waterways or sensitive environments. Immediate localised remediation would be required for the secondary containment area after use.

11.6.3 Oil spill kits
An oil spill kit shall be available for every major substation to assist with the provision of secondary containment.

11.6.4 Secondary containment options
Annexure A provides details of the secondary containment options and the requirements for major substations.
12.0 OIL WATER SEPARATOR AND OIL CONTAINMENT TANKS

12.1 Parallel Plate Separator (PPS)

12.1.1 General

Parallel Plate Separators (PPS) shall be used with closed drainage oil containment systems that rely on bund storage. A PPS can also be used in cases when it is not possible to drain entirely by gravity, where a high velocity water spray system is installed (e.g. CBD substations), and for retrofitting into existing major substations.

The Ausgrid currently accepted PPS unit is the Ovivo “EnviroSEP OS 7500” supplied by Ovivo or an approved equivalent. The PPS shall be correctly installed and fully commissioned on site with a minimum 12 months defects liability period to ensure effective long term operation of the system. Refer to Annexure C for the inspection requirements and hold points associated with PPS system installation and commissioning.

The PPS control panel, and the motor-pump arrangement that supplies the PPS, shall be installed above the bund high water level in order to prevent the equipment flooding in the event of bund filling. The control panel shall also be installed in a location accessible from outside the bund.

The PPS shall be fitted with waste oil tank that triggers the pump to stop when full. Testing and maintenance specifications shall be supplied and verified by the manufacturer.

12.1.2 PPS system shut down

The PPS system shall be able to operate independently of the substation protection system. This means the system shall independently shut down after an incident to avoid discharging oil off site.

The PPS power supply shall be dedicated and fitted with a Residual Current Device (RCD) unit at the point of supply.

12.1.3 PPS system alarms

A communications system shall be installed using the Network Fibre Optic System where available. This will enable local and remote monitoring and control of the PPS for the purposes of improved efficiency and maintenance.

The PPS system shall provide alarm signals to the PPS control panel for the following conditions as a minimum:

a) Waste oil tank high level,

b) Pump failure, and

c) High bund level.

For Item c) the high level float switch shall be located in the sump just clear of the grate. The alarm signal to SCADA is to be delayed by four hours.

Should any of these alarms activate, a flashing light mounted on top of the control panel is to activate. In addition, suitable signals can be sent via the communications network identifying the type of fault and any further data as required.

Only one alarm signal shall be sent to the control room via SCADA.
12.1.4 Neat oil flow
The PPS unit shall accept neat oil being pumped through the unit in the case of a bulk oil loss from a catastrophic transformer failure. Under this condition the PPS unit shall:

a) shut down when the waste oil tank high level is activated, and

b) not discharge oil from the separator unit.

12.1.5 PPS design and installation
Annexure B provides details of the main design features and installation requirements for PPS systems to be installed at major substations.

12.2 Enhanced Gravity Oil Water Separator (EGOWS)

12.2.1 General
The EGOWS is an oil-water separation system developed by the University of New South Wales. EGOWS are used with gravity drainage systems and generally provide stormwater discharges of less than 10ppm of oil in water during normal storm events (refer to Clause 13.1.4).

During higher intensity storm events the EGOWS could discharge oil/water of up to 100ppm or greater. However, these events are rare and generally the discharge concentrations would be much lower.

In environmentally sensitive areas the EGOWS tank may need to be increased in size where it is necessary to achieve the required discharge limits for these higher intensity storm events.

Alternatively, where the site layout permits, a non-overflow tank design can be installed that complies under all storm events. This system maintains a constant discharge and allows the inflow to surcharge into the bund areas. The EGOWS tank will generally require access covers that are raised to bund height.

EGOWS systems shall be installed in accordance with a site specific design to be provided by Ausgrid for each substation. Refer to Annexure C for the inspection and hold points associated with oil-water separator system installation and commissioning.

12.2.2 Emergency operation of EGOWS
A butterfly valve shall be located at the outlet of an oil containment tank in an easily accessible and identifiable location. A butterfly valve may also be required at the secondary containment outlet. Both valves shall be shut off with the application of firefighting medium in order to close off the gravity drainage system.

Closure of the valves will allow the oil containment system to surcharge in such a way as to allow overflow to be directed to a secondary containment area, whilst retaining bulk oil in the oil containment tank. Alternatively, the flow can be surcharged into the transformer bund areas which will provide a large secondary containment volume.

Where secondary containment is not viable an emergency plan response process will be required to manage the surcharge overflow.
12.3 Access to tanks

12.3.1 General
All tanks shall be fitted with three 900 x 900 access covers to the appropriate class (Class B or D). The covers shall be located one each on the inlet, middle and outlet chambers. Where surcharging is possible, the tanks shall use bolt-down, gas tight covers in accordance with Clause 12.3.2.

All tanks shall have 1.8m internal head clearance and shall contain internal vertical ladders or step irons.

Enclosed tanks are confined spaces and will require signage and confined space entry procedures in accordance with AS 2865 and WHS Regulation 2011. Refer to NS 190 for further details.

Tanks shall be provided with a 500 mm wide concrete slab at each end of the tank for the complete width of the tank. This will allow erection of the fall arrest/confined space rescue supporting frame.

Where possible, allow 1 metre minimum access space around the access points of the tank for the erection of fall arrest equipment.

All tanks are to be labelled with confined space signage located just inside the access covers on the side edge of the roof slab.

All tanks shall be suitably located to allow for removal of hatches and to enable ready access by maintenance crews and cleanout tankers

12.3.2 Bolt – down covers for hydraulic pressure
Bolt-down, gas tight covers shall be used where surcharge of the system is possible. The use of bolt-down, gas tight covers will be site specific and dependent on the operation of the oil containment system and hydraulic conditions.

12.4 Inspection and hold points
Annexure C provides details of the main inspection and hold points associated with the installation of oil-water separators. Annexure C outlines the timing, responsibility and key inspection items necessary to ensure that oil-water separation systems are properly installed and fully functional at each site.

For closed drainage PPS systems a detailed commissioning procedure and checklist is provided in Annexure B.
13.0 DRAINAGE AND ASSOCIATED STRUCTURES

13.1 Pipework

13.1.1 Closed drainage PPS system
Pipework installed between pumps and the PPS shall be located above ground and within the bund storage area where possible.

Pipework shall be constructed using the following materials and designed to the appropriate criteria;

- Outdoor locations outside the bund area – stainless steel pipes
- Outdoor locations inside the bund area – PVC pipes or other suitable material
- Indoor locations where damaged pipework would discharge into stormwater – stainless steel pipes
- Indoor locations elsewhere – PVC pipes or other suitable material
- Temporary locations – PVC pipes or other suitable material

Construction of above ground pipework is also preferred where a PPS system is being retrofitted to an existing site or where buried pipework or gravity drainage is impractical. In such cases, the appropriate pipework materials as indicated above shall be used.

13.1.2 Gravity drainage with oil containment tank
All pipes draining to an oil containment tank shall be designed to resist at least 100°C and be oil resistant. In addition, any exposed pipes laid in open trenches shall also be fire resistant.

The preferred drainage system for gravity systems is:

- Galvanised steel rolled grove system (Victaulic or approved equivalent), or
- Stainless steel rolled grove system (Victaulic or approved equivalent), or
- Cast iron pipes.

All pipe joints with rubber seals shall use Nitrile rubber or other oil resistant material.

Pipes are to be laid above ground on supports where possible or in trenches with removable covers (similar to secondary cable trenches). Pipe trenches shall be drained to the stormwater system.

For existing Brownfield sites, buried pipework using heavy-duty PVC, or cast iron can be direct laid as a temporary measure to suit the phasing of construction works where required.

For Brownfield sites, suitable exposed pipes that are laid on supports within existing cable trenches can be considered where minimal ground disturbance is necessary. However, this approach will be subject to achieving an acceptable design solution, and will require a site based risk assessment and specific approval for each site.

A risk assessment shall be undertaken when adopting buried pipework to determine the risk of soil contamination. The risk assessment shall consider issues such as site conditions, sensitive environments, design life and ease of replacement.

Pipework in cable basements shall be subject to specific approval and will generally only be acceptable in CBD major substations. Pipework in cable basements may also be considered at sites where the transformers are adjacent to the substation building basement area. Stainless steel or cast iron shall be used for all internal pipework in basements.
13.1.3 Pre-commissioning tests and inspection
All existing underground or above ground drainage pipes that can be used as part of the oil containment system shall have full hydraulic testing undertaken in accordance with the AS 3500.3. All installed drainage pipes shall have zero leakage.

13.1.4 Design
Generally, a minimum of 0.5% fall is to be maintained for all drainage channels and pipework draining to an oil containment tank.

Oil containment pipes for gravity drainage shall be 150mm in diameter, except for CBD substations where larger diameter pipes may be necessary to cater for the high velocity water spray system.

As a guide, the oil containment tank should be sized such that oil globule sizes of 33 microns or larger are contained within the tank for the following rainfall events:

- 1 in 1 year ARI storms of 1 hour, 12 hour, 24 hour, 48 hour and 72 hour duration, and
- 1 in 20 year ARI storm of 5 minute duration.

The various flow rates for firefighting medium are discussed in Clause 6.1. For CBD substations the oil containment pipes shall have sufficient capacity for the transformer high velocity water spray system flowrates.

At suburban locations the pipework can be designed to allow the transformer bund area to surcharge during firefighting flows. At these locations a butterfly valve is provided to shut off the oil containment tank discharge to stormwater before firefighting commences (refer to Clause 13.3.2).

For gravity drainage systems that adopt the use of pits at junctions (refer to Clause 13.2.1), the pipework shall be designed to ensure any downstream pits do not surcharge in the event that all the oil from one transformer is lost instantaneously within one bunded area. During such events it is assumed there will be no additional flow from a storm event or activation of fire hoses.

13.2 Pits and drainage channels
13.2.1 Encasement and finish
The use of continuous metal pipework laid in open trenches for gravity drainage systems negates the need for any pits at junctions and also the need for watertightness at those pits. For pipework in open trench systems, there shall be no pits on the inlet drainage line.

An alternative gravity drainage system that uses buried pipework with pits at junctions may also be viable, but is generally not preferred. Where adopted (e.g. to retrofit existing sites) the associated pits shall be cast in-situ and a hydrophilic seal placed around the pipe and cast into the pit. Hydrophilic seals shall also be used on any concrete joints in the pit construction.

The finish on the inside of pits and drainage channels shall be watertight. If a watertight structure has not been achieved, a suitable concrete sealant shall be applied to achieve a seal. The sealant used shall be resistant to transformer oil and remain effective for the life of the pit or drainage channel.

Pipe trenches that are used to protect oil containment pipelines are not considered to be drainage channels and the above requirements for watertightness do not apply.
### 13.2.2 Flame traps

Flame traps consist of a down turned pipe with a 300 mm (minimum) downturn and a 150 mm clearance from the pit floor. The pits are typically 900 mm x 900 mm. The flame traps remain full of water or oil forming a seal.

Flame traps are required for gravity drainage systems and should be located as close to the transformer as possible to:

(a) facilitate the fast removal of oil/water;
(b) reduce oil drainage paths across the bunded area; and
(c) reduce flame front size.

Flame traps must be cast in-situ with a hydrophilic seal around the pipe. Concrete joints should be avoided in flame traps, but where they are required hydrophilic seals shall be used.

### 13.3 Valves

#### 13.3.1 Closed drainage PPS systems

PPS systems shall use a ball valve to facilitate maintenance and removal of the pump. The ball valve material shall be suitable for connection to the adjoining pipework.

#### 13.3.2 Gravity drainage systems

A butterfly valve shall be used to shut off an oil containment tank or to direct flow as required. The valve shall be located in a pit that is readily accessible and identifiable, and shall be operable with a spindle extension so entry to the valve pit is not required. The pit shall have a hinged grate cover.

The butterfly valve shall be located such that it can be safely operated manually during a fire. A suitable separation distance or a fire resistant barrier should be provided to reduce the radiant heat exposure to an acceptable level. Refer to NS187 Passive Fire mitigation Design of Substations. Where adequate fire segregation cannot be provided for the butterfly valve location, a risk assessment shall be undertaken for the site.

The location of the butterfly valve can allow for a reduced fire front area based on the bunds being gravity drained. The radiant heat level can be based on a transformer tank fire (sides and top) together with a small pool fire along the flow path from the transformer to the sump. Modelling of a full bund oil fire is not required during operation of the butterfly valve.

The position of the valve within a tank outlet area depends on the secondary containment method. If the tank is to be used as secondary containment, the valve is positioned on the inlet to the valve pit. If the secondary containment is a separate area, the valve needs to be positioned appropriately to direct flow.

The equipment shall be capable of withstanding the conditions expected on site including potential water/oil temperatures in a fire and be corrosion resistant. Valves shall also be low maintenance, simple to operate, and all automatic shut off valves shall have a manual override.

The use of non-return valves should be avoided wherever possible, however they may be required if the system is likely to be effected by:

- a 1:100 year flood; or
- surcharge of the pipework.

The “Hume-King Flood Gate” or approved equivalent is recommended for use as a non-return valve.

A stainless steel non-return valve is the only type acceptable for use in the major substation environment.
13.4 Pumps

13.4.1 General
All pumps to be used on low lift oil containment systems shall be diaphragm pumps.

Diaphragm pumps are preferred for low lift applications. The system should be designed to ensure that dirty water is low lift and this may mean relocating the discharge point closer to the influent source.

Where high lift is required, a non-emulsifying screw pump may be used. These are prone to seizing from debris and do not tolerate no flow conditions. Therefore, it is preferred to redesign the system to facilitate the use of diaphragm pumps wherever possible.

13.4.2 Pumps for Parallel Plate Separators
All pumps used on the PPS system shall be “ASM DS32” diaphragm pumps or approved equivalent.

13.5 Ventilation pipework
Ventilation pipes associated with oil containment tanks shall be spatially separated from any lightning masts located on the site. The minimum horizontal separation distance between the pipe exhaust point and the mast shall be 1.5m, with an increased distance of 3m preferred where site conditions allow.

13.6 Infiltration trenches
The use of infiltration trenches is generally not preferred and shall be subject to the approval of Ausgrid.

14.0 FIRE FIGHTING WATER CONTAINMENT CAPACITY
For CBD and other major indoor substations using fixed firefighting systems, provision shall be made for up to 90 minutes of expelled firefighting water to be stored in accordance with Fire Safety Study Guideline, Hazardous Industry Planning Advisory Paper No. 2, Department of Planning NSW Fire Brigades.

For both non-rural and rural sites, the minimum containment storage time for non-fixed system firefighting is 20 minutes. The assumed firefighting method shall be one hose with foam at 4 L/s.

For both non-rural and rural sites, the required minimum containment storage can be inclusive of the volume available within the bunded areas, plus any secondary containment or overflow areas available on site. Refer also to Annexure A.

Where a full bund oil fire may occur, a suitable volume allowance can be made based on a nominated burn down rate of 100mm per hour applied across the surface area of the bund. Actual burn down rates may vary based on conditions and the use of higher values shall be subject to approval by Ausgrid.
15.0 CAPACITORS

15.1 General
High voltage capacitors contain either Jarylec or Faradol fluid for the purpose of insulation. With a specific gravity of 1.006 and 1.001 respectively, these fluids are slightly heavier than water and therefore, standard gravity separation is impractical. Stormwater run-off from capacitor bank areas shall not pass into the standard oil containment catchments or oil containment tanks.

15.2 Outdoor capacitor banks
Capacitors are generally sealed units containing minimal oil with low risk of leakage. For this reason, capacitors in outdoor yards shall not be bunded.

If there is a significant risk of leaking capacitors, the use of a concrete perimeter bund may be required and a risk assessment should be undertaken.

Evidence of leaking oil should be visible on founding concrete slabs or the ground around them and should be inspected during oil containment maintenance.

15.3 Capacitor banks and fire sprinklers
Where the capacitor banks are located within a building and the room is fire protected with fire protection sprinklers, the room shall be drained to a dedicated containment tank. The containment tank shall have the capacity to take minimum 90 minutes of the firefighting water. The room shall also be bunded.

16.0 POST EMERGENCY CLEAN UP

After an emergency it will be necessary to empty the oil containment system or storage tank and undertake remediation of any areas of the major substation as required. Clean up work must be undertaken in accordance with appropriate environmental guidelines and legislation. Contact Environmental Services and Services Maintenance for more information regarding emergency clean up.

Following the emergency use of the system, the system will need to be re-commissioned.

17.0 DECOMMISSIONING OF OIL CONTAINMENT TANKS

An underground oil containment tank that has been taken out of service shall be either;

a) removed, or

b) drained, steam cleaned and completely filled with an inert solid material (e.g. sand, backfill mortar).

All pipework shall be disconnected and removed from the tank, drained and the open ends sealed off.

Due to the nature of an oil containment tank, there is potential for oil leakage during the service life and resulting contamination of the surrounding soil and groundwater. When oil containment tanks are decommissioned and/or removed the potential for contamination shall be investigated.

Contact Ausgrid's Environmental Services for more information regarding the management of contaminated land.
18.0 AUTHORITIES AND RESPONSIBILITIES

For this network standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this network standard can be obtained from the Company Procedure (Network) – Production / Review of Engineering Technical Documents within BMS. The responsibilities of persons for the design or construction work detailed in this network standard are identified throughout this standard in the context of the requirements to which they apply.

19.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Table 1 – Recordkeeping

<table>
<thead>
<tr>
<th>Type of Record</th>
<th>Storage Location</th>
<th>Retention Period*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved copy of the network standard</td>
<td>BMS Network sub process Standard – Company</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Draft Copies of the network standard during amendment/creation</td>
<td>HPRM Work Folder for Network Standards (HPRM ref. 2014/21250/216)</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Working documents (emails, memos, impact assessment reports, etc.)</td>
<td>HPRM Work Folder for Network Standards (HPRM ref. 2014/21250/216)</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>

* The following retention periods are subject to change eg if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

20.0 DOCUMENT CONTROL

Content Coordinator : Manager – Trans and Dist Subs Engineering
Distribution Coordinator : Snr Engineer Guidelines Policies and Standards
Annexure A – Secondary Containment Options

A1 Greenfield and brownfield sites with PPS systems

Where the site has no tank and the closed drainage PPS system will be installed, the following options in order of preference, should be considered.

<table>
<thead>
<tr>
<th>Options</th>
<th>Containment method</th>
<th>Detailing requirements</th>
<th>Additional containment available</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Allow for the burn down rate due to a full bund oil fire</td>
<td>Adopt a burn down rate of 100mm/hr over the full bund surface area</td>
<td>Dependant on bund surface area and time, (e.g. 12m³ for a 60m² bund after 2 hours)</td>
<td>Available volume is time dependant</td>
</tr>
<tr>
<td>2</td>
<td>Raise bund height</td>
<td>Raise bunds to a height to meet risk assessment containment volumes.</td>
<td>Minimum 5000 litres - maximum depends on maximum allowable bund height.</td>
<td>Higher bunds means greater heights for persons to traverse into the bund. This may create a WHS risk.</td>
</tr>
<tr>
<td>3</td>
<td>Provide controlled overflow into neighbouring bunds</td>
<td>Needs connection to neighbouring bunds via pipework valves or underflow weirs.</td>
<td>Available volume has to be calculated for each site, but generally will be approximately 40,000 litres.</td>
<td>Some residual fire risk to neighbouring assets if the overflow control is normally &quot;open&quot;. Foam is corrosive. Some damage may occur to the neighbouring assets. Would require a clean-up after an incident. Extensive pipework may be required where bunds are not adjacent to one another. Preferred only where FSWs are in place.</td>
</tr>
<tr>
<td>4</td>
<td>Provide an overflow area</td>
<td>Requires drainage paths to direct flow to the containment area. Requires installation of appropriate signage and warnings.</td>
<td>Limited only by site constraints. (topography and site use).</td>
<td>Suitable containment area must be available at the site. Difficult to achieve at brownfield sites due to topography and space. Requires a clean-up of the area following an incident.</td>
</tr>
<tr>
<td>5</td>
<td>Direct overflow to the cable basement</td>
<td>Requires the basement to be made watertight or keep a zone 300 mm from the floor penetration free. Requires appropriate shut off valves and additional drainage lines. Requires appropriate warning alarms to evacuate the basement.</td>
<td>Depends on the basement size. Generally in excess of 30,000 litres.</td>
<td>Some residual fire risk to cable basement if the overflow control is normally &quot;open&quot;. Corrosive foam could cause damage to the assets in the basement. Requires extensive pipework. Many sites do not have suitable cable basements. Requires a clean-up of the area following an incident.</td>
</tr>
</tbody>
</table>
## A2 Greenfield sites with tanks (EGOWS)

Where the site has a tank that the bunded areas can drain to by gravity, the following options in order of preference should be considered.

<table>
<thead>
<tr>
<th>Options</th>
<th>Containment method</th>
<th>Detailing requirements</th>
<th>Additional containment available</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilise the freeboard in the tank</td>
<td>Needs the tank outlet shut off valve to be fitted. The valve is to be shut prior to application of fire-fighting medium. Needs the drainage system from the bunds to the tank to be watertight to prevent loss. All pits must have bolt down gas lids.</td>
<td>Approximately 5000 litres. Actual volume depends on the tank size.</td>
<td>Needs bolt down covers which are a minor inconvenience for maintenance. Watertight systems may exclude FRC pipe systems.</td>
</tr>
<tr>
<td>2</td>
<td>Provide controlled overflow into neighbouring bunds</td>
<td>Needs connection to neighbouring bunds via pipework, valves or underflow weirs.</td>
<td>Available volume has to be calculated for each site, but generally will be approximately 40,000 litres.</td>
<td>Some residual fire risk to neighbouring assets if the overflow control is normally “open”. Foam is corrosive. Some damage may occur to the neighbouring assets. Would require a clean-up after an incident. Extensive pipework may be required where bunds are not adjacent to one another. Preferred only where FSWs are in place.</td>
</tr>
<tr>
<td>3</td>
<td>Utilise the freeboard in the tank and raise bunds</td>
<td>Same as option 1, except for the addition of raised bunds.</td>
<td>Limited by bund height restrictions on site</td>
<td>Same as option 1, except the increased WHS risk of raising bunds must be considered.</td>
</tr>
<tr>
<td>4</td>
<td>Provide an overflow area</td>
<td>Requires tank outlet pit outlet shut-off valve. This will direct flow to another area. Alternatively, the tank can overflow to the secondary containment area and the outlet from that area is provided with a shut off valve.</td>
<td>Limited only by site constraints (topography and site use).</td>
<td>Suitable containment area must be available at the site. Would require clean-up after an incident.</td>
</tr>
<tr>
<td>5</td>
<td>Direct overflow to the cable basement</td>
<td>Requires the basement to be made watertight - or keep a zone 300 mm from the floor penetration free. Requires appropriate shut off valves and additional drainage lines. Requires appropriate warning alarms to evacuate the basement.</td>
<td>Depends on the basement size. Generally in excess of 30,000 litres.</td>
<td>Some residual fire risk to cable basement if the overflow control is normally “open”. Corrosive foam could cause damage to the assets in the basement. Requires extensive pipework. Some sites do not have suitable cable basements. Would require a clean-up after an incident.</td>
</tr>
</tbody>
</table>
### A3 Brownfield sites with tanks (Single stage, three stage or other)

Where the site has an existing tank that will be re-used when upgraded, the following options in order of preference should be considered.

<table>
<thead>
<tr>
<th>Options</th>
<th>Containment method</th>
<th>Detailing requirements</th>
<th>Additional containment available</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilise the freeboard in the tank</td>
<td>Needs a tank outlet shut off valve to be fitted. The valve is to be shut prior to application of fire-fighting medium. Needs a watertight drainage system.</td>
<td>Approximately 5000 litres. Actual volume depends on the tank size.</td>
<td>Potentially expensive. Existing drainage lines may not be watertight in most, if not all, cases.</td>
</tr>
<tr>
<td>2</td>
<td>Provide controlled overflow into neighbouring bunds</td>
<td>Needs connection to neighbouring bunds via pipework, valves or underflow weirs. Needs shut off to tank inlet. Needs a watertight drainage system between bunds and the tank, to prevent oil loss. All lids must have bolt down gas tight lids.</td>
<td>Available volume has to be calculated for each site, but generally will be approximately 40,000 litres.</td>
<td>Some residual fire risk to neighbouring assets if the overflow control is normally “open”. Foam is corrosive. Some damage may occur to the neighbouring assets. Potentially expensive. Existing drainage lines may not be watertight in most, if not all, cases. Would require a clean-up after an incident. Extensive pipework may be required where bunds are not adjacent to one another. Preferred only where FSWs are in place.</td>
</tr>
<tr>
<td>3</td>
<td>Utilise the freeboard in the tank and raise bunds</td>
<td>Same as option 1, except for the addition of raised bunds.</td>
<td>Limited by bund height restrictions on site.</td>
<td>Same as option 1, except the increased WHS risk of raising bunds must be considered.</td>
</tr>
<tr>
<td>4</td>
<td>Provide an overflow area</td>
<td>Requires tank outlet pit outlet shut-off valve. This will direct flow to another area. Alternatively, the tank can overflow to the secondary containment area and the outlet from that area is provided with a shut off valve.</td>
<td>Limited only by the site constraints.</td>
<td>Suitable containment area must be available at the site. Containment areas will require maintenance and monitoring. Would require a clean-up after an incident.</td>
</tr>
<tr>
<td>5</td>
<td>Direct overflow to the cable basement</td>
<td>Requires the basement to be made watertight. Requires appropriate shut off valves and additional drainage lines to divert flow to the basement. Requires appropriate warning alarms to evacuate the basement.</td>
<td>Depends on the basement size. Generally in excess of 30,000 litres.</td>
<td>Some residual fire risk to cable basement if the overflow control is normally “open”. Corrosive foam could enter and cause damage to the assets in the basement. Requires extensive pipework. Many sites do not have suitable cable basements. Would require a clean-up after an incident.</td>
</tr>
</tbody>
</table>
Annexure B – Oil Separator Design, Installation and Commissioning Requirements

B1 Introduction
The design, installation and operation of an oil containment system requires the coordination of a number of functional groups within Ausgrid. A fully compliant system requires the timely input of various design, environmental, procurement, construction and operational personnel in order to achieve a satisfactory outcome.

Figures B1 and B2 provide an outline of the key roles and responsibilities within Ausgrid from initial design up to the practical completion stage.

B2 Key responsibilities
1. Parallel Plate Separator systems

There are a number of manufacturers and types of PPS oil containment systems. The PPS unit currently being installed in major substations for Ausgrid is the Ovivo EnviroSEP OS 7500 Oil Separator.

The design principle is generally consistent across all substations but may require variations to the final placement of some components due to local equipment and conditions.

The key roles and responsibilities within Ausgrid for the design, installation and commissioning of PPS oil containment systems are as follows:

1. The installation or upgrade of the PPS system is project managed by the Major Projects or Capital Programs Group;
2. The design drawings “For Construction” are provided by the Project Development Group;
3. The installation is mainly carried out by Contractors, with power supply and SCADA connections by Ausgrid Field Technicians;
4. The inspection and commissioning responsibilities are as identified in Annexure C. The commissioning checklist and procedure are contained in Sections B5 and B6 of this Annexure;
5. The emergency drainage diagram is prepared by Project Development Group to meet the requirements of NS 186, and is installed by the Services Maintenance group;
6. The operation and maintenance functions are to be carried out by the Services Maintenance Group. Refer to Annexure A of NS 190.

The PPS oil containment system shall be correctly installed and fully commissioned on site with a minimum 12 months defects liability period to ensure effective long term operation of the system.

To facilitate this process, and ensure an effective handover of the equipment, the Project Manager shall obtain the advice and input of the Services Maintenance Group during the delivery, installation and final inspection of the PPS system.

Certification that the system has been installed in accordance with the design documentation and manufacturer’s requirements shall be provided by all commissioning parties (including the PPS manufacturer) at the completion of commissioning works.

2. Oil containment tank systems

The key roles and responsibilities within Ausgrid for the design, installation and commissioning of oil containment tank systems are as follows:

1. The overall system design, internal configuration, internal dimensions and standard details are the responsibility of the Project Development Group. The Project Development Group may delegate any aspect of these functions to others as required;
2. Project management, construction and fit-out of the oil containment system is the responsibility of the Major Projects or Capital Programs Group;
3. Final inspection and acceptance of the completed installation is the responsibility of the Project Development Group (Civil Works), with specialist and technical input for equipment (e.g. oil sensors) as required by the Services Maintenance Group during installation and commissioning;

4. The emergency drainage diagram is prepared by Project Development Group to meet the requirements of NS 186, and is installed by the Services Maintenance Group;

5. Operation and maintenance of the complete oil containment system is the responsibility of the Services Maintenance Group. Refer to Annexure A of NS 190.
Figure B1 – Oil containment systems – design responsibilities
Figure B2 – Oil containment systems – procurement and construction responsibilities
Parallel Plate Separator design and installation

The Ovivo EnviroSEP OS 7500 Oil Separator Unit is made of 304 Grade Stainless Steel and designed to operate at a maximum flowrate of 5000L/hr. Welding uses mild steel rods as standard, with stainless steel available on request.

The Ovivo EnviroSEP OS 7500 Unit is 2.1m x 1.86m x 1.175 m high and weighs 550kg empty and 2400kg when full.

The PPS oil separator can be used with inlets from up to four bund pumps. Each pump is set at an equal proportional flowrate so as not to exceed the maximum 5000L/hr at the PPS inlet. Hence, the Total System Capacity of 5000L/hr = F (proportional single flowrate) x N (Number of sump pumps).

The required flowrate for various combinations of pumps is indicated below. All pumps should have the required flowrate indicated on the Pump ID label, located near the pump.

<table>
<thead>
<tr>
<th>Description</th>
<th>Required Flowrate L/hour</th>
<th>Allowable Range L/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Single Pump Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One pump operating</td>
<td>2,500</td>
<td>2,400 – 2,500</td>
</tr>
<tr>
<td>2. Multi-Pump Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All pumps operating</td>
<td>5,000</td>
<td>4,900 – 5,000</td>
</tr>
<tr>
<td>One of two pumps operating</td>
<td>2,500</td>
<td>2,400 – 2,500</td>
</tr>
<tr>
<td>One of three pumps operating</td>
<td>1,700</td>
<td>1,600 – 1,700</td>
</tr>
<tr>
<td>One of four pumps operating</td>
<td>1,250</td>
<td>1,150 – 1,250</td>
</tr>
</tbody>
</table>

Wherever possible all pipes carrying water shall be installed inside the bund area to enable leaks to be contained.

All conduits and termination boxes for electrical cables shall be in accordance with AS 3000.

Each pump is to be supplied by a dust-tight, immersion-proof (rated IP67 or above) 10A 240v Switched Outlet accessible from outside the bund.

The PPS shall have a dedicated 240vAC 20Amp supply from a 20A Combination Circuit Breaker and RCD (Safety Switch) on the Substation main AC Board and be labelled at both ends to identify the circuit. When commissioned, a single Alarm shall be operational to the System Control Room, with the contact phone number marked on the Control Panel. The Alarm shall have the provision inside the Control Panel of being made “Non-Auto” during servicing.

The PPS oil separator tank shall be located in a bunded area and mounted on four 50mm x 15mm threaded mounting studs so as to provide a height adjustment nut below the support bracket and a locknut above.

The Control Panel shall be mounted to be accessible from outside the bund area. The Control Panel door shall be lockable with a lock type that enables fitting of a suitable Abloy lock to be supplied and keyed by the Oil Containment Group.

The PPS shall have all outflow 50mm Kamlock fittings located for the easy connection of tanker hoses from the front. Where the PPS is located in confined areas, the use of a detachable 900 elbow with Kamlock fittings is acceptable.

Each bund pump shall have a stainless steel flexible hose approximately 500mm long (end fittings excluded) to suit the site constraints and located on the outlet side only. Each pump outlet shall have a ball valve between the flexible hose and rigid pipe. Each pump shall have a stainless steel waterproof cover that can be easily removed for servicing and is fitted with ventilation louvres on three sides adjacent to the motor vents. The pump cover is to be hinged on the opposite side to the pump pulleys.
Where cables are installed in metal pipes or covers, the ends shall be bushed to prevent cable damage.

The discharge of the PPS shall be directed to the transformer roadway or other well drained areas and shall allow sufficient space for future sampling. The discharge shall not be connected directly to stormwater pipes or pits. Site drainage shall be arranged so as to avoid long term ponding directly in front of the Control Panel.

The Control Panel shall have an Auto/Off Selector Switch for the PPS Alarm circuit. A Control Panel Operations Manual and PLC logic diagrams shall be available to enable the interrogation and calibration of the Control Panel PLC. An electrical circuit diagram for the Control Panel shall also be available in order to facilitate connection of sensors etc by qualified persons.

B4 PPS manufacturer installation requirements

B4.1 General

**Installation**

Electricals shall comply with AS 3000. The installing electrical Contractor shall provide to the Project Manager a Certificate of Completion - Electrical Works (CCEW) to confirm compliance with AS 3000.

**Pump installation**

A stainless steel flexible hose of approximately 500mm in length (end fittings excluded) and correct diameter on the discharge side only of the pump. Refer to OCD 513.

**Level Floats**

Pump start and stop settings are to be to Ausgrid standard detail OCD 514. The high level float should operate at the maximum height in the sump just below the grate level.

B4.2 Electrical requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Rating</th>
<th>Minimum Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>20A RCD Unit on Sub AC Board to Control Panel</td>
<td>240vAC 20A</td>
<td>1 x 3 core cable</td>
</tr>
<tr>
<td>SCADA</td>
<td>Sub SCADA to Control Panel</td>
<td>110vDC</td>
<td>1 x 2 core cable</td>
</tr>
<tr>
<td></td>
<td>Sub SCADA to Control Panel</td>
<td></td>
<td>1 x 4 core fibre cable</td>
</tr>
<tr>
<td>Floats</td>
<td>Junction Box to each Float</td>
<td>24vAC</td>
<td>1 x 2 core cable per float</td>
</tr>
<tr>
<td></td>
<td>Junction Box to Control Panel</td>
<td></td>
<td>1 x 6 core cable</td>
</tr>
<tr>
<td>Pumps</td>
<td>Control Panel to each Pump Motor Supply Outlet</td>
<td>240vAC 10A</td>
<td>1 x 3 core cable per pump</td>
</tr>
</tbody>
</table>

B4.3 Pump installation

Generally, ASM DS32 pumps shall be used on all sites to reduce the requirement for spares. Other pump sizes may be used where specific site conditions dictate.

The pump motor must be covered to the details shown on the project drawings.

B4.4 Pipe installation

Pipes shall be as specified on the project drawings. Generally, the use of ASM DS32 pumps will require 40mm suction pipes and 50mm discharge pipes.
### B5  OVIVO EnviroSEP OS7500 Oil separator – commissioning checklist

#### Substation No.:  
**Name:**

<table>
<thead>
<tr>
<th>A</th>
<th>OIL SEPARATOR UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unit installed on four mounting studs c/w nuts for height adjustment</td>
</tr>
<tr>
<td>2</td>
<td>Lids are adequate and can be secured in Open and Closed Positions</td>
</tr>
<tr>
<td>3</td>
<td>Levels are Weir +/- 0mm across the fixed secondary weir and max 5mm along the unit</td>
</tr>
<tr>
<td>4</td>
<td>Hose Kamlock fittings readily accessible with or without the 90° detachable elbow, as applicable.</td>
</tr>
<tr>
<td>5</td>
<td>Discharge to well drained area and no long term ponding in front of Control Panel</td>
</tr>
<tr>
<td>6</td>
<td>Flowrate checked OK</td>
</tr>
<tr>
<td>7</td>
<td>High Oil Alarm operation checked</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>CONTROL PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control Panel door is lockable and hinged mounting panel is lockable</td>
</tr>
<tr>
<td>2</td>
<td>Installed securely to enable access from outside of bund area</td>
</tr>
<tr>
<td>3</td>
<td>Oil Containment Label and contact phone number on outside</td>
</tr>
<tr>
<td>4</td>
<td>Control Room Operator contact number on inside, near Alarm Switch</td>
</tr>
<tr>
<td>5</td>
<td>20A Supply on a dedicated circuit from Substation AC Board</td>
</tr>
<tr>
<td>6</td>
<td>Alarm Auto/Non-Auto Switch fitted to Control Panel</td>
</tr>
<tr>
<td>7</td>
<td>Alarm and cancel operation checked with Control Room</td>
</tr>
<tr>
<td>8</td>
<td>All conduit and cable entries are waterproof and secure</td>
</tr>
<tr>
<td>9</td>
<td>Pump Isolating Switch is lockable in OFF Position</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>BUND AREAS, PUMPS and FLOAT SWITCHES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pumps installed above high water level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pumps are fitted with a removable weatherproof cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Each Pump Motor is supplied via a 240vAC 10A Switched Power Outlet (rated IP67 or above)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pump motor clockwise rotation (from rear) and breather checked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Pump primed and flowrate checked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Flexible hose length is 500mm on the discharge side only of pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>All pipes sizes are as per pipe schedules on project drawings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ball valve fitted only between flex hose and fixed pipes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>All electrical conduits are in accordance with AS 3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Float Switch position and operation checked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Bunds and Pumps labelled correctly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>GENERAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All conduits with cables are bushed to prevent cable damage</td>
</tr>
<tr>
<td>2</td>
<td>All conduits are mechanically protected over/outside of bunds</td>
</tr>
<tr>
<td>3</td>
<td>Water supply available nearby, (where possible)</td>
</tr>
<tr>
<td>4</td>
<td>Power Supply circuit protected by RCD Unit incorporating a C.B.</td>
</tr>
<tr>
<td>5</td>
<td>Operation/Maintenance settings and functionality checked</td>
</tr>
<tr>
<td>6</td>
<td>Discharge water 500ml sample for Oil%, PCB and pH levels</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>ADMINISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Substation has an Emergency Drainage Diagram</td>
</tr>
<tr>
<td>2</td>
<td>Oil Separator Unit entered in TIS as Task U116</td>
</tr>
<tr>
<td>3</td>
<td>Electricians “Certificate of Completion” signed and submitted – No. Dated:</td>
</tr>
<tr>
<td>4</td>
<td>A copy of this report is given to Major Projects Group</td>
</tr>
<tr>
<td>5</td>
<td>Identified remedial actions completed.</td>
</tr>
</tbody>
</table>

Checked by: ................................................................. Date: ..................................
B6 OVIVO EnviroSEP OS7500 Oil separator commissioning procedure

<table>
<thead>
<tr>
<th>Substation:</th>
</tr>
</thead>
</table>

**Contact:** Major Projects Group :

**Equipment required:**
1. Socket Set
2. Silicon and Application Gun
3. Allen Keys
4. Rags
5. Spirit Level
6. Rule / Tape measure
7. Permanent Marker

**System Status:**
1. Installation is complete
2. Power is connected
3. Pump direction has been checked – clockwise from rear of pump motor
4. Oil Separator unit is filled with water
5. Water is available on site for this procedure

**System Preparation:**
1. Alarm Non-Auto and advise System Control Room – as per label
2. Record details of the Oil Separator Unit and all pumps
3. Ensure all switches in the Control Panel are OFF
4. Check the Pump Isolating Switch on the side of the Control Panel is OFF
5. Check the Main Supply Circuit Breaker inside the Control Panel is OFF
6. Check that all wiring appears complete.
7. Check that the pumps are mounted above the bund spill height.
8. Check that electrical cables do not rub against metal edges
9. Check that the pump has been prepared for operation
10. Pipework between the sumps and pumps are complete and correct size (40mm).
11. Pipework between the pumps and separator are complete and correct size (50mm)
12. Flexible hoses are used between pumps and discharge pipes of at least 500mm in length (end fittings excluded).
13. The oil separator outlet pipe flows to stormwater.
14. Water in all the bund sumps covers the float switches.
15. Check the Oil Separator Unit levels – front to back (+/- 0mm) and side to side (+/- 5mm)

**Pump Operation Checks:**
1. Ensure the Main Supply Circuit Breaker inside the Control Panel is ON
2. Ensure the Pump Isolating Switch on the side of the Control Panel is ON
3. Turn Pump Switch No1 to AUTO
4. Raise No.1 float switch to initiate No.1 pump start
5. With each pump operation check pump direction and water flow – prime if necessary
6. Repeat pump operation check for each Pump Switch
7. Ensure that all Pump Switches are OFF after each pump operation check

**Bund Float Alarm Checks**
1. Ensure the Main Supply Circuit Breaker inside the Control Panel is ON
2. Ensure the Pump Isolating Switch on the side of the Control Panel is ON
3. Raise High Alarm Float in Bund No.1 and observe alarm operation
4. Bund No.1 Alarm and Common Flashing Alarm should both light up.
5. Lower the High Alarm Float and both the Alarm Indicators should reset
6. Repeat the High Alarm check for each bund.
| High Oil Level Alarm Check | 1. Ensure the Main Supply Circuit Breaker inside the Control Panel is ON  
2. Ensure the Pump Isolating Switch on the side of the Control Panel is ON  
3. Raise High Oil Alarm Float in the Oil Separator and observe alarm operation  
4. The High Oil Alarm and Common Flashing Alarm should both light up.  
5. Lower the High Oil Alarm Float and both the Alarm Indicators should reset |
| --- | --- |
| Pump Supply Fail Alarm Check | 1. Ensure the Main Supply Circuit Breaker inside the Control Panel is ON  
2. Ensure the Pump Isolating Switch on the side of the Control Panel is ON  
3. Trip the Circuit Breaker for Pump No.1 inside the Control Panel  
4. Observe that the Pump Fault Light and Common Alarm Light operate  
5. Reset the Circuit Breaker and observe that both alarms reset  
6. Repeat this test for each pump |
| Oil Weir Setting | 1. Fill unit with water to almost full  
2. Note the distance from the top of the water to the top of the fixed oil weir  
3. Set the distance from the water to the adjustable oil weir  
4. Set the adjustable oil weir with silicon  
5. Ensure that the silicon is level across its length |
| Outlet Weir Setting | 1. The Outlet Weir setting determines the level of the water in the separator.  
2. Ensure the Main Supply Circuit Breaker inside the Control Panel is ON  
3. Ensure the Pump Isolating Switch on the side of the Control Panel is ON  
4. Turn each Pump Switch on the Control Panel to AUTO  
5. Allow the flow to maximise and settle  
6. Adjust the Outlet Weir to be 3 – 8 mm below both the oil weirs.  
7. Lock the Outlet Weir using an Allen Key on the grub screw.  
8. Allow the system to drain each bund which automatically switches each pump OFF |
| Discharge Testing | 1. Ensure that the oil separator has stabilised and is operating with discharge water flowing  
2. Fill a 500ml sample bottle from the discharge outlet flow for testing  
3. Arrange for testing of the discharge sample for Oil, PCB and pH. |
| Checks completed | 1. Contact Supervisor if the supply RCD Safety Switch does not reset after test.  
2. Ensure that all Switches are in AUTO or ON  
3. Secure the inside panel and Control Panel door and retrieve all access keys  
4. Restore Alarm then contact System Control Room Operator to confirm Alarm and Reset  
5. Ensure all equipment details are recorded  
6. Record any defects, required repairs and items for attention  
7. Contact Supervisor if any unsafe condition is found. |
## Annexure C – Oil separator inspection requirements and hold points

<table>
<thead>
<tr>
<th>Inspection Area</th>
<th>Relevant Details</th>
<th>When Inspection Is Required</th>
<th>Inspection</th>
<th>Developer Services - Civil &amp; Building Group (See Notes 1 and 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. EGS Oil Containment Tanks</td>
<td>Survey of the pipes penetrations</td>
<td>After pouring the foundation and the base plates</td>
<td>First Survey</td>
<td>1. Joint is at correct height</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Reinforcement is correct</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Hydrotests are correct placed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Hydrotests are correct placed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project Design Drawings</td>
<td>1. Location and design of anti-climb devices is in place</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Inspect safety equipment of oil hoppers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Inspect safety equipment on basement works</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Inspect fitting of anti-climb devices</td>
</tr>
</tbody>
</table>

### Notes:
1. The project name is to be written on the filling area.
2. The items to be inspected are to be written in the filling area.
3. The locations of the items to be inspected are to be written in the filling area.
4. The specified time for the inspection is to be written in the filling area.
<table>
<thead>
<tr>
<th>Stage</th>
<th>Work Description</th>
<th>Deliverables</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Installation</td>
<td>Pipes and Pumps On delivery to site and before installation</td>
<td>Pump and Pipe size table on Project Design Drawings</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Check drawings and flowrate 2. Arrange Work Order No. for site from SAP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Monitor installation of Oil Containment System</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td>AS3000 Following wiring installation by Licensed Electrician</td>
<td>AS3000 and Project Design Drawings</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Check position of Control Panel, Junction Boxes etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Check Pumps / Floatswitches have plugs &amp; sockets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Obtain Certificate of Completion - Elec Works (CCEW)</td>
<td></td>
</tr>
<tr>
<td>Testing</td>
<td>Separator Test and Settings Whilst manufacturer is field checking and setting</td>
<td>O&amp;M Manuals</td>
<td>Services Maintenance Group &amp; PPS Manufacturer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Check Unit bolts and levels (side to side / front to back)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Adjust settings (Wax, Thimble etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Check High Oil Alarm and Shut-Off function</td>
<td></td>
</tr>
<tr>
<td>Commissioning</td>
<td>Final Checks and Acceptance On Practical Completion</td>
<td>Network Standards and Project Design Drawings</td>
<td>Services Maintenance Group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Check labels are correct and in place.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Check Pipes, Pumps and Valves operate without leaks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Float switches are not obstructed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. All defects and Alarms OK.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Entry into SAP On Practical Completion</td>
<td>Final Inspection Report</td>
<td>Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. SAP entry as completed.</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. Where the structural design is undertaken by an external consultant, the commissioning inspections shall also be undertaken by that consultant.
2. Inspections of Anti-Climb devices and Electrical Safety Clearances shall always be undertaken by Development Services.
# Annexure D – Sample Compliance Checklist

## Network Standard Checklist Form

**NS189 Oil Containment for Major Substations**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Refer Clause</th>
<th>Completed/Actioned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>This standard covers the design of oil containment systems for new and existing major substations with primary voltages of 132, 66 and 33 kV.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Design Principles, Site and Regulatory Requirements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>All material and equipment to be used are free of asbestos</td>
<td>5.0</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>2</td>
<td>Ausgrid Asbestos register checked for site location prior to work commencing</td>
<td>5.0</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>3</td>
<td>Basic assumptions for oil containment design are consistent with the proposed oil containment system</td>
<td>6.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>4</td>
<td>For existing major substations where any piece of oil-filled equipment has more than 1000 litres of oil, a containment system has been implemented</td>
<td>7.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>5</td>
<td>For existing major substations, the piece of equipment has less than 1000 litres, oil containment may not be necessary subject to conditions in Cl.7.1</td>
<td>7.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>6</td>
<td>Potential for stormwater to be contaminated with oil has been minimised</td>
<td>7.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>7</td>
<td>For new substations all oil-filled equipment is bunded unless indicated otherwise by this NS199</td>
<td>7.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>8</td>
<td>For the risk of catastrophic failure causing prolonged fire, the drainage systems risk of spreading off-site reduced by containing oil in bund. The PPS is designed to shut down on neat oil flow through the separator</td>
<td>7.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Refer Clause</td>
<td>Completed/Actioned</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------</td>
</tr>
</tbody>
</table>
| 0    | For the risk of catastrophic failure causing large amount of oil spreading off-site:  
  - For closed drainage PPS systems bunds have capacity for contents of transformer plus 5000 litres of fire-fighting medium.  
  - Oil removed from bund as soon as possible.  
  - For gravity drainage systems bunds contain oil in area of loss preventing fire spreading off-site. Bunds able to hold 100% of oil volume.  
  - For gravity drainage systems bund drains to oil containment tank.  
  - For gravity drainage systems, oil containment tank fitted with manual or automatic shut-off valve at outlet of tank.                                                                                                                                                                                                                       | 7.1          | Yes/No/NA          |
| 10   | To minimise oil pollution during normal operation for closed drainage PPS systems and gravity drainage systems:  
  - Maintain oil-filled equipment in good working order.  
  - Stormwater discharge contains less than 10ppm of oils and greases.                                                                                                                                                                                                                                                                               | 7.1          | Yes/No/NA          |
| 11   | For greenfield sites, selection of preferred oil containment system based on life cycle cost evaluation and site-specific criteria outlined in Cl. 7.2.                                                                                                                                                                                                                                                                                | 7.2          | Yes/No/NA          |
| 12   | For existing brownfield retrofit sites the designed oil containment system is closed drainage PPS system (preferred).                                                                                                                                                                                                                                                                                                             | 7.2          | Yes/No/NA          |
| 13   | For closed drainage PPS systems, pumps and above ground pipework provided.                                                                                                                                                                                                                                                                                                                                               | 7.3          | Yes/No/NA          |
| 14   | For gravity drainage systems all drainage accomplished by gravitational action where possible. Fixed pumps may be used at the outlet of an oil containment or storage tank for CBD locations.                                                                                                                                                                                                                           | 7.3          | Yes/No/NA          |
| 15   | All existing or temporary major substations sites the minimum requirement is a bund around each transformer. Provision for monitoring and emptying after rain events made.                                                                                                                                                                                                                                        | 7.4          | Yes/No/NA          |
| 16   | All components of oil containment system designed for expected loading conditions.                                                                                                                                                                                                                                                                                                                                                 | 7.5          | Yes/No/NA          |
| 17   | Designer Safety Reports submitted to Ausgrid in accordance with WHS Regulation 2011.                                                                                                                                                                                                                                                                                                                                      | 7.6          | Yes/No/NA          |
| 18   | Site selection criteria in accordance with Cl. 8.0.                                                                                                                                                                                                                                                                                                                                                                         | 8.0          | Yes/No/NA          |
| 19   | Sewer and stormwater regulatory requirements met.                                                                                                                                                                                                                                                                                                                                                                            | 9.2, 9.3     | Yes/No/NA          |
| 20   | Local council stormwater codes of practice and guidelines adopted where practicable.                                                                                                                                                                                                                                                                                                                                     | 9.3          | Yes/No/NA          |

### Typical Layouts, Bunding and Drainage

| 21   | For CBD major substation:  
  - Transformer is bunded and is drained to a tank.  
  - Tank has capacity for minimum 90 minutes of high velocity spray and 10% of volume of largest transformer.  
  - Tank overflows (from bottom of tank) to cable basement for high velocity water spray in excess 90 minutes.  
  - Bays with oil-filled capacitors are bunded and are drained to a separate storage tank if fitted with sprinklers. A tank pump out point provided for tanker access.                                                                                                                                                                                                                       | 10.1         | Yes/No/NA          |
| 22   | For suburban major substation:  
  - For closed drainage PPS system:  
    - Used bund storage and PPS oilwater separator  
    - Site selection in accordance with Cl. 7.2  
    - Transformers individually bunded and any discharge points kept normally closed  
    - Automatically operated pumps with suitable bund sums used  
    - Pipes in accordance with Cl. 13.1.1 are used above ground  
    - Bund storage sized to retain all oil spills with margin for rainfall and fire-fighting medium  
    - Overflow from bunded area directed to secondary containment or.                                                                                                                                                                                                                                                                 | 10.2         | Yes/No/NA          |
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Refer Clause</th>
<th>Completed/Actioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>All subsoil drainage, yard run-off and roof-drainage excluded from bunded areas</td>
<td>11.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>24</td>
<td>Oil containment areas designed to minimise entry of clean stormwater</td>
<td>11.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>25</td>
<td>For existing retrofit sites all transformers with greater than 1000 litres oil are bunded unless a risk assessment indicates otherwise.</td>
<td>11.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>26</td>
<td>For new sites all oil-filled transformers are bunded</td>
<td>11.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>27</td>
<td>Bunded areas designed to capture 1.2 spray discharge to AS1040. Where bunded design cannot meet spray discharge, spray screens may need to be used.</td>
<td>11.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>28</td>
<td>For new sites transformer roadways drainage is to stormwater with butterfly valve to control discharges during oil transfers or with oil-filled equipment on the roadway.</td>
<td>11.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>29</td>
<td>For existing sites transformer roadways, same condition applies where it is possible to do so without laying new drainage pipes</td>
<td>11.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>30</td>
<td>For sites with restricted size an alternative arrangement of draining the roadway directly to an oil containment tank can be used subject to a risk assessment and LCC.</td>
<td>11.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>31</td>
<td>Bunding design requirements applied as specified in Cl 11.5</td>
<td>11.5</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>32</td>
<td>Secondary containment facilities design using risk management approach as required by Ausgrid</td>
<td>11.6.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>33</td>
<td>Secondary containment areas located in suitable areas</td>
<td>11.6.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>34</td>
<td>Oil spill kits provided</td>
<td>11.6.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td><strong>Oil Water Separators, Tanks and Drainage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>PPS System used with closed drainage designs relying on bund storage</td>
<td>12.1.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>36</td>
<td>PPS control panel and motor-pump located above bund high water level and control panel accessible from outside the bund</td>
<td>12.1.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>37</td>
<td>PPS system shut-down operates independently of substation protection system and fitted with RCD unit at point of supply.</td>
<td>12.1.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>38</td>
<td>PPS system alarms configured as required</td>
<td>12.1.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>39</td>
<td>Design complies with PPS requirements for neat oil flow</td>
<td>12.1.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>40</td>
<td>PPS system design complies with requirements detailed in Annexure A</td>
<td>12.1.5</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>41</td>
<td>EGOWS system installation compliant with Ausgrid site specific design</td>
<td>12.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>42</td>
<td>Tank access designed in accordance with requirements</td>
<td>12.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>43</td>
<td>Installation, inspection and hold points meet requirements of Annexure C</td>
<td>12.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>44</td>
<td>Pipework designed in accordance with requirements</td>
<td>13.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>45</td>
<td>Hydraulic testing requirements of oil containment system pipework undertaken as required.</td>
<td>13.1.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>46</td>
<td>Drainage pipework design complies with requirements</td>
<td>13.1.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>47</td>
<td>Design and placement of pipes and pits comply with design requirements</td>
<td>13.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>48</td>
<td>Flume trap design complies with requirements</td>
<td>13.2.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>49</td>
<td>For closed drainage PPS systems the valve design meets design requirements</td>
<td>13.3.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>50</td>
<td>For gravity drainage systems the butterfly valve design and access pit complies with design requirements and is located in a suitable position to permit operation under emergency and fire conditions. A suitable separation distance of fire resistant barriers may be required.</td>
<td>13.3.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Refer Clause</td>
<td>Completed/Actioned</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>--------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>51</td>
<td>Pump types and design comply with design requirements</td>
<td>13.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>52</td>
<td>Where infiltration trenches used, approval sought from Ausgrid prior to design acceptance</td>
<td>13.5</td>
<td>Yes/No/NA</td>
</tr>
</tbody>
</table>

**Fire Fighting & Clean up**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Refer Clause</th>
<th>Completed/Actioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>For CBD major substations storage provided for 90 minutes firefighting water</td>
<td>14.0</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>54</td>
<td>For both non-rural and rural sites the storage capacity shall support 20 minutes of foam used from a single hose with flow rate 41/s</td>
<td>14.0</td>
<td>Yes/No/NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Refer Clause</th>
<th>Completed/Actioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Containment storage can include available bund volume (with provision for burn down rate of 100mm per hour where full bund oil fire occurs)</td>
<td>14.0</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>57</td>
<td>Design complies with special requirements for capacitors using Jarylec or Faradol fluid</td>
<td>15.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>58</td>
<td>Outdoor capacitor banks do not require bunding. However where leakage is a significant risk a concrete apron may be required subject to a risk assessment.</td>
<td>15.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>59</td>
<td>Indoor capacitor banks with fire protection sprinklers are drained to dedicated storage tank</td>
<td>15.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>60</td>
<td>Post emergency cleanup and re-commission of the oil containment system complies with requirements</td>
<td>16.0</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>61</td>
<td>Decommissioning of oil containment tanks complies with requirements</td>
<td>17.0</td>
<td>Yes/No/NA</td>
</tr>
</tbody>
</table>

Notes: