Design and construct contract

Schedule 14: Company's requirements

2
volume

SYDNEY'S DESALINATION PROJECT

Sydney's Desalination Project

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SYDNEY'S DESALINATION PROJECT

Sydney Desalination Plant Pty Limited

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Volume

TS 01

Design and construct contract:
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SYDNEY'S DESALINATION PROJECT

TS-01 Scope of Work – D&C Contract – Separable Portion 1

TS-01 Scope of Work

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1 Scope of Work

1.1 General

This document describes the scope of the work to be provided by the Contractor for Separable Portion 1 of the Project consisting of seawater inlet and seawater concentrate outlet, seawater pre-treatment, reverse osmosis treatment, potabilisation and on-site storage of Drinking Water. The delivery system, including pump station, delivery pipelines and surge control will be delivered under a separate alliance agreement. On completion of Separable Portion 1 the Plant must be sized for the average production of 125 ML/day of Drinking Water. The Plant must subsequently be augmented to 250 ML/day in accordance with Separable Portion 2, and must be capable of being further upgraded at short notice to produce 500 ML/day of Drinking Water.

Notwithstanding the broad capacity descriptions above, several elements of the Project must have capacities greater than 125 ML/day, as detailed elsewhere in the Company's Requirements.

1.2 Scope of Work during the Design and Construction Phase

The Scope of Work of the Project includes the development and completion of the design and engineering, obtaining any required approvals, procurement, manufacturing, factory testing, transport to Site, erection, construction, commissioning and performance testing.

The Scope of Work for the Project must include the following:

(a) Design and Construction

Design

Generally, the Contractor must develop the detail design including:

- Assessment of Site conditions including carrying out all additional Site investigations required;
- Carrying out all necessary surveys and studies to support the design;
- Finalisation of the design and construction specification from the starting point of the Contractor's tendered specification;
- Preparation, verification and submission of design input reports as required by the document;
- Preparation, verification and submission of "Concept" and "For Construction" designs for the Project;
- Preparation and provision of other documentation required by Authorities and obtaining all approvals for the operation of high voltage equipment including all submissions to Energy Australia;
- Preparation of management plans as required by the document and by the Planning Approval and obtaining all other approvals where required; and
- Preparation of procurement documentation for long lead items, including high pressure pumps, energy recovery devices, membranes, pressure vessels, high pressure piping and valves and tunnel boring machines, along with any additional items that the Contractor determines to be long lead items.

Specifically, the Contractor must carry out the detailed design and documentation of the Project for the scope of work described below.

Site Development

Generally, the Contractor must carry out Site development works as follows:

- Development of the Site, including all civil and structural infrastructure, energy distribution, consumables-supply, seawater supply and concentrate discharge and connection measures with all necessary surveys and studies;
- Temporary and permanent civil works associated with the Project including:
  - Site preparation including clearing, stripping and grubbing and cutting or filling to levels, dewatering, backfilling with compaction/consolidation, and earth works;
  - Treatment of any Potential Acid Sulphate Soils (PASS) or Acid Sulphate Soils (ASS) encountered on any of the construction sites;
  - Soil improvement measures or appropriate foundations to support temporary and permanent buildings and structures, including removing unsuitable material and importing clean fill;
  - Remediation of any contaminated soil located on the Site in accordance with the D&C Contract.
  - Temporary and permanent environmental works such as detention basins, silt traps and silt fences, and noise and sight-screens, drainage works and groundwater recharge facilities to meet the requirements of the D&C Contract.

Site Facilities

Generally, the Contractor must provide all necessary temporary and permanent facilities for Site supervision and construction, such as:

- Site fencing and screening, lighting, security and access control facilities;
- Contractor's and the Company's construction compound facilities, including car parking, Site offices, ablutions, amenities and change rooms, first aid facilities, workshops and stores, dangerous goods compounds (gases and fuels, chemicals, explosives etc), security buildings;
- Preparation of construction work zones and lay-down areas, including construction roads and hardstand and temporary drainage;
- Construction power reticulation at 11kV from the energy authority's 11kV point of supply on Site, including metering of the supply and voltage transforming to 415V and as required for specialised construction machinery. The Contractor's construction power reticulation must extend to the interface with Sydney Water's Alliance Participants' work site, and must terminate at a circuit breaker at that location for on-connection to the Alliance Participants' work site. The construction power supply to the Alliance Participants' work site must be at 415V and must have a capacity of 200kVA.

  This power supply will only have a capacity of 1MVA and will be insufficient for construction purposes through the life of the construction phase.

  The Company will arrange for an additional 12MVA supply at 33kV, to be made available from the energy authority's substation on Captain Cook Drive. To assist the Contractor, Sydney Water has designed the 33kV cable run to the Site (see Drawings WTW155-E0109 Rev A and WTW155-E0110 Rev A) and the substation on Site to a level sufficient to order major equipment (see Drawings WTW155-E0015 Rev A, WTW155-E0016 Rev A, WTW155-E0017 Rev A, WTW155-E0018 Rev B, WTW155-E0019 Rev A, WTW155-E0106 Rev A, WTW155-E0107 Rev A, WTW155-E0108 Rev A, WTW155-E1035 Rev A, WTW155-E1036 Rev A), and has pre-ordered the 33kV cable, a 12.5MVA 33/11kV transformer and 11kV switchgear, which will be supplied free issue to the Contractor. The Contractor must construct the 33kV supply, including a permanent 33/11kV switchyard on Site and must then transfer its own on Site construction power reticulation, and that of Sydney Water's Alliance Participants, onto the 11kV output of this supply from the 1MVA supply. The Company will also provide an additional, reconditioned 33/11kV transformer rated at 10 MVA, which the Contractor must install into the switchyard to facilitate early start up of the 12MVA supply and to act as a back-up.

Following completion of construction, or at a time after the permanent 132kV supply has been put into service, and when the construction supply is no longer required by Sydney Water's Alliance Participants, the Contractor must design and construct a reconfiguration of the 11kV output from the 33kV supply as a permanent back-up supply to the Plant to cater for the event of failure of the 132kV supply. This must include disconnection and removal to the Company's nominated location of the reconditioned transformer.

- Compressed air supply and reticulation as required during construction;
- Temporary and permanent environmental protection systems including sewage, stormwater and wastewater treatment and disposal systems, waste collection, handling, storage and disposal, soil protection, noise reduction and prevention of lighting spill from the Site;
- Water supply and reticulation facilities;
- Temporary fencing and safety measures for the construction site;
- Temporary fire protection services;
- Site identification board;
- Registration/permits/approvals/licences for equipment and construction operations;
- Restoration of the temporary construction areas to a pre-existing condition by the removal of all construction activity services, structures, paving, ancillaries and wastes, asphaltic and bituminous materials. Removal of hardstand and laydown areas and regrading to prevent ponding must be undertaken as agreed with the Company's Representative as soon as practical after Completion; and
- Landscaping and urban design.

General

Generally, the Contractor must carry out other works as necessary, including:

- Risk assessment studies and RED studies;
- HAZOP studies including provision of experienced HAZOP-leader and reports (pre-HAZOP and final HAZOP);
- Environmental approvals and/or permits required during construction, testing and commissioning of the Project including waste water discharge, waste disposal, noise, and air emissions; and
- Corrosion protection and prevention systems.

Procurement

The Contractor must procure all temporary and permanent materials and equipment required for the Works. This must include preparation of detailed procurement specifications and procurement documentation, and must require the Contractor to carry out, or cause to be carried out, any tests required to ensure the materials and equipment comply with the Company's Requirements.

The Contractor must arrange for all materials and equipment to be delivered to Site and must arrange for all imported equipment and materials to be cleared through customs and quarantine.

Commissioning and Testing

The Contractor must progressively commission and test the Works as they are constructed and must carry out the various commissioning and performance tests detailed in the Company's Requirements.

(b) Scope of Plant Facilities and Associated Infrastructure

The following sub-sections describe in broad detail the extent of the Works to be provided under the D&C Contract. For completeness, this section needs to be read in conjunction with the other requirements of the D&C Contract to define fully the scope of work.

Seawater Extraction and Intake System

- Complete seawater extraction and intake system including intake risers, velocity caps and coarse screens;
- Seawater intake tunnel and landside chamber connecting seawater intake to the Desalination Plant, and oil/hydrocarbon monitoring and warning system;
- Suitable access facilities for tunnel and chamber maintenance;
- Seawater pumping station;
- Storage and dosing systems for chlorination at seawater intake and seawater pumping station;
- Seawater quality monitoring system;
- All other equipment necessary for reliable and safe operation of the seawater intake system; and
- Seawater by-pass pipe from the seawater pump station to the seawater concentrate outlet shaft.

Seawater Screening Plant

- An active on-shore fine-screening plant, capable of screening solids from the sea water;
- A cleaning system for the screening plant; and
- All other equipment necessary for reliable and safe operation of the seawater screening system.

Seawater Concentrate Outlet

- Seawater concentrate landside chamber and outlet tunnel from the Desalination Plant to the off-shore location for the outlet;
- Discharge points for the seawater concentrate to the sea including risers and diffusers and gravity protection structures;
- Suitable access for tunnel and chamber maintenance; and
- All other equipment necessary for reliable and safe operation of the seawater concentrate outlet system.

Desalination Plant

- Seawater pre-treatment plant to condition seawater for the Desalination Plant, including:
  - Filtered seawater storage facility;
  - Filtered seawater pumps and backwash water pumps;
  - Backwash water treatment facility;
  - Backwash sludge treatment and handling facility.

- RO feed conditioning with chemicals storage, preparation and dosing equipment;
- Two pass RO system including cartridge filters;
- Chemical cleaning equipment for 1st and 2nd pass RO membranes;
- Intermediate surge facilities;
- Permeate tanks and flushing facilities including permeate transfer and flushing pumps, common manifolds for suction and discharge lines, isolation and non-return valves, flow metering equipment, interconnecting pipework between permeate tanks and drinking water tanks; and
- All standard equipment and accessories which are required for a Desalination Plant but which are not separately listed.

Potabilisation Plant

- Potabilisation system, using carbon dioxide and lime water, followed by chlorination and fluoridation and chloramination, with equipment for storage, handling, preparation and dosing of chemicals.

Drinking Water Storage

- Drinking water storage tank complete with roof, piping connections, overflow and vents and access and maintenance facilities;
- All standard equipment and accessories required for drinking water storage but which are not separately listed; and
- Drinking water purge system to allow water to be removed from the storage tanks and drinking water delivery system to the seawater concentrate outlet.

Environmental Protection Systems

Environmental protection systems and treatment process plant for emissions control, including sewage, process wastewater, storm water collection and transfer facilities, soil erosion protection, noise control measures, and waste collection and segregation facilities.

Electrical Systems

- Design, procurement and installation of 132 kV feeder(s) from energy authority's point-of-supply to the Plant sub-station, including design, procurement, installation and commissioning of 132kV/11kV transformers (including N+1 redundancy), switchgear, and protection systems;
- Design, procurement, construction, and commissioning of permanent 11kV power supply reticulation to the various load centres across the Site, including local 11kV sub-stations as required;
- Design, procurement, construction, and commissioning of the LV (240V, 415V, 670V) reticulation and connections to the Plant items; and
- Design, procurement, construction, and commissioning of a back-up 12 MVA power supply to be used to close down and preserve the Plant in the event of a failure of the 132kV supply. The back-up supply must be taken from the 33kV 12 MVA construction power supply feeder.

Instrumentation and Control (I&C) and SCADA System

An I&C and SCADA system for process control and monitoring, including all necessary field devices, instruments, programmable logic controllers, computer servers and workstations, network infrastructure and equipment, cabling, peripherals, applications and system software and licences. The systems must also include:

- Online metering and monitoring equipment;

- Water Quality Historian Data Server including hardware, software, printers, GPS clock and networking facilities;
- Data exchange with Sydney Water's System Operation Center (SOC); and
- Metering and billing systems for water and power.

Civil Works

- All access roads, hardstands, footpaths, paving, stormwater management systems, traffic controls, and signage for the Plant; and
- Permanent paved access to the residual site area, constructed to the same standard as other site access roads.

Instrument & Service Air System

All standard equipment and accessories which are required for instruments and service air systems including ring main system, oil free compressors (with appropriate spare capacity) and cooling system, noise attenuation and pipe labelling.

Fire Fighting and Alarm System

All standard equipment and infrastructure required for fire fighting and alarm systems including ring main system, water supply and pumps as necessary for the appropriate level of fire protection as determined by the Contractor.

Workshop, Stores/Warehouses and Laboratory Facilities

- Permanent workshop, including equipment and machines for maintenance, repair and cleaning works required to meet the requirements of the Desalination Plant and the Operator;
- Store/warehouse and equipment for efficient and safe storage and handling of membrane elements, pressure vessels, spare parts, chemicals, and consumables, all to the requirements of the Desalination Plant and the Operator; and
- Laboratory with equipment and instruments for analysis of seawater, seawater concentrate, permeate, drinking water, chemicals and wastewater, and for quality monitoring and control, including all testing facilities for support of the Plant operation, all to the requirements of the Desalination Plant and the Operator.

Cranes, Lifting Equipment and Maintenance Facilities

- Overhead travelling cranes for heavy equipment;
- Mobile and/or other cranes or monorails and hoists as required for maintenance, cleaning and repair work of the Desalination Plant;
- Access stairs, platforms and landings to facilitate operation and maintenance of the Desalination Plant; and
- Emergency egress as required from buildings and plant areas.

Safety and Security Systems

The Plant will be designated as critical infrastructure, and the Contractor must design, supply, install and commission a security system in accordance with Sydney Water's standards for such an installation, as detailed in the appropriate section of the BDCO. Such system must include specific requirements for fencing, access control, lighting, CCTV surveillance and monitoring, alarm systems etc.

In addition, the Contractor must provide weldmesh panel fencing in accordance with the Company's requirements around the unused portion of the Site (excluding the Conservation Area), and around the Plant proper. The Contractor must provide for vehicular access to this area from Sir Joseph Banks Drive, with a padlocked weldmesh panel gate at the vehicle entry/exit point.

Sydney Water is constructing a permanent weld mesh panel fence along boundary between the Conservation Area and the construction site. Fencing to be provided by the Contractor must tie in with this fence. Near the northern Site boundary the Conservation Area boundary passes through an existing detention basin – where this basin is to be retained the Contractor must form a new embankment and extend the existing outlet as required, and must relocate the fence constructed by Sydney Water to follow the Conservation Area boundary.

In addition, the Plant must be equipped with appropriate levels of:

- Safety showers and eye wash facilities;
- Self Contained Breathing Apparatus equipment;
- Flotation devices; and
- All other equipment required for the safe operation of the Plant.

HVAC

Ventilation and air conditioning systems for all buildings of the Desalination Plant, as required by the detailed design.

Spare Parts, Special Tools and Consumables

All spare parts and special tools for commissioning, and all chemicals, reagents and other consumables required up to Completion must be provided.

Furthermore, all recommended spare parts and consumables for the commissioning phase shall be included in the Scope of Work.

Operation and Maintenance obligations

The Contractor must prepare Operation and Maintenance Manuals in accordance with the requirements of the document and to the satisfaction of the Independent Verifier, the Operator and the Company, and must collaborate with the Operator to provide assistance in the preparation by the Operator of the Operations Management Plan for the Desalination Plant.

The Contractor must procure the equipment warranties required by the document from the equipment vendors and subcontractors and must ensure such warranties are in favour of both the Company and the Operator.

1.3 Interfaces and Battery Limits

(a) Limits of Contract

Table 1.1 below set out the physical limits of Contract:

Table 1.1 Terminal Points

Description		Location
1.a	Drinking water delivery system	Connection of drinking water tank outlet pipes to drinking water pump station suction header pipe. See also Section 1.3 (b)
1.b	Drinking water purge system	Connection of purge line to energy dissipation system on the Plant side of the energy dissipation system. See also Section 1.3 (b)
2.a	Power supply 132 kV	Connection to point-of-supply at energy authority's sub-station.
2.b	33 kV (back-up)	Connection to point-of-supply at energy authority's sub-station.
3.	Sewerage	To connect to Sydney Water's existing sewerage system.
4.	SCADA	All signals to be transmitted by SCADA to, and received from, Sydney Water's IICATS System to terminate at the RTU I/O rack. See also Section 1.3 (b) As a minimum, the Contractor must provide for and integrate into the plant SCADA system 400 I/O points (300 digital and 100 analogue) from the drinking water pump station.
5.	Telecommunications	The incoming terminal strip. The telecommunication's supplier will lay cable within the Site up to the terminal strip.
6.	Seawater intake	Seawater must be drawn from the ocean at the location determined by the Contractor based on the design and environmental criteria, the Project Approval and the Company's Requirements.
7.	Seawater concentrate discharge	Seawater concentrate must be discharged back to the ocean at the location determined by the Contractor based on the design and environmental criteria, the Project Approval and the Company's Requirements.
8.	Industrial and potable water	To connect to Sydney Water's drinking water reticulation system.
9.	Firewater	To connect to Sydney Water's drinking water reticulation system.
10.	Stormwater	Terminal point to comply with Planning Approvals.

It will be the Contractor's responsibility to ensure that all connections between existing facilities and the Works are compatible.

(b) Interface Issues and Requirements

In addition to the limits of contract/battery limits detailed above, the Contractor should note the requirements of the interface between the document and the contract for the design and construction of the drinking water delivery system and drinking water pumping station (the Alliance

Agreement and, similarly, the Alliance Participants). Table 1.2 details the specific interface issues and requirements. It will be the responsibility of the Contractor to liaise with, coordinate its design and construction with and cooperate with the Alliance Participants in relation to these interfaces. A similar obligation will be placed on the Alliance Participants in respect of its dealings with the Contractor in relation to these issues.

The locations of the physical interfaces between the Plant and the Delivery Infrastructure are shown generally in drawing WTW0155 / G0705-1. It will be the Contractor's responsibility, in consultation with the Company and the Alliance Participants, to optimise all aspects of the interfaces between the Plant and the Distribution Infrastructure to ensure that their relationship is seamless and promotes ease of operation.

The Contractor must develop an Interface Management Plan to document the processes to be used to manage the various interfaces, both engineering and environmental in nature, associated with design construction and operation of the Plant.

Table 1.2 Interface Areas and Issues

Item	Interface Area	Interface Issue
1	Drinking water purge line	Pressure reduction device and settings
2	Drinking water storage tank(s)	• NPSH(available) to drinking water pump station (DWPS). • Details and location of connection points from DWPS to outlets from drinking water storage tank(s).
3	SCADA interface	• Integration of pumping station control system into plant SCADA system and relaying DWPS control and status signals including metering of power usage and incorporation in the functional specification for the SCADA system, including performance requirements and consistency of human-machine interface functions and "look and feel". • Setting design requirements for the DWPS to form part of a common site-wide SCADA architecture. • SCADA functionality and information transfer requirements for the DWPS. • Attendance by the Contractor and the Alliance Participants at all FAT's, Site tests and during SCADA commissioning as required.
4	Power supply	• Requirements for 11kV supply and fault rating for the DWPS, including metering and switching. • Coordination of earthing requirements of the DWPS substation with the site-wide earthing requirements set by the Contractor.
5	Security	Liaison to establish the design and installation requirements for building and area security systems and fences and allow for installation and integration of all security system by the Contractor into the Works.
6	Building design	Selection of building facades and finishes consistent with Plant finishes.
7	Services	Development of needs requirements for building services (fire service, potable water, compressed air, sewerage).

Item	Interface Area	Interface Issue
8	Roads	Design and construction of DWPS roads to requirements of plant-wide integrated road network.
9	Construction	Liaison, coordination and cooperation with Sydney Water's alliance participants in relation to the construction and commissioning of the Plant and the DWPS and the drinking water delivery system. In this regard, the Contractor will be responsible for managing these and all interfaces.

(c) Construction Power Supplies

Details of the free issue electrical equipment to be supplied to the Contractor, and the Contractor's resulting scope of work, are as follows and as detailed on Drawing WTW155-E0018 Rev B:

- 11kV 1MVA switchgear located within an outdoor weatherproof enclosure, on Site next to the existing Site entrance on Sir Joseph Banks Drive, energised and ready for the Contractor to connect to for its own on Site reticulation as necessary for construction purposes. Energisation will only occur following connection of the Contractor's reticulation to the supply and endorsement of the Contractor's HV Safety Plan by the supply authority;
- Approximately 1.4 km of 33kV cable, to be laid by the Contractor from the EnergyAustralia substation located on Captain Cook Drive to the 33kV Site switchyard adjacent to the existing Site entrance off Sir Joseph Banks Drive;
- One reconditioned 10 MVA 33/11kV transformer, to be supplied only, free on truck on Site, to be installed, tested and commissioned by the Contractor;
- One new 12.5MVA 33/11kV transformer, to be delivered and pre-commissioned on Site by the Company's agent, in a position to be nominated by the Contractor within the 33/11kV switchyard. Note this transformer may arrive on Site after the installation and commissioning of the reconditioned 33kV transformer. Details of this item can be found in the SWC document entitled "Specification for Desalination Plant Power Transformer, January 2007" contained in the set of Project Information;
- Associated CTs and VTs for the 33/11 kV transformer supply, to be installed by the Contractor. Details of the VTs can be found in the SWC document entitled "Specification for Desal (5.1) DWP1 – Power Supply, Desalination Plant Main Substation (DWP1) Electrical Equipment, February 2007'. Details of the CTs can be found in the SWC document entitled "Specification for Early Site Works – 33kV Construction Power Supply, 33kV Post Type Current Transformers, March 2007". Both of these documents are contained in the set of Project Information; and
- 11kV switchgear, inclusive of supply metering equipment, for the 33kV 12MVA supply, to be installed by the Contractor.

The 1MVA 11kV construction supply will be brought along Sir Joseph Banks Drive by EnergyAustralia and terminated at the outdoor enclosure located on Site next to the Site entrance off Sir Joseph Banks Drive. The battery limit for the 1MVA 11kV supply will be the outgoing terminals on the supplied 11kV switchboard (i.e. EnergyAustralia will own and maintain the 11kV cable from their substation to the Site, and the switchboard up to the outgoing terminals). The Contractor shall be responsible for the supply and installation of the 11kV meter.

The Contractor should note that the Company will de-energise the 11kV 1MVA supply and the associated outdoor enclosure after the Contractor has commissioned the 33/11kV supply.

The battery limit for the 12MVA 33kV supply will be a connection point at the EnergyAustralia substation located on Captain Cook Drive (i.e. the 33kV cable from the EnergyAustralia substation to the Site and all equipment downstream will become part of the Plant). The Contractor shall be responsible for the operation and maintenance of the 33kV supply from the point of connection at the energy authority's sub-station.

Once the new 33/11kV transformer has been installed and commissioned, the Contractor must isolate the incoming 33kV supply from the reconditioned unit so that the new unit becomes the duty transformer. The reconditioned unit must remain de-energised, but connected, as a standby, and shall be brought on line by the Contractor in the event of a fault with the new unit. The Contractor shall be responsible for rectification of any faults with the new unit during its service.

Fault levels for the 33kV supply are as follows:

	3ph MVA	**1ph-e MVA**	**2ph-e MVA**
Kurnell STS 33kV 2006	632	612	561
Kurnell STS 33kV 2011	794	838	818

The SWC document entitled "Specification for Desal (5.1) DWP1 – Power Supply, Desalination Plant Main Substation (DWP1) Electrical Equipment, February 2007' contains further information on Energy Australia's protection requirements. The Contractor should note the information in this document related to the 132kV supply is provided for information only. The design and construction of the 132kV supply remains the responsibility of the Contractor.

All construction and permanent power supplies will be metered inside the Site boundary.

(d) Other Works by Sydney Water

In addition to the other works proposed to be carried out by Sydney Water and specifically identified previously in this document, Sydney Water will carry out the following preliminary works at no charge to the Contractor:

- Construction of a weldmesh panel fence to separate the construction zone from the Conservation Area. The fence will extend from the northern Site boundary to the southern Site boundary. Near the northern Site boundary the Conservation Area boundary passes through an existing detention basin – the fence will be erected along the top of the existing embankment of this detention basin but on the Conservation Area side of the embankment to allow the Contractor to have access to the top of the embankment during the construction period;
- Removal of approximately 36 car bodies from the Site;
- Relocation of the existing Serenity Cove sewer that currently traverses the Site. The sewer will be relocated to the bushfire protection zone along the west, south and east of the Site.
- Additional geotechnical investigation comprising:
  - 1 No. on-shore bore hole in the vicinity of the Intake shaft;
  - 1 No. on-shore bore hole in the vicinity of the Intake tunnel TBM launch chamber;
  - 1 No. on-shore bore hole on the Intake tunnel alignment, approximately 300m east of the intake shaft;
  - 2 No. on-shore bore holes in the Botany Bay National Park, on the alignment of the Intake tunnel, approximately 150m and 300m respectively inland from the coast line;

- 3 No. on-shore bore holes in the Botany Bay National Park, on the alignment of the Outlet tunnel, all approximately 50m inland from the coast line, two angled northwards to intersect the adjacent dyke, and the other vertical;
- 1 No. on-shore inclined bore hole in the vicinity of the North-West corner of the Site.

- Acid Sulphate Soils (ASS) testing, involving sampling at 35 locations across the Site (refer to Desalination Plant Site ASS Testing Program for details provided with the Project Information).

All boreholes and cores will be subject to packer testing, point load index, UCS, Poissons Ratio and abrasion testing/measurement. The borehole on the alignment of the Intake tunnel approximately 150m inland from the coast line and the vertical borehole on the alignment of the Outlet tunnel will also be subject to Hydrofracture in-situ stress measurement (subject to contractor availability). Both boreholes on the alignment of the Intake tunnel and one of the inclined boreholes on the alignment of the Outlet tunnel will also be subject to televiewer imaging.

2 Volume

TS 01A

Design and construct contract:
Schedule 14 company's requirements

SYDNEY'S DESALINATION PROJECT

TS-01A Scope of Work – D&C Contract – Separable Portion 2

TS-01A Scope of Work

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1 Scope of Work

1.1 General

This document describes the scope of the work to be provided by the Contractor for Separable Portion 2 to augment the capacity of the 125 ML/day Plant to a total capacity of 250 ML/day. The augmented Plant must be sized for the average production of 250 ML/day of Drinking Water, capable of being upgraded at short notice to produce 500 ML/day of Drinking Water.

Notwithstanding the broad capacity descriptions above, several elements of the augmented Project must have capacities greater than 250 ML/day, as detailed elsewhere in the Company's Requirements.

1.2 Scope of Work during the Design and Construction Phase

The Scope of Work of Separable Portion 2 includes all works detailed in TS-01 Scope of Work that are applicable to Separable Portion 2.

The augmentation works must include:

- Any reconfiguration of the intake risers, velocity caps and coarse screens that is required for the seawater intake system to operate effectively and sustainably, meeting the performance requirements of the augmented Plant;
- Any reconfiguration of the outlet risers and diffusers that is required for the seawater concentrate outlet system to operate effectively and sustainably, meeting the performance requirements of the augmented Plant; and
- All other temporary and permanent works that are required to augment the capacity of the 125 ML/day Plant to a total capacity of 250 ML/day.

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TS 02

Design and construct contract:
Schedule 14 company's requirements

TS 02

SYDNEY'S DESALINATION PROJECT

TS-02 Technical Requirements – D&C Contract – Separable Portion 1

TS-02 Technical Requirements

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1. Performance Requirements

1.1 Purpose of the Project

The purpose of the Project is to extract seawater and produce Drinking Water using treatment processes which include reverse osmosis, in accordance with the Company's Requirements, to help secure Sydney's drinking water supply.

1.2 Performance Criteria

The mandatory performance criteria with which the Plant must comply are detailed herein. The achievement or otherwise of these performance criteria will be determined by the processes described in the document.

The following sections detail the specific performance requirements in respect of each of the following:

- Drinking Water quality;
- Drinking Water production rate;
- Specific Energy Consumption;
- Compliance with the Planning Approval; and
- Compliance with Licence conditions.

In addition, the Contractor must provide performance warranties in respect of reduced capacity, chemical consumption and membrane lifetime, as set out in the Works Warranties Schedule.

In doing so, the Contractor must obtain input from the Operator and must receive the Operator's endorsement of the performance warranties described above.

1.3 Drinking Water Quality

The Plant must provide Drinking Water in accordance with the Drinking Water Specifications as specified in Table 1.1. For parameters not listed, the quality must comply with the Australian Drinking Water Guidelines (2004).

The Drinking Water Specifications must be met when the seawater quality remains equal to or within the warranted range of seawater quality nominated in the Works Warranties Schedule. In this regard, the seawater quality data on which the Contractor has developed its design may be based on the results acquired in its seawater assessment or from the pilot plant trials conducted by Sydney Water. The data must include safety margins for certain seawater parameters (e.g. suspended solids content, oil/ hydrocarbons, salinity) that the Contractor considers necessary for reliable operation of the Plant and achievement of the warranted Plant output of Drinking Water.

Table 1.1 Drinking Water Specifications

Sydney Desalination Plant			
Drinking Water Quality (ex Drinking Water Storage Tank)	**Unit**	**Target Values (95 %ile)**	**Warranted Values (100 %ile)**
Turbidity	NTU	<0.3	max. 0.5
True colour	TCU	< 5	max. 10
pH (maximum deviation from setpoint, initial setpoint value 7.8)	-	±0.3 of the setpoint	min. 7.3; max. 8.3
TDS	mg/L	< 115	max. 140
Chloride	mg/L	< 35	max. 45
Boron	mg/L	<1.0	max. 2.0
Bromide	mg/L	< 0.10	max. 0.10
Chlorine (maximum deviation from setpoint, initial setpoint value 0.7)	mg/L	±0.25 of the setpoint	±0.25 of a setpoint value between 0.25 and 1.5
Fluoride	mg/L	0.9 - 1.0	min. 0.6; max. 1.0
Iron	mg/L	<0.2	≤0.2
Chlorine : Ammonia (maximum deviation from target, initial value 3:1)		Within ±0.3 of a target	Within ±0.3 of a target value between 2:1 and 8:1
Taste and Odour		Not objectionable to Taste & Odour panel	Not objectionable
Total Coliforms	/100mL	0	0
E. Coli	/100mL	0	0
$(Cl + 2\ SO_4)/HCO_3$	mmol/ mmol	< 1	< 1.5
Alkalinity (as $CaCO_3$)	mg/L	>40	min. 35; max. 50
Calcium carbonate precipitation potential (CCPP) (as $CaCO_3$)	mg/L	- 3 to - 6	min. -8; max. –1

All other parameters must comply with the health values of the Australian Drinking Water Guidelines (2004).

Target values must be met at least 95 % of the time.

Warranted values must not be exceeded (Reference document see Australian Drinking Water Guidelines, chapter 9 and 10, Information sheets 3.1 to 3.4).

1.4 Drinking Water Production Rate

The Plant must be capable of delivering 45.6 GL of Drinking Water per 12-month period into Sydney Water's system, taking into account all outages and downtime, both planned and unplanned. This is equivalent to an Average Daily Output of 125 ML.

To meet the annual output requirements of the Plant, surplus capacity must be provided in the Plant design to compensate for the periods of non-availability, including planned outages and unplanned outages. To cater for periods of non-availability, the Plant must be capable of providing a Minimum Daily Output in excess of the Average Daily Output of 125 ML of Drinking Water into Sydney Water's drinking water distribution system. The Minimum Daily Output must be capable of being achieved under the warranted seawater quality conditions set out in the Works Warranties Schedule, maximum average membrane age and while at least one membrane train is offline for cleaning. In determining the Minimum Daily Output, the Contractor must not consider an availability greater than 94%.

In addition, the Plant must have additional capacity above the warranted Minimum Daily Output to allow for all internal consumption needs, including potabilisation requirements and site services water.

The Plant must include adequate redundancy measures to ensure that the Company's Requirements are met. The Contractor with the collaboration of the Operator must also propose reasonable redundancy measures for forced outage events, such as sufficient stand-by capacity and/or adequate storage capacities for Drinking Water.

1.5 Energy Consumption

In order to minimise greenhouse gas emissions, and also to provide an energy efficient Plant, the Specific Energy Consumption of the Plant, but excluding drinking water pumping, must be less than 4.2 kWh/m^3 of Drinking Water produced under the warranted Minimum Daily Output operating condition.

The warranted Specific[1] Energy Consumption of the Plant must be based on the seawater conditions of minimum temperature and maximum total dissolved solids (TDS) content values and the maximum average membrane lifetime (AMLT) in 1st and 2nd pass, on which the RO plant design is based.

The Specific Energy Consumption must include all energy used from the seawater intake through to the drinking water storage tanks, excluding the drinking water pumping station. Energy consumed in seawater concentrate disposal and other waste disposal must also be included. All non-process related equipment such as lighting and HVAC, building, laboratories and workshops power requirements must also be included in this calculation.

1.6 Planning Approval

The Contractor must comply with and must cause the Plant to comply with all aspects of the Planning Approval, and the Statement of Commitments (SoC) in accordance with the D&C Contract.

1.7 Licence Conditions

The Contractor must comply with the requirements of all Law including compliance with all conditions of approvals, licences, permits and concurrences required for the Plant.

[1] Energy consumption per unit of drinking water produced

1.8 Performance Warranties

The Contractor warrants that the Plant will achieve the levels of warranted performance set out in the Works Warranties Schedule.

1.9 Safety

The Contractor must ensure no harm in delivery of the Plant.

2. Functional Requirements

The requirements in this section are considered to be mandatory and must be incorporated into the design, construction and operation of the Plant. These items are in addition to the design and performance requirements stipulated herein.

2.1 General Requirements

- The Plant must be fully operational within the production range specified herein. The Plant must be operationally stable within this operational range, under changes in seawater conditions and drinking water demand. Plant Operational Capacity:
  - For the 125 ML/day capacity plant: 25% - 100% of Minimum Daily Output;
  - For the 500 ML/day capacity plant: 25% - 100% of Minimum Daily Output;
- All building floor levels and electrical switchgear must be sited above the site 1:100 year ARI flood level;
- Chemical storages provided must be sized to provide 28 days storage for the 125 ML/d capacity Plant or 14 days storage for the 500 ML/d capacity Plant. However, for fluorosilicic acid, the storage capacity is to be provided is twelve weeks storage for a 125 ML/day Plant and six weeks storage for a 500 ML/d Plant;
- Cathodic corrosion protection systems must be provided for all equipment and metal components which are in normal contact with the seawater, unless it can be demonstrated that the materials selected result in an equivalent level of protection in the proposed application;
- The Plant processes must be automated and suitable for remote monitoring and control to allow cost effective and reliable operation;
- The physical appearance must be aesthetically pleasing. To this end the design must incorporate architectural design of the building forms, facades and colours;
- All equipment selected and incorporated into the Works must have demonstrable and proven successful experience in operation in applications similar to that required of it for the Project. The Company may reject equipment proposed where successful experience in operation cannot be demonstrated.

2.2 Intake System

- The seawater intake and supply system must extract seawater from within the zone specified in drawing WTW0155 / G0030 and convey screened seawater to the pre-treatment system;
- The velocity of seawater drawn into the Plant, measured at the face of the intake facilities sited in the ocean, must not exceed 0.10m/s;
- The intake structures must be configured to promote horizontal in-flow into the structures by means of a velocity cap to minimise entrapment of marine organisms;
- The seawater intake system must be sized for the 500 ML/day Plant, but must be able to operate effectively and sustainably, meeting the performance requirements, for the 125 ML/day Plant;
- The intake system must have an integrated means of varying the intake capacity between that required for the 125 ML/day and the 500 ML/day Plant;
- The intake tunnel and intake shaft must be lined with an impervious liner. For the purpose of this requirement impervious means having inundation/leakage of less than 0.25 L/m^2/day for the face area of the land shaft, less than 300L/100m/day for the section of the tunnel beneath land

that is above High Astronomical Tide level, or less than 1000L/100m/day for the remainder of the tunnel. No drainage system is to be provided associated with groundwater control behind the shaft or tunnel liner;

- A chlorination system must be provided to shock chlorinate to each seawater intake structure provided and to the seawater pump station. Excess and residual chlorine levels must be measured and controlled with on-line monitoring equipment;
- The intake system must incorporate a seawater sampling point upstream of the seawater pumps and screening system to allow characterisation of the type and number of any marine organisms inadvertently brought in with the incoming seawater flow;
- The intake system must incorporate, where the Contractor's investigation shows it to be feasible and effective, ancillary measures to minimise the degree of entrapment of marine organisms in the Plant.

2.3 Seawater Screening and Pump Station System

- Screening System capacity to be provided:
  - Building/Civil/Structural Works – 125 ML/day Plant capacity including connection from intake shaft with in built facility to be expanded to that required for a 500ML/day Plant without interrupting operation of any existing Plant;
  - Mechanical/Electrical Works - 125 ML/day Plant capacity including standby and bypass capacity;
- Pump Station System capacity to be provided:
  - Building/Civil/Structural Works - 500 ML/day Plant capacity including connection from intake shaft;
  - Mechanical/Electrical Works - 125 ML/day Plant capacity including standby and bypass capacity;
- A seawater bypass facility must be provided from the seawater pump station to the seawater concentrate outlet system. The minimum capacity to be provided for the bypass must be 340 ML/day. The bypass system is required for the following purposes:

  a. Draining the drinking water storage tanks

  b. Draining or purging the bay pipeline

  c. Diverting product water that is outside of specifications
- The seawater screening system provided must be reliable and able to be safely operated and maintained under all weather conditions.

2.4 Pre-treatment System

- The pre-treatment system must be able to provide a filtered seawater feed to the RO membranes of a quality and composition that fully complies with the membrane manufacturer's guidelines (e.g. Silt Density Index (SDI), turbidity, residual chlorine, and organics) and which minimises organic and biological fouling of the Plant;
- The system must be capable of delivering the required rate of flow, uninterrupted during backwash operations, necessary for plant operations throughout the entire year, over the lifetime of the Plant;
- The pre-treatment process must include a minimum of single stage filtration. If a single stage of filtration is proposed, provision (space and hydraulic allowance, connectivity etc.) must be made to allow the addition of a second stage of filtration in the future;

- The pre-treatment process must provide filtered seawater to the RO feed, with an SDI_{15} of 3 or less 95% of the time, and with an SDI_{15} of 4 or less 100% of the time;
- Each filter under continual operation (i.e. between backwashes), must maintain a filtered water SDI_{15} of 3 or less 95% of the time, and 4 or less 100% of the time, for at least 24 hours under the warranted seawater conditions;
- As a minimum requirement, the pre-treatment process must include contact filtration with coagulation. However, provision must be made (space and hydraulic allowance /connectivity etc.) to be able to add flocculation if required in the future;
- The pre-treatment filters must be protected against sunlight-induced biological growth in the filters without impeding access for normal observation during operation;
- Provision must be made to allow the bypass or removal of the backwash wastewater treatment facility in case the Company is permitted to discharge the pre-treatment backwash wastewater to the ocean.

2.5 RO System

- The process must be a 2-pass reverse osmosis system with 100% of the flow treated by the second pass.

2.6 Potabilisation System

- The potabilisation system provided must be configured to provide 2 identical 250ML/day capacity lines between the permeate tanks and the drinking water storage tanks for the 500ML/day capacity plant. Each line must be capable of operating at a capacity of up to 375ML/day of the warranted output from a 500ML/day Plant, with increased headlosses, to cater for emergencies or maintenance/shutdown of the other line. Operation of the system at 375ML/day capacity may be achieved by utilising dosing equipment from both potabilisation lines;
- One line must be provided for the 125ML/day Plant with piping works required for the 250ML/day capacity of that line, and with all other works installed suitable to produce the Minimum Daily Output of water from the 125ML/day Plant. Suitable provision must also be made on this line so that it can be operated accurately and reliably down to 25% of this plant's Minimum Daily Output. Civil/structural works provided for the 125ML/day Plant must be arranged to allow for an integrated layout in the 500ML/day Plant to provide an efficient arrangement for operation of the plant.

2.7 Outlet System

- The seawater concentrate outlet system must terminate at a set of diffusers, designed to promote rapid dispersion of the concentrate with the surrounding seawater;
- Diffusers must be provided as part of the seawater concentrate outlet system to provide a 30-fold dilution of the concentrate before the end of the near field. This degree of dilution is derived from the proposition that the Plant will produce a concentrate of 65 ppt, which must then be diluted down at the end of the near field to 36 ppt, which is within the background level of natural variation (ie +/-1ppt). The outer edge of the near field will be considered to be the point at which the falling trajectory of the seawater concentrate plume intersects the ocean bed. The arrangement and number of individual diffuser jets, or 'nozzles', must limit the size of the combined near field from all diffuser nozzles to an area consistent with that indicated in the Environmental Assessment and the Preferred Project Report (PPR). The concentrate diffuser nozzles must jet the concentrate upward at an angle to the horizontal to promote mixing. The

maximum height to which the resulting seawater concentrate plume rises must be no more than 2m from the ocean surface;

- Visible tracer testing must be undertaken to confirm the performance of the system;
- The seawater concentrate outlet tunnel, risers and riser caps must be sized for the 500 ML/day Plant. The seawater concentrate diffusers may be initially installed suitable for the 250 ML/day Plant, with the design and construction of the riser caps allowing for the upgrade of these structures through the addition of manifolds when the Plant is upgraded to 500 ML/day capacity. A prerequisite of this staged arrangement will be proof that the concept meets the technical requirements above by physical modelling of the diffusion system for the 500 ML/day Plant where the final system arrangement departs from or may give rise to performance that differs from that indicated in the Environmental Assessment, the PPR or reflected in the physical modelling conducted by Sydney Water. The seawater concentrate outlet system must be able to operate effectively and sustainably, meeting the performance requirements, for the 125 ML/day Plant;
- The outlet system must have an integrated means of varying the outlet capacity between that required for the warranted capacity of a 125 ML/day and 500 ML/day Plant;
- The outlet zone must be located in the zone specified in drawing WTW0155 / G0030;
- The outlet tunnel and shaft must be lined with an impervious liner. For the purpose of this requirement impervious means having inundation/leakage of less than 0.25 L/m^2/day for the face area of the land shaft, less than 300L/100m/day for the section of the tunnel beneath land that is above High Astronomical Tide level, or less than 1000L/100m/day for the remainder of the tunnel. No drainage system is to be provided associated with groundwater control behind the shaft or tunnel liner;
- All Plant wastewaters discharged to the concentrate outlet system for disposal must be treated on Site by a wastewater treatment system prior so that discharges meet the Planning Approval, and all other project requirements specified.

2.8 Drinking Water Storage System

- One drinking water storage tank must be provided with an active capacity of 40 ML for the 125 ML/day Plant, plus any additional volume the Contractor considers necessary to compensate for the requirements of a 250ML/day plant, both normal and resulting from an extended shut down. Allowance must be made for a second tank of equal capacity to be provided with any augmentation of the Plant to 500 ML/day.

3. Design Requirements

3.1 Design Conditions

3.1.1 Seawater Temperature and Quality

The seawater conditions data provided by Sydney Water were obtained from the raw seawater quality experienced during the period of the monitoring program. The Plant will be required to treat a wider range of raw seawater quality than that encountered during the monitoring program. Possible sources of adverse raw seawater quality such as storm events, algal blooms and water pollution were not encountered during the program and need to be allowed for in the design of the Plant. The Contractor must assess the data and reach its own conclusions as to the results of the monitoring program and the impact on the Plant design. The Contractor must also obtain the Operator's endorsement of the design as being suitable for meeting the Company's Requirements.

The Contractor must design the Plant as a minimum to meet all process performance and functional requirements, warranties and guarantees where the source seawater is of a quality within or equal to the minimum warranted range of seawater conditions nominated in Table 3.1.

Table 3.1 Seawater Design Analysis

Water Quality Parameter	Dimension	Measured Range	Minimum Warranted Range and Values
pH	-	8.20 – 8.66	7.50 – 8.70
Temperature	°C	15.3 – 25.0	15.0 – 25.0
Total dissolved solids	mg/L	32,903 – 39,272	32,000 – 41,000
Total suspended solids	mg/L	2.0 – 6.0	≤ 7.0
Conductivity	ms/cm	43.6 – 49.0	no limit
Turbidity	NTU	0.2– 4.0	≤ 9.0
Alkalinity	mg $CaCO_3$/L	117 – 129	no limit
Hardness	mg $CaCO_3$/L	6,550 – 7,000	no limit
Bicarbonate	mg/ HCO_3/L	106 - 132	≤ 160
Carbonate	mg/CO_3/L	10 - 22	no limit
Ammonia	µgN/L	10 - 20	no limit
Sodium	mg/L	9,920 – 12,000	no limit
Potassium	mg/L	350 – 600	no limit
Barium	mg/L	0.002 – 0.007	≤ 0.01
Boron	mg/L	3.4 – 5.8	≤ 6.5
Strontium	mg/L	6.6 – 9.7	≤ 12.0
Calcium	mg/L	350 – 510	≤ 600

Water Quality Parameter	Dimension	Measured Range	Minimum Warranted Range and Values
Magnesium	mg/L	1,100 – 1,500	≤ 1,700
Chloride	mg/L	18,000 – 22,000	no limit
Bromide	mg/L	65 – 76	≤ 80
Sulphate	mg/L	2,300 – 3,584	≤ 3,800
Fluoride	mg/L	0.72 – 1.16	no limit
Silica	$mgSiO_2/L$	0.1 – 0.3	≤ 0.50
Total N	µgN/L	100 – 340	≤ 600
Total P	µg/L	7 – 28	≤ 60
Total Iron	µg/L	5 – 15	≤ 30
Total Aluminium	µg/L	5 –12	≤ 30
Total Organic Carbon (TOC)	mgC/L	0.6 – 3.7	≤ 4.50
Biological oxidation demand (BOD_5)	mg/L	2.0 –11.0	≤ 18.0
Oil and Grease	mg/L	< 5	≤ 6.0
Total hydrocarbons	mg/L	< 0.1	≤ 0.1 [2)]
Total coliforms	cfu/100mL	0 – 4,200 [1)]	≤ 4000
Faecal coliforms	cfu/100mL	0 – 700	≤ 800
Enterococci	cfu/100mL	0 – 95	≤ 100
E. coli	cfu/100mL	0 – 700	≤ 700

1) 4200 result only measured on one day.

2) In the event that total hydrocarbons are detected in raw seawater at > 0.1 mg/L, the Contractor must adequately demonstrate that the hydrocarbons originated from the raw seawater and were not due to contamination from the Contractor's area of responsibility such as infiltration to the intake tunnel or site contamination. This must be done by offshore sampling at the intake location and depth, with sample collection and testing undertaken by an independent organisation.

3.2 Design Criteria

3.2.1 General

This section defines the minimum criteria for design of the Plant.

The Contractor is responsible for the configuration and optimisation of the Plant. The Contractor must propose the design and configuration that it considers most suitable for achieving or surpassing the Company's Requirements and attaining high efficiency and a reliable supply of Drinking Water at a competitive cost.

The design of the Plant must conform to the following general requirements:

- The Plant must have an Average Daily Output of 125 ML, as further described and defined in Section 1;
- The Contractor must prepare arrangement drawings and concept layouts to indicate how the Plant could be amplified from 125 ML/day, up to the ultimate capacity of 500 ML/day on the Site;
- Staged expansion of the Plant must be able to be undertaken without interruption to the operation of the existing Plant;
- The staging of the Plant must be arranged to provide flexibility for future expansion of the Plant by the Contractor, the Operator or another party. To this end, the layout for a Plant up to 250 ML/day must be arranged to allow the Plant to be expanded quickly and cost effectively by the Contractor, the Operator or another party. Staging arrangements that would unreasonably restrict options for future expansion and associated operation beyond 250 ML/day will not be accepted;
- The design of the Plant must be in full compliance with all environmental and safety standards in force by Sydney Water and in New South Wales including the requirements for double isolation;
- The Plant must be designed for the design lives specified herein;
- The design must be the most cost-effective, based on whole-of-life cost considerations for a 20-year period. The Contractor must carry out a whole-of-life cost analysis for the Plant;
- The Plant must be designed to allow the security of the Plant to be efficiently and effectively maintained;
- The design must address infrastructure requirements for commissioning, such as the provision of additional valves and pipework necessary to allow commissioning to proceed;
- The design of the Plant must consider safety-in-design, operability and maintainability as essential inputs to the design. To this end, the design phase must incorporate the Risk Elimination at Design (RED) process, and the RED must be detailed in the Risk Management Plan. Under the RED system, design studies and workshops such as Operability, HAZOP, CHAZOP, and CHAIR studies, to ensure these matters receive appropriate attention;
- The design phase must also include Failure Mode Effects and Criticality Analysis (FMECA) addressing the processes and equipment. This will then be used for maintenance planning. The Contractor must provide:
  - mean time between failures (MTBF) for each piece of equipment;
  - mean times to repair (MTTR) equipment;
- The design of the Plant must allow for a sea level rise due to global warming no less than that stated in AS 4997-2005;
- The Plant layout must incorporate a 20 metre bushfire Asset Protection Zone within the Site (excluding the Conservation Area). The Asset Protection Zone must be established and maintained as required by Planning for Bushfire Protection (Planning NSW, 2001) for an Inner Protection Area, and must include a perimeter fire trail. In finalising the design the Contractor must consult with the NSW Rural Fire Service.

Regardless of whether a material of manufacture or minimum material requirement is specified, all material selections must be suitable and proven for use in the proposed application.

Structures below ground level such as the seawater pump station must be designed to accommodate hydrostatic uplift forces assuming the water table at ground level when the structure is dewatered.

3.2.2 Design Life

The minimum design life of assets associated with the Plant must be as listed below.

Asset Class	Design Life
Civil assets (tunnels, shafts, buried pipelines, concrete structures and substructures, above and below ground storage tanks)	100 years
Ocean intakes and outlets and diffusers	50 years
Buildings	50 years
Mechanical assets	25 years
Electrical assets	25 years
Instrumentation / control assets	15 years
SCADA assets	10 years
Other specialist equipment	As specified in the Works Warranties Schedule

3.2.3 Durability Report

The Contractor must carry out a durability assessment covering all aspects of the Plant and their operating environment and must prepare a report (Durability Report) that will set out the design basis for all aspects of the Plant, in respect of durability issues.

The Report must, as a minimum, address:

1. All civil, building and mechanical material elements and their respective environmental exposure with a full list to be provided;
2. Potential durability issues for all civil, building and mechanical material elements for macro and micro environmental conditions;
3. Durability related design details and specifications; and
4. Recommendations for durability performance criteria.

The Report must assess the durability aspects of the following materials:

1. Reinforced concrete, steel/synthetic-fibre-reinforced concrete/shotcrete;
2. Metal inserted or embedded in reinforced concrete;
3. Joints and installed sealants in reinforced concrete;
4. Cementitious and other grouts;
5. Rock bolts and ground anchors
6. Waterproof membranes;
7. Structural Steel, including all connecting members and fixings;
8. All exposed and buried metalwork including roof sheeting, supports, fittings, fixings and steel liners;
9. Render/Plaster finishes applied to concrete and other masonry;

10. Paint finishes applied to concrete/cementitious surfaces;
11. Paint and/or protective finishes applied to all structural steel and metalwork,
12. Floor surface finishes;
13. Pipelines and associated supports, joints, internal linings, protective coatings, etc.;
14. Chemical storage tanks, pumps, dosing lines and equipment;
15. All mechanical equipment; and
16. Other generic materials considered deterioration risks that are used in the Works.

The report must give attention to deterioration of elements that cannot be easily accessed for maintenance or repair, and hence consider and report on the durability issues to be covered by the detailed design.

3.2.4 Plant Operational Flexibility

The Plant must have sufficient operational flexibility to cater for variations in seasonal rainfall patterns and dam levels. Possible operational scenarios could be:

- Full capacity operation and then Shutdown for lengthy periods when Sydney's dams are full;
- Continuous part load operation when the dams are approaching full capacity; or
- Running at low production when the dams are full so as to prevent shutting down the Plant.

Shutdown of part of the Plant or of the whole Plant must be possible for extended periods (weeks, months, years). The Plant must also be capable of shorter and more frequent load adaptation based on fluctuating demand.

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TS 02A

SYDNEY'S DESALINATION PROJECT

TS-02A Technical Requirements – D&C Contract – Separable Portion 2

TS-02A Technical Requirements

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1. Performance Requirements

1.1 Introduction

The mandatory performance criteria with which the augmented Plant must comply are detailed herein. The achievement or otherwise of these performance criteria will be determined by the processes described in the document.

1.2 Drinking Water Production Rate

The augmented Plant must be capable of delivering 91.3 GL of Drinking Water per 12-month period into Sydney Water's system, taking into account all outages and downtime, both planned and unplanned. This is equivalent to an Average Daily Output of 250 ML.

To meet the annual output requirements of the augmented Plant, surplus capacity must be provided in the Plant design to compensate for the periods of non-availability, including planned outages and unplanned outages. To cater for periods of non-availability, the augmented Plant must be capable of providing a Minimum Daily Output in excess of the Average Daily Output of 250 ML of Drinking Water into Sydney Water's drinking water distribution system. The Minimum Daily Output must be capable of being achieved under the warranted seawater quality conditions set out in the Works Warranties Schedule, maximum average membrane age and while at least one membrane train is offline for cleaning. In determining the Minimum Daily Output, the Contractor must not consider an availability greater than 94%.

In addition, the augmented Plant must have additional capacity above the warranted Minimum Daily Output to allow for all internal consumption needs, including potabilisation requirements and site services water.

The augmented Plant must include adequate redundancy measures to ensure that the Company's Requirements are met. The Contractor with the collaboration of the Operator must also propose reasonable redundancy measures for forced outage events, such as sufficient stand-by capacity and/or adequate storage capacities for Drinking Water.

1.3 Other Requirements

The augmented Plant must comply with all other performance requirements that are detailed in TS-02 Technical Requirements.

2. Functional Requirements

The requirements in this section are considered to be mandatory and must be incorporated into the design, construction and operation of the augmented Plant. These items are in addition to the design and performance requirements stipulated herein.

2.1 General Requirements

- The augmented Plant must be fully operational within the production range specified herein. The augmented Plant must be operationally stable within this operational range, under changes in seawater conditions and drinking water demand. Plant Operational Capacity:
  - For the 250 ML/day capacity plant: 12.5% - 100% of Minimum Daily Output.

2.2 Intake System

- The seawater intake system must be sized for the 500 ML/day Plant, but must be able to operate effectively and sustainably, meeting the performance requirements, for the 250 ML/day Plant.

2.3 Seawater Screening and Pump Station System

- Screening System capacity to be provided:
  - Building/Civil/Structural Works – 250 ML/day Plant capacity including connection from intake shaft with in built facility to be expanded to that required for a 500 ML/day Plant without interrupting operation of any existing Plant;
  - Mechanical/Electrical Works - 250 ML/day Plant capacity including standby and bypass capacity;
- Pump Station System capacity to be provided:
  - Building/Civil/Structural Works - 500 ML/day Plant capacity including connection from intake shaft;
  - Mechanical/Electrical Works - 250 ML/day Plant capacity including standby and bypass capacity.

2.4 Potabilisation System

- One potabilisation line must be provided for the 250 ML/day Plant with all civil/structural, piping, mechanical and electrical works required for the full capacity of that line. Suitable provision must also be made on this line so that it can be operated accurately and reliably down to 12.5% of the Plant's Minimum Daily Output.

2.5 Outlet System

- The seawater concentrate outlet system must be able to operate effectively and sustainably, meeting the performance requirements, for the 250 ML/day Plant.

2.6 Other Requirements

The augmented Plant must comply with all other functional requirements that are detailed in TS-02 Technical Requirements.

3. Design Requirements

This section defines the minimum criteria for design of the augmented Plant.

The Contractor is responsible for the configuration and optimisation of the augmented Plant. The Contractor must propose the design and configuration that it considers most suitable for achieving or surpassing the Company's Requirements and attaining high efficiency and a reliable supply of Drinking Water at a competitive cost.

The design of the Plant must conform to the following general requirements:

- The augmented Plant must have an Average Daily Output of 250 ML, as further described and defined in Section 1;
- The Contractor must prepare arrangement drawings and concept layouts to indicate how the augmented Plant could be further amplified from 250 ML/day, up to the ultimate capacity of 500 ML/day on the Site;
- The design of the augmented Plant must consider safety-in-design, operability and maintainability as essential inputs to the design. To this end, the design phase must incorporate the Risk Elimination at Design (RED) process, and the RED must be detailed in the Risk Management Plan. Under the RED system, design studies and workshops such as Operability, HAZOP, CHAZOP, and CHAIR studies must be carried out, to ensure these matters receive appropriate attention. Such studies must address the augmented Plant as a whole;
- The Contractor must prepare an updated Durability Report that will set out the design basis for all aspects of the augmentation works, in respect of durability issues;
- The design of the augmented Plant must comply with all other design requirements that are detailed in TS-02 Technical Requirements.

2

Volume

TS 04

Design and construct contract:
Schedule 14 company's requirements

TS 04

SYDNEY'S DESALINATION PROJECT

TS-04 Design Process and Documentation – D&C Contract – Separable Portion 1

TS-04 Design Process and Documentation

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1. Introduction

1.1 General

This section prescribes the design process the Contractor must as a minimum employ in the design of the Plant. It also describes types of documentation the Contractor is required to produce in the design of the Plant.

The documents required for design and construction, commissioning of the Project and the operation and maintenance of the Plant must be prepared/finalised and provided in a timely manner so as to permit the Project to be constructed and commissioned in accordance with the Project timetable.

1.2 Design Reviews

The Contractor must develop the Tender Design into a Concept Design and then a final detail design. During this process documentation must be progressively submitted to the Company for review in accordance with the document.

1.3 Documentation Approval Practice

The design and drawings will not be checked by the Company. The documents may be reviewed and comments provided to the Contractor, who will be responsible for addressing the issues raised to comply with the Company's Requirements, Project Approval and all Authorities requirements. The Company will either not reject, or reject the Contractor's designs and documentation and provide comment as to the reasons for rejection. It remains the Contractor's responsibility in accordance with the D&C Contract to ensure the design is correct and efficient. No acceptance or approval of these documents by the Company affects the Contractor's warranties or obligations under the document.

Resubmitted documents must be submitted showing tracked changes from the previous submissions. Drawings, where resubmitted, must have amendments clouded.

1.4 Other Documentation

In addition to the design documentation, the Contractor may be required by the D&C Contract to prepare other plans, schedules, manuals and documentation to meet the requirements of the D&C Contract. These must be prepared, submitted for review and finalised as specified elsewhere in the D&C Contract.

1.5 Requirements for Project Initiation Workshop

The Contractor must convene a Project Initiation Workshop within 28 days of the execution of the D&C Contract.

The Contractor must propose an agenda for the Project Initiation Workshop to the Company which must include:

- Introduction of staff from the Contractor and the Company (and their respective subcontractors and consultants);
- Outline by the Contractor of key issues and risks in the execution of the Works, including:
  - Timing;

- Procurement of equipment;
- Major risks;
- Environmental measures;
- Safety management;
- Handover to Operator;

- Interface with the Operator;
- Role of and interface with the Independent Verifier.

The Project Initiation Workshop will be conducted so as to promote co-operation between the parties for the management of the Contract, with the objective of achieving successful project outcomes.

Each participant in the workshop will meet their own costs for attendance and the Contractor will meet the other costs. The Contractor will be responsible for organising the facilitation of the workshop and the venue for conducting the workshop.

The workshop should take up to two days, however, the final format and duration will be agreed between the Contractor and the Company.

Participants

The Contractor must propose a list of participants which may include, in addition to the Contractor's representatives, representatives of Authorities, utilities and Subcontractors (including consultants and suppliers).

Up to 15 participants from the Company will attend the workshop.

2. Design Process

2.1 Design Documentation and Sequencing

The Contractor's design must include the following:

- Design Management Plan;
- Design inputs report;
- Concept Design Report;
- CHAIR, HAZOP, CHAZOP and RED reports;
- FMECA Report;
- Durability Plan;
- Detailed design drawings, and related design documentation;
- Mechanical Equipment, Drives, Valve and Penstock Schedules
- Instrumentation Schedule;
- Design documentation for Electrical works;
- Design documentation for automation, SCADA, and IICATS works; and
- Testing and Commissioning Plan.

The Contractor may decide the sequence of submission of the design documentation, within the following constraints:

(a) The Contractor must submit the Final Draft Concept Design Report prior to commencing detailed design documentation;

(b) The Contractor must complete the detailed design documentation for a particular work package, except for PLC/SCADA programming activities, before commencing construction activities for the same work package.

(c) The Concept Design Report must be submitted in accordance with Section 2.5 below;

(d) No Design Documentation will be submitted during the 10 Business Day period following submission of the Concept Design Report.

2.2 Design Management Plan

The Contractor must prepare and submit a Design Management Plan, which must include documented procedures that describe the management of the design activities, in accordance with Schedule 6 to the D&C Contract, and the establishment of work packages.

2.3 Design Inputs Report

The Contractor must submit a design inputs report (DIR), (refer Documentation Requirements) which describes all inputs and design criteria that will be used as the basis for the design of the Works to be constructed under the document.

The Contractor must submit the DIR in the following stages:

- Draft DIR; and
- Final DIR.

Each review of the Design inputs report must include a presentation involving the designers for the design package under review. The Contractor must prepare minutes of the presentations.

It must be configured by the inclusion of tables, checklists and/or flowcharts to easily and readily allow verification of the final design against all project requirements.

The design inputs report must become the first section of the Concept Design Report (CDR), and must be completed and submitted for review prior to any significant design work commencing.

The draft DIR must be submitted with the draft Concept Design Report.

2.4 Procurement Documentation for Long Lead Items

The Contractor must develop documentation for the procurement of long lead items, including high pressure pumps, energy recovery devices, membranes, pressure vessels, high pressure piping and valves and tunnel boring machines, along with any additional items that the Contractor determines to be long lead items.

2.4.1 Procurement Documentation

Time of Submission

Within 5 Business Days after execution of the D&C Contract.

Content of Submission

The submission must include drafts of all documentation required for procurement of long lead items. This documentation must be prepared in conjunction with the development of the Concept Design Report.

2.5 Concept Design Report

The Contractor must develop the Tender Design and submit a Concept Design Report (CDR), which shows and describes the Works to be constructed under the document.

2.5.1 CDR

Time of Submission

Within 5 Business Days after execution of the D&C Contract.

Content of Submission

The CDR must be a development of the Contractor's Tender Design Report and must incorporate advances made in the design since the tender, and any changes to the tender design that may result from the tender negotiation period. The report must be structured around the work packages defined in the Contractor's Design Management Plan and all of the material defined herein.

2.6 Concept Design Workshops

2.6.1 General

The Concept Design Workshops must comprise the following:

- CDR Review;
- HAZOP Review; and
- Risk Elimination in Design Review.

2.6.2 Arrangements for the Concept Design Workshops

The Contractor must convene and hold the Concept Design Workshops. No workshops will be held within the 10 Business Day review period of the Concept Design Report.

The Concept Design Workshops must be held at Sydney Water's Head Office in Sydney. Sydney Water will make no charge for the use of the building for the Concept Design Workshops, but the Contractor must bear all other costs of holding the Concept Design Workshops.

The Company will nominate other stakeholders to attend the workshops.

2.6.3 CDR Review

During the CDR Workshop, the Contractor must present the CDR, including reasons, the basis for the design concept, options considered and the evaluation process undertaken to arrive at the CDR. The Contractor must also address the comments made by the Company on the CDR.

The workshop attendees will discuss the CDR and the Company will either concur with the CDR as presented or direct changes be made to it to comply with the requirements of the D&C Contract.

2.6.4 HAZOP Review

General

The Contractor must engage an independent, suitably qualified and experienced third party to facilitate the HAZOP Review.

The HAZOP review of the design of the Works must be based on the Layout and P&IDs in the Draft CDR and must be conducted to ensure that any process, environmental, safety and health concerns are adequately addressed.

Basis of the HAZOP Review

The review must be conducted using the Hazard and Operability (HAZOP) study methodology. As a minimum, the following must be considered during the review:

1. Does the design meet Australian Standards, statutory requirements and the needs of the relevant codes?
2. Will maintenance and operating personnel responsible for keeping the process/ facility/equipment operating be able to do so without personal risk and without the risk of environmental damage?
3. Does the design satisfy reasonable requirements for personnel safety?
4. Does the design satisfy reasonable requirements of process control and equipment performance and control?

5. Will the plant, processes and equipment adopt a safe working status in the event of a failure? (eg power failure, PLC failure, PLC communications failure, equipment failure, equipment component failure).

After the HAZOP Review, the Contractor must submit a HAZOP Review Report and a report detailing the changes required to the Draft CDR, within the time stipulated herein.

The cost of complying with the requirements of (1) to (5) above must be included in the Contract Sum.

2.6.5 Risk Elimination at Design Review No. 1

The Risk Elimination at Design (RED) Review No. 1 must be based on the Draft CDR and must be carried out using a systematic procedure to help identify and eliminate (or minimise) inherent risks in the design. The Risk Elimination at Design Review must consider, as a minimum, whether the process/facility/equipment, as designed:

- Can be constructed safely and without risk of environmental damage;
- Meets the need to keep the Plant operational and complying with licence requirements during construction, testing and commissioning stages.

For the Risk Elimination at Design Review in the Concept Design Workshops, the Contractor must use the format of "CHAIR 1 Study" from "CHAIR - Safety in Design Tool" (WorkCover NSW).

The Contractor must submit a Risk Elimination at Design Review Report and final minutes of changes to the Draft CDR, as agreed by the Company and Contractor, within the time stipulated herein.

2.6.6 Outcomes from Concept Design Workshops

If outcomes from the reviews at the Concept Design Workshops impact on the CDR or any of Contractor's Management Plans and Design Documentation, the Contractor must incorporate the outcomes into the CDR or those Management Plans and Design Documentation, at no variation to the Contract Sum, unless the Company directs a Change under the D&C Contract.

2.6.7 Tender Design Departures

The CDR must have a section highlighting any proposed changes from the Tender Design and the reasons for the changes. No changes to the Tender Design with respect to process details, equipment or controls will be permitted unless agreed to by the Company. Any proposed changes from the Tender Design must firstly be discussed with the Company during the preparation of the Concept Design and if agreed to by the Company incorporated into the final concept design documentation.

No agreement or otherwise by the Company to changes from the Tender Design will alleviate the Contractor of its responsibility to design the Plant in accordance with the Company's Requirements.

2.6.8 Design Development

The Contractor acknowledges that in preparing the CDR and the design documentation, the Contractor will be required to undertake necessary design development to finalise the documentation for the Works.

As a consequence of the Contractor's design development, there may be numerous changes to the Concept Design and to the design documentation. These will not constitute Changes to the Works.

No comment, instruction, rejection, or request from the Company in relation to the CDR or to the Design Documentation to enable the performance of the Works or to ensure compliance with the Company's Requirements will constitute a Change, unless a Change is directed by the Company under the D&C Contract.

2.6.9 FMECA

The Contractor must complete, document and maintain a Failure Modes, Effects and Criticality Analysis (FMECA) on the CDR. The procedure for the conduct of the FMECA must be in accordance with IEC-812: Analysis Techniques for System Reliability – Procedure for Failure Modes and Effects Analysis (FMECA).

Based on the FMECA, the Contractor must develop a Reliability Critical Items List and a Safety Critical Items list and demonstrate how these criticalities will be managed in the design, construction and commissioning of the Works.

The initial analysis must be completed in conjunction with the reliability modelling and prediction activity. The Contractor must submit the preliminary Risk Report for review by the Company's representative with the CDR.

The Contractor must update and resubmit the Risk Report at the completion of the detail design phase.

2.7 Detailed Design Documentation

The detailed design documentation must include the design documentation as shown below:

(a) For all construction work packages, detailed design drawings, including civil, structural, mechanical, site works, P&IDs, electrical works and automation, SCADA and IICATS works, necessary to construct, test, and commission the Plant. Detailed design drawings must be developed from drawings submitted with the CDR;

(b) Mechanical Equipment and Drive, Valve, Penstock and Instrumentation Schedules;

(c) Design Documentation for Electrical Works;

(d) Design Documentation for Automation, SCADA and IICATS works; and

(e) A schedule of departures from the Concept Design.

2.7.1 Mechanical Equipment and Instrumentation Schedules

The Contractor must:

- Extend the Mechanical Equipment and Drive Schedule, Valve Schedule, Penstock and Instrumentation Schedule, included in the CDR, to include all mechanical equipment, all drives, all valves, all penstocks and all instrumentation in each work package; and
- Submit the final schedules during the "Detailed Design Documentation Stage" Design Review meeting for each work package.

The Contractor must submit a WAE copy of all Schedules, as part of the requirements of the WAE documentation submission.

2.7.2 Design Coordination Meetings

The Contractor must convene design coordination meetings on its premises with the Company during the detailed design. The Company may nominate other stakeholders to attend the design coordination meetings. The frequency of the design co-ordination meetings will be two weekly, or as agreed with the Company.

Each party will bear its own costs in attending/holding the design coordination meetings.

2.7.3 Review Issues

During the design review meetings issues to be reviewed will include:

- Compliance with relevant standards, with the Management Plans and Design Documentation prepared, and with other requirements of the Contract;
- Design development of the detailed drawings from the drawings included in the CDR;
- Construction Methodology;
- Maintainability, operability and reliability;
- Outcomes from the Risk Elimination at Design Review, (CHAIR 2 study); and
- Materials and durability.

2.7.4 Risk Elimination at Design Review

Towards the completion of the detailed design of each work package (or group of work packages), the Contractor must hold and facilitate Risk Elimination at Design Review meetings, which follow the format of “CHAIR 2 Study” from “CHAIR - Safety in Design Tool” (WorkCover NSW).

The CHAIR 2 Study must include any issues from Sydney Water’s Risk Elimination at Design process that are not included in the format for the CHAIR 2 Study.

In evaluating risks and in undertaking design, the Contractor must comply with the requirements of Clause 2 of Group Procedure SHS-KP-001 “Safe Entry and Working in Confined Spaces”.

If outcomes from the CHAIR 2 Study impact on any Project Plans and Documentation, the Contractor must incorporate the outcomes into those Project Plans and Documentation.

3. Documentation Requirements

3.1 Design Inputs Report

The Contractor must provide a design inputs report covering each design package as a basis for the design development of the packages. The design inputs report must be prepared progressively, to suit the submissions for review, updated to suit the design review process and made available as input to the next stage of design.

The design information in the Contract documents, Contractor's Tender Design and other information, as appropriate, must be part of the design inputs. The design inputs must also include, and the design inputs report must cover, for each design package, where relevant:

- A detailed scope of the Works, kept up to date as the scope is developed;
- A schedule of proposed design packages and construction packages;
- The limits of the Works and design packages, and the interfaces and inter-relationships between design packages and with other contractors' work, including contemporaneous work and interface work (using written and graphical descriptions);
- A schedule of design information, if any, required and/or obtained from other contractors;
- Design criteria, including functional, specified and derived criteria;
- Value management criteria, including 'whole of life' cost, reliability, component design life, maintenance cycle and maintainability criteria;
- Reference reports, drawings and studies;
- Identification of Standards, codes and guidelines applicable;
- Assumptions and constraints;
- Planning Approval conditions, Authority Approval conditions and other Authority requirements; and
- Delivery/construction methodology, where this influences design.

3.2 Procurement Documentation for Long Lead Items

The Contractor must develop documentation for the procurement of long lead items, including high pressure pumps, energy recovery devices, membranes, pressure vessels, high pressure piping and valves and tunnel boring machines, along with any additional items that the Contractor determines to be long lead items.

The procurement documentation that is submitted for review must include the following for each long lead item, where relevant:

- Technical specifications;
- Commercial documentation;
- Procurement timetable;
- Inspection and Test Plans; and
- Any other documentation required for procurement of that item.

3.3 Concept Design Report

The following describes the minimum requirements for documentation to be included in the Final Concept Design Report. The Contractor must base the structure of the report on its Tender Design Report so that the Concept Design Report becomes an extension of it to reflect refinements made to the tender design during the Contractor's design process.

3.3.1 General

- For each work package:
  a. Process description with reference to the P&IDs;
  b. Complete set of design parameters;
  c. Calculations for each process and for each item of equipment in the process;
  d. Calculations for each major item of equipment to justify the size, pressure rating, duty point, etc, of the equipment;
- Site layout;
- Identification of delivery lead times for items with expected lead times greater than 3 months;
- Description of the process and outcomes of liaison with all relevant Authorities and copies of any correspondence between the designer and the relevant Authorities;
- Time schedule for engineering, manufacturing, delivery, erections/installations, commissioning and Performance and Reliability Test Run;
- Construction approach, methodology phases of construction, commissioning and operation;
- Space requirements for lay-down area, construction site and equipment;
- Description of major equipment for transport, handling and unloading at Site;
- Description of major equipment, systems, civil works, including Site development, buildings, seawater intake and concentrate and wastewater discharge systems; major desalination process equipment, major equipment for chemicals transport, handling and unloading at Site, environmental protection systems, pipelines, tunnels, pumps valves, and flowmeters;
- Schedules, including the following (the equipment schedules must include provisional asset numbering, which the Contractor must subsequently change to MAXIMO or equivalent asset numbers):
  a. Mechanical equipment, including manufacturers' names, model number, place of manufacture, duty, location, type (centrifugal, positive displacement etc.), material, mode of operation (fixed/variable speed), power requirement; duty/standby, process fluid;
  b. Valves, including manufacturers' names, model number, place of manufacture, size, location, type, material, mode of operation (manual, electric actuator, spring etc.), process fluid;
  c. Penstocks including manufacturers' names, model number, place of manufacture, size, location, type, material, mode of operation (manual, electric actuator, spring etc.) process fluid;
  d. Instrumentation, including manufacturers' names, model number, place of manufacture, size, location, type, material, power requirement, process fluid;
  e. Electrical equipment, including manufacturers' names, model number, place of manufacture, location, type, material, mode of operation (fixed/variable speed), power requirement; duty/standby;

- Description of planned/conducted surveys and site development activities;
- Information on conditions of operation;
- Facilities for seawater extraction and concentrate discharge, type and location to prevent recirculation;
- Operational philosophy (start-up and shutdown of individual units) and redundancy concept, seawater quality and drinking water quality monitoring concept, concept for preventive and active measures against seawater pollution and adaptation of operating mode to changes in seawater conditions;
- Documents on the quality assurance system of the Contractor and suppliers;
- Standards, codes and regulations: listing of major standards, codes and regulations (local, international, supplier's own country) which will be applied for the design and construction of each major element of the Plant;
- Description of the security measures and methodology to be adopted for the Project;
- Stormwater management system during construction and operation;
- Plant location map with areas temporarily used during construction;
- Environmental Performance Data:
  Description and details of emissions and environmental control measures at least as follows:
  - Nature and estimated quantities of concentrate discharge, wastewater, wastewater treatment and discharge and disposal methods;
  - Ambient noise levels during construction and operation of the Plant during daytime/night-time hours at site boundary;
- Documentation Regarding Contractors and Suppliers:
  A list of proposed makes and vendors as well as details and references of the nominated and/or proposed contractors and suppliers/manufacturers (where applicable) such as (NB This material may be integrated into the various equipment and instrumentation schedules required if appropriate):
  - Suppliers of major equipment, subcontractors;
  - Seawater screening plant;
  - Pre-treatment plant;
  - Reverse osmosis membranes and reverse osmosis pressure vessels;
  - Pipes and fittings, pumps, valves and flowmeters;
  - Stainless steel fittings and couplings;
  - Static mixers;
  - Cartridge filters and vessels;
  - High-pressure pumps;
  - Energy recovery systems;
  - Potabilisation system (including CO_2-production plant, if required);
  - Main power transformers;
  - MCCs;
  - Major pumps; and
  - Drinking water storage tanks.

3.3.2 Concept Design - Process

- Process flow diagrams;
- Detailed process and instrumentation (P&ID) diagrams;
- Process Functional Description to fully describe the operation and function of the Plant and each process, incorporating:
  - Process design and process description including process design data, design criteria, and calculations, P&ID's, hydraulic flow schematics showing all flow rates and recycles and scenarios, mass balance schematic showing all solids flows and recycles;
  - All process information required for preparation of the UPGs and SOPs and development of the detailed Functional Description including for each unit or system, the purpose and operational intent for each process unit and piece of process equipment, anticipated operation ranges level, flow, pressure, alarm points, interlocks etc;
  - The designer's intent for control including control objectives and proposed operational logic, operation sequences, operator adjustable variables, variable ranges, set points, alarm conditions, and initial set point for programming PLCs and SCADA;
  - Reference to and integration with the mechanical, drive, electrical and instrument lists;
- Hydraulic profiles;
- Process design parameters;
- Unit loadings;
- Selection of chemical;
- Form of chemical delivery;
- Chemical storage and housing;
- Chemical conveyancing materials;
- Chemical dosing size and configuration;
- Wastes disposal methods and routes;
- Operational philosophy (start-up and shutdown of individual units) and redundancy concept, seawater quality and drinking water quality monitoring concept, concept for preventive and active measures against seawater pollution and adaptation of operating mode to changes in seawater conditions;
- Description of the environmental protection systems of the Plant (wastewater treatment, soil protection, etc);
- Mass balance diagrams for the various operating points of the seawater reverse osmosis; and
- Diagrams/tables showing dependency of permeate and drinking water quality on seawater temperature, salinity and composition with initial to end of membrane lifetime values for total dissolved solids and chloride for the design recovery rate and range of operating pressure of the seawater reverse osmosis system.

3.3.3 Concept Design – Mechanical

Complete mechanical design summary documents, which as a minimum include:

- System resistance curves with relevant operating envelopes and single and multiple pumping performance curves superimposed (for designs involving pumping systems);

- Equipment performance characteristics curves or relevant technical data (for designs not involving pumping systems, eg. blowers) relating to temperatures, pressures, efficiency, etc;
- Design parameters for pipelines, pumps, valves and flowmeters;
- Details of proposed equipment and materials of construction;
- Equipment control settings;
- Protection equipment details and settings; and
- Final water hammer analyses and details of the mitigation measures.

3.3.4 Concept Design – Electrical

- Single line diagrams, showing protection details and detailed calculations for the maximum demand and sizing of equipment;
- Starter schematics for each type of starter;
- Earthing plan;
- Systems calculations (including maximum demand of plant consumers, low flow studies, harmonics calculations, etc);
- Datasheets, description and manufacturer's catalogues for major equipment and systems; and
- Layout drawings of control rooms and switch rooms.

3.3.5 Concept Design – SCADA and Instrumentation

- Final system architecture (including SCADA/PLC system block diagrams);
- Communication system design including:
  - Communication network types;
  - Block diagrams including major items of network equipment;
  - Wide area network design;
  - IICATS plant control interface;
- Final input/output database;
- Locations and specification of all major equipment including computers, network equipment, PLCs;
- Detailed functional specification and Control system logic descriptions; and
- PLC, SCADA hardware and instrument datasheets, description and manufacturer's catalogues.

3.3.6 Concept Design - Civil, Structural and Buildings

- Proposed building types including finishes, corrosion protection and architectural treatments;
- Size and type of pipe material and basis for design;
- Foundation details for all structures;
- Construction methodology;
- Proposed tunnel route and construction methodology;
- Geotechnical details;
- Description of building facilities and operation;

- Description of civil works investigations such as:
  - Hydrographical surveys;
  - Site and geotechnical surveys;
  - Site surveys for tunnels, shafts, pipelines and pumping stations;
- Civil drawings with the following details of mechanical equipment:
  - Plant and equipment on all floors and roofs;
  - Type of foundation;
  - Materials of bearing structure, walls, roofs, plumbing and finishes;
  - Chambers for valves and flowmeters;
  - The drawings in addition must show the following details:
    - The minimum spaces for access around equipment during erection, operation and maintenance as well as the clearance diagram of the equipment;
    - The minimum height of crane hook (if any) and the minimum capacity of crane;
    - The lay down areas, storage areas, access areas;
    - The main loads; and
    - Installation details, foundation details and construction methodology.

3.3.7 Concept Design - Plant Equipment and Layout

- General arrangements, drawing sections and plans covering electrical/mechanical aspects of the Plant;
- Building mechanical layouts including operator facilities;
- Arrangements of pipeline routes and profiles, including all equipment (valves, instrumentation, scours, etc.);
- Tunnel routes and profile;
- Shaft locations and space requirements;
- General arrangement of each complete unit or system giving front and side elevations and plans including major equipment, major pipework and valves including auxiliaries with overall dimensions, Sydney Water connecting points and space for dismantling major parts; and
- General arrangement, sectional arrangements and cross sections of all components.

3.3.8 Plant Augmentation Plan

- Conceptual design and arrangements for expansion of Plant to 500ML/day capacity;
- Process flow diagrams;
- Site layout;
- Construction approach, phases of construction, commissioning and operation; and
- Space requirements for lay-down area, construction site and equipment.

3.4 Durability Plan

3.4.1 Durability Plan: Project Works Report

After execution of the D&C Contract, the Contractor must engage a materials technology expert to prepare and finalise the Durability Plan: Project Works Report. This report must be the basis for and support the design team's deliberations and outputs. It is envisaged that the Durability Plan: Project Works Report will be a live document that will interact with the progress and development of the detailed design. This interaction will result in development and amendments to the report as the design and associated documentation is finalised. Notwithstanding, the Durability Plan: Project Works Report must at all times set the design requirements in respect of the durability of the Works to be designed given the operating conditions reasonably anticipated for the Project, the design lives specified in the document, the availability, maintainability and reliability targets specified in the document and the whole-of-life principles set out in the document.

The Contractor must provide as a deliverable the Durability Plan: Project Works Report including, or referencing separate supplementary documents including:

- Early Age Thermal and Early/Long Term Shrinkage Control Method Statement Report;
- Water Retaining Structures Crack Control Design and Construction Method Statement Report;
- Cathodic Protection of Reinforced Concrete Design Report;
- Corrosion Monitoring System for Reinforced Concrete Design Report;
- Pipelines: Durability Control Method Statement Report; and
- Durability of Buildings and Structures Report.

The Durability Plan: Project Works Report must be verified by the Independent Verifier as conforming to the Company's Requirements and must be made available to the design team as an in-progress development of durability matters, and must be made available to the Company on request.

3.4.2 Durability During Construction

Durability design objectives contained in the Durability Plan: Project Works Report must be translated to the construction process. The materials durability tasks must include:

- Review of all technical proposals in relation to material durability, including review for compliance with the requirements of the Durability Plan: Project Works Report of all materials selected to be procured;
- Development and incorporation of durability-relevant items into all inspection and test plans;
- Review of Works requirements related to durability, including trials, installation of monitoring equipment etc;
- Monitoring of day-to-day materials sampling and testing works;
- Assistance in site supervision of construction of critical durability elements;
- Maintain a register of all non-conformances impacting durability, including review and approval all remedial measures to be carried out;
- Issue an Addendum to the Durability Plan: Project Works Report, authored or reviewed by the Contractor's materials technology expert(s), at construction completion, which confirms the completed Works are in full compliance with durability requirements; inclusive of a review of:

- All non-conformances and remedial works completed;
- All variations or amendments;
- Assistance in the compilation of As-built Drawings and Operations & Maintenance Manuals to ensure all Durability matters are appropriately included; and
- Assistance at Defects Correction inspection.

3.5 FMECA Report

The Contractor must complete, document and maintain, and the Independent Verifier must verify, a Failure Modes, Effects and Criticality Analysis (FMECA) on the CDR. The FMECA data must be used to finalise the system design, maintenance manuals, test equipment, spare parts holding and the training plan.

The FMECA process may be completed and documented to the Contractor's standard, provided that the approach meets the basic objectives set out within the Potential Failure Mode and Effect Analysis Handbook, which forms part of the set of documentation for the QS 9000 supplement to QS 9000 Quality Systems. The FMECA must be documented using a FMECA software tool acceptable to the Company's Representative. Where the Contractor elects to use other software tools, the Contractor must provide an electronic copy of their analysis in a format acceptable to the Company's Representative to allow transfer of the information into the Operator's systems.

The purpose of the FMECA will be to review and analyse the design to establish:

- Potential or demonstrated failure modes for each item within the design. This will be carried out at the replaceable subassembly level;
- The likelihood of failure for each identified failure mode, where possible expressed in terms of failure probability;
- The effect of failure in terms of the impact on safety, operating performance, environmental impact and economic consequences, including damage to other equipment; and
- The criticality of failure in terms of operation of the system.

The FMECA process is closely linked to the reliability modelling and improvement program. FMECA serves to identify potential failure modes that must be considered as part of the reliability estimation process for a specific item and to provide information on those elements, which should receive highest priority for reliability improvement.

FMECA also provides the basis for development of programmed maintenance requirements and for identifying failure modes and effects for consideration as part of the Safety program.

The FMECA must be conducted down to the Lowest Replaceable Unit level.

Based on the FMECA, the Contractor must develop a Reliability Critical Items List and a Safety Critical Items list and demonstrate how these criticalities will be managed in the design, construction and commissioning of the Works.

The initial analysis must be completed in conjunction with the reliability modelling and prediction activity.

The Risk Report must include (sorted by the respective system):

- The FMECA worksheets;
- The Reliability Critical Items List; and

- The Safety Critical Items List.

The results obtained from FMECA throughout both the design and build phase and the maintenance phase must be used to update the Maintenance Plan.

3.5.1 FMECA Report

The Failure Modes, Effects and Criticality Analysis (FMECA) must include:

- Definition of the potential failure modes, description of the manner in which the system must respond to each potential failure and the remedial action required by the system, operators or technicians to each potential failure;
- The risks associated with the development, customising and setting-to-work of software modules, protocol conversion systems and communications protocols. The FMECA report must specifically address the above risks and include details of Risk Minimisation Strategies; and
- Documentation of the effects of an item failure upon the system operations and classification of each potential failure according to the severity of those effects. The Contractor must describe the function, the maintenance concept for, and the design conditions, such as fail-safe mode requirements or environmental requirements, for each item. The Contractor must document the reliability and system effectiveness.

3.6 Drawings

3.6.1 CAD Standards

Unless noted otherwise in the document, the Contractor must prepare all drawings, in accordance with Sydney Water's Computer Aided Drafting (CAD) Standards, using the Project drawing sheet template "swa1_1.dwg".

Process Flow and Process & Instrumentation Diagram drawings must be developed by the Contractor using only the standard symbols and linetypes shown on the Project drawings as follows:

- WTW155 - Equip Symbols;
- WTW155 - Instrumentation Symbols; and
- WTW155 - Prefix and Piping Codes.

The Contractor must integrate these drawings into its drawing set for the Project. Where these drawings do not provide a required symbol or linetype the Contractor must agree the symbol to be used with the Company, amend the relevant drawing and reissue it at its next revision.

Title blocks for drawings must be in accordance with the following:

1st Line: Sydney Water Desalination Project

2nd Line: Desalination Plant

3rd Line: Name of Process Unit, eg RO System, Balance Tank

4th Line: Description of drawing, eg General Arrangement, Plan, Sections, Details, P&ID, etc.

3.6.2 Drawing Numbers

The Contractor must allocate drawing numbers to indicate the type of drawing and its applicable area, as follows:

Example:

S 4 2 1 7

Area Drawing Sequence Number

Plant Area Category

Plant Drawing Category

These drawing numbers must be inserted in the location provided beneath the Plant project number “WTW 0155” in the drawing title block.

3.6.3 Project Drawing Category

Project Drawing Categories are:

A. Architectural

E. Drawings of an electrical nature, including drawings of controls and instrumentation.

G. Drawings of a general nature, embracing concept design data, P&IDs, GAs and Site layouts, earthworks, roads, Site drainage, landscaping, etc.

M. Drawings of a mechanical nature, e.g. pump installation, pipework, ducting, machine installations, etc.

S. Drawings of a structural nature, e.g. concrete details of structures, reinforcement drawings, structural steelwork, drawings including handrails, ladders, grid flooring, etc.

3.6.4 Desalination Plant Area Category

0 General Site;

1 Administration and Maintenance Buildings, Substation and Miscellaneous;

2 Seawater Screening System;

3 Pretreatment System;

4 RO system including Cartridge Filters;

5 Potabilisation System;

6 Drinking Water Storage, and Chloramination System;

7 Seawater Concentrate and Wastewater treatment and Disposal System;

8 Delivery Infrastructure (not applicable to the D&C Contract).

3.7 Standard SCADA System Drawing Templates

A set of standard drawing templates have been developed by Sydney Water and included as part of the Sydney Water Treatment Plant SCADA Standards Version 2.4. The Contractor must follow these templates for the development of the detailed design for all SCADA works.

The purpose of the starter templates is to standardise the starter circuits and the PLC I/O's for every type of drive so that their interface to the SCADA matches the standard Prodef Devices.

The Contractor must note that this set of templates does not constitute the complete electrical control system required under this document. It is the responsibility of the Contractor to design the complete electrical control system based on the templates. (The Contractor must note that IICATS starter drawings for motor starters controlled by IICATS RTUs are different to SCADA starter drawings).

If an electrical circuit is required that is not covered by one of the standard drawing templates, then the Contractor must develop a new drawing, highlight the differences in writing and submit a copy to the Company for approval before proceeding with the manufacture. The Contractor must not develop any new templates without the written permission of the Company.

3.8 Critical Drawings Manual

3.8.1 General

The Contractor must prepare and the Independent Verifier must verify a "Critical Drawings Manual". The Critical Drawings Manual must include the following information:

- Site plan(s) with access, electrical and water supplies, flood levels, hazardous areas, fire services, and Site electrical isolation points;
- Process and Instrumentation Diagrams (P&IDs) and Process Flow Diagram;
- Site plans showing the locations of underground services including potable water, reclaimed effluent, gas, telephone lines, process lines and high voltage and medium voltage mains;
- Location plans for equipment and process area isolation including valves, penstocks and main switches;
- Hydraulic profile;
- Electrical single line diagram for power supply and distribution to starters;
- Licensed discharge points;
- Power supply feeds and sub-stations and supply authority contact details; and
- Upstream over flow locations.

All Critical Drawings must have the words "Critical Drawing" as the last line in the title block.

3.8.2 Critical Drawings General Requirements

The Critical Drawings must be issued in electronic format in both AutoCAD (*.dwg) and Adobe Acrobat (*.pdf) formats.

The general requirements for Civil Survey Critical Drawings are:

- Survey must be on MGA (Map Grid of Australia); and
- All levels must be on AHD (Australian Height Datum).
- All point codes and heights to be shown as point attributes in AutoCADD;
- Accuracy requirements:
  - Surface detail $\pm$ 0.01m position, $\pm$ 0.005m levels;
  - U/G services $\pm$0.05m position, $\pm$0.005m levels;

- Hardcopy of each WAE drawing to be signed by a registered surveyor and project manager; and
- Deliverables to include electronic drawing file and signed hardcopies.

The following information also to be shown as point attributes:

- Watermains:
  - Pipe material (eg PVC, SS) & diameters in millimetres;
  - Fitting types;
  - Fitting numbers (where available);
  - Levels on top of pipe at junctions, change of direction or change of grade;
- Sewer & Stormwater Mains:
  - Pipe material (including linings) & diameters in millimetres;
  - Invert levels at manholes (inlets & outlet);
  - Levels on access chambers;
- Electricity, Telecommunication:
  - Duct material & size in millimetres;
  - Levels on top of duct at each change of direction or grade;
- Other Conduits:
  - Type & size;
  - Material flowing through conduit; and
  - Levels on top of conduit at each change of direction or grade.

3.9 Asset Numbering

Sydney Water utilises a Computerised Maintenance Management Information System (MAXIMO). In order to utilise this system, each asset is identified with a unique Asset Number, which is termed a “Location Number” in MAXIMO.

The Contractor’s design process and documentation must be structured to incorporate the requirements of and to generate the prerequisite information required to input into MAXIMO or an equivalent asset management system.

3.10 WAE Documentation

The "Work as Executed" documentation must be issued in draft prior to the start of pre-commissioning and updated to incorporate all changes or alterations carried out during the commissioning and process proving. Final "Work as Executed" documentation must be submitted to the Company for review. The "Work as Executed" documentation must have been reviewed by the Company as a pre-condition to the issue of the Certificate of Attainment of Completion.

The Contractor must submit all engineering drawings, including all Work-as-Executed drawings in accordance with Sydney Water’s "CAD Standards". All Work-as-Executed (“WAE”) drawings must accurately reflect the Works as constructed and installed, including the dimensions, geometry and alignment of all works. The drawings must include geological mapping of all tunnel, shaft and pipeline excavations.

The Contractor must certify the accuracy of all Work-As-Executed drawings prior to delivering them to the Company. The Company retains the right to reject any drawings submitted as Work as

Executed if, in the reasonable opinion of the Company, they do not represent the work as executed.

During construction of the Works, WAE information must be compiled prior to backfill of trenches. Line, location and level of all structures must be confirmed by a registered surveyor to an accuracy of +/-0.10m unless specified elsewhere in this document, as part of the preparation of the WAE information. The surveyor must certify the drawings as a correct representation of the positioning of the elements depicted.

As a minimum, the following must be updated to "Work as Executed" status or updated to reflect Work as Executed details as applicable:

- All contract drawings;
- All other detailed design documents;
- UPGs, SOPS, O&M manuals including all information required under the Contract;
- Copies of PLC programs;
- Critical Drawings Manual; and
- Asset maintenance management system.

The Contractor must deliver the WAE drawings, as part of the final documentation as follows:

- One electronic copy on CD or DVD in .dwg (Autocad) format with X-Refs bound;
- Two A3 size hard copies, bound in A3 folders; and
- One copy placed in the Operations and Maintenance Manuals.

The Contractor must place the electronic copies of the Work-as-Executed Drawings in a separate directory on the final CD soft-copy (AutoCAD format), with sub-directories as follows:

  - Area (eg Area 2 Pretreatment System):
    - Mechanical;
    - Electrical;
    - Structural; and
    - General (includes P&IDs and General Layout).

The CD soft-copy must have a master index that includes hyperlinks to individual drawings. The index must be in MS Excel format and must include as separate columns:

- Drawing number;
- Revision number;
- Drawing type (mechanical, electrical, structural, general);
- Drawing title;
- Drawing location (area number); and
- Drawing date.

3.11 Specification for a Project Information Management System

3.11.1 General

The Contractor must provide a Project Information Management System (PIMS) for the storage and dissemination of all information created and provided under the Contract.

The PIMS must be a software package with a demonstrated record of successful usage on projects of similar size and complexity. The Contractor must provide particulars of the previous usage of the software in sufficient detail to enable the Company to confirm that it was successful and that it will be able to meet the following requirements.

3.11.2 Information to be Managed

The information to be managed by the PIMS must include:

- Correspondence;
- Emails;
- Drawings;
- Specifications;
- Reports;
- Notices;
- RFIs;
- Transmittals; and
- All other information generated under the Contract.

3.11.3 Usage of the Information

Users of the PIMS must include the Company, the Contractor, Subcontractors, suppliers, consultants, Authorities and third parties. All users must be able to post information on the PIMS according to a set of security and accessibility rules to be proposed by the Contractor.

Information managed by the PIMS must be able to be transferred among the users via the internet.

The Contractor must provide a matrix that defines the transfers of information allowed by the PIMS and transfers of information that the PIMS is able to prohibit. For example, Sub-contractors' price information will not be able to viewed by the Company or other Sub-contractors, whereas Sub-contractors' management plans should be available to the Company.

The PIMS must incorporate a method of recording the date and time that information becomes available on the system.

The PIMS should incorporate a system of permitted viewers based on the classification of the information, with provision for manual over-ride by specified operators. Alternatively, the Originator of new or revised information will be responsible for defining those Users that are allowed to view or those Users that are not allowed to view the information.

The PIMS must incorporate a system of control and recording of revisions and status of documents.

Information posted on the PIMS will be considered to have been delivered to the permitted Users at the date and time of an email advising the permitted Users of the posting.

3.11.4 Rights of the Company to Information Posted on the PIMS

The Company's intellectual property rights to information posted on the PIMS must be as defined in the D&C Contract.

3.11.5 Security of the Company's Information Posted on the PIMS

The Contractor must propose a regime of backups and safekeeping for all information posted on the PIMS. The regime must include continued access to the information in the event of default of the service provider (where warehouse storage of information is proposed), or on the occurrence of a Force Majeure Event.

The Company must be entitled to make its own backups and copies of information which it posts on the PIMS, and information to which it has Intellectual Property Rights. The PIMS must allow the Company to make backups and copies independently of the Contractor.

The Contractor must propose procedures that allow the PIMS to continue operating in the event that the main servers are not available. The duration and frequency of loss of service for any reason must be limited to levels to be proposed by the Contractor.

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TS 04A

Design and construct contract:
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TS 04A

SYDNEY'S DESALINATION PROJECT

TS-04A Design Process and Documentation – D&C Contract – Separable Portion 2

TS-04A Design Process and Documentation

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2. Design Process 2

3. Documentation 3

1. Introduction

1.1 General

This section prescribes the design process the Contractor must as a minimum employ in the design of Separable Portion 2. It also describes types of documentation the Contractor is required to produce in the design of Separable Portion 2.

The documents required for design and construction, commissioning of Separable Portion 2 and the operation and maintenance of the augmented Plant must be prepared/finalised and provided in a timely manner so as to permit Separable Portion 2 to be constructed and commissioned in accordance with the Project timetable.

1.2 Design Reviews

The Contractor must develop the Tender Design into a Concept Design and then a final detail design. During this process documentation must be progressively submitted to the Company for review in accordance with the document.

1.3 Documentation Approval Practice

The design and drawings will not be checked by the Company. The documents may be reviewed and comments provided to the Contractor, who will be responsible for addressing the issues raised to comply with the Company's Requirements, Project Approvals and all Authorities' requirements. The Company will either not reject, or reject the Contractor's designs and documentation and provide comment as to the reasons for rejection. It remains the Contractor's responsibility in accordance with the D&C Contract to ensure the design is correct and efficient. No acceptance or approval of these documents by the Company affects the Contractor's warranties or obligations under the D&C Contract.

1.4 Other Documentation

In addition to the design documentation, the Contractor may be required by the D&C Contract to prepare other plans, schedules, manuals and documentation to meet the requirements of the D&C Contract. These must be prepared, submitted for review and finalised as specified elsewhere in the D&C Contract.

2. Design Process

The Contractor's design for the augmentation works must include the following:

- Updated Design Management Plan;
- Updated Design Inputs Report;
- Updated Concept Design Report;
- CHAIR, HAZOP, CHAZOP and RED reports for the augmented Plant as a whole;
- Updated FMECA Report;
- Updated Durability Plan;
- Detailed design drawings, and related design documentation;
- Procurement documentation for long lead items;
- Mechanical Equipment, Drives, Valve and Penstock Schedules;
- Instrumentation Schedule;
- Design documentation for Electrical works;
- Design documentation for automation, SCADA, and IICATS works; and
- Testing and Commissioning Plan for Separable Portion 2.

The draft updated Design Inputs Report, the draft updated Concept Design Report and the draft procurement documentation for long lead items must be submitted within 5 Business Days after execution of the D&C Contract.

The process for the design of Separable Portion 2 must in all other respects follow the design process described in TS-04 Design Process and Documentation.

3. Documentation

The documentation for the design of Separable Portion 2 must comply with all other documentation requirements that are detailed in TS-04 Design Process and Documentation.

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TS 05

Design and construct contract:
Schedule 14 company's requirements

SYDNEY'S DESALINATION PROJECT

TS-05 Performance Testing – D&C Contract – Separable Portion 1

TS-05 Performance Testing

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1. Performance Testing and Reliability Testing

1.1 Introduction

This section prescribes the Performance Tests and Reliability Test Run that the Plant will be required to pass as preconditions to the achievement of Completion.

Prior to commencing the Performance Tests, the Contractor must have carried out the relevant pre-commissioning, commissioning processes and operator training defined in the relevant Management Plan (the Commissioning Management Plan). Following satisfactory completion of those processes, and with the Plant operating at full capacity and disposing of the product water to waste (sea), it will, subject to the Contractor having satisfied every other pre-requisite for commencement of the Performance Tests, be satisfactory for the Contractor to commence the Performance Tests detailed in this document.

1.2 Sequence and Timing

The Performance Tests, as described in Sections 1.3 and 1.4, will be conducted within a period of 14 consecutive days, during which the Plant must be operated at 100% of its Minimum Daily Output required to satisfy the Average Daily Output requirement of the Plant. The requirements for this period, the Performance Test Period, are described in Sections 1.3 and 1.4.

Following satisfactory completion of the Performance Test Period, and satisfaction of all criteria of the Performance Tests, the Contractor must finalise and report on all test results and must obtain all approvals necessary to allow the product water to be introduced into the Sydney Water drinking water reticulation system, including those of Sydney Water. During this period, the Contractor must cease production of desalinated water and must demonstrate preservation of the RO trains.

By the time of completion of the Performance Test Period, and during the approvals-finalisation period, the Company will have arranged for the flushing, disinfection and commissioning of the drinking water delivery system to have been carried out by others. Water for these various purposes will have been supplied by Sydney Water and will be disposed of via the flushing line from the drinking water pumping station and the seawater bypass line to the seawater concentrate outlet.

It is essential that the Contractor will have completed and commissioned those lines and their connections in sufficient time so as not to delay the flushing of the drinking water delivery system. It is therefore a pre-requisite that commissioning of the flushing line and plant bypass be completed prior to commencing the Performance Tests. The Contractor's Performance Test Program must also incorporate a minimum period of 3 days over which the Company will require flushing water from the delivery system to be discharged via the plant bypass and concentrate outlet.

Following completion of flushing, disinfection and commissioning of the drinking water delivery system and with all requisite approvals in respect of the Plant having been obtained, the Contractor may commence the Reliability Test Run.

The Reliability Test Run will be a period of 28 consecutive days during which the Plant must be operated by the Contractor in accordance with the Commissioning Management Plan over the full operating range up to the Minimum Daily Output of the Plant. During this test, Sydney Water will operate the drinking water pump station under the reasonable direction of the Contractor, to deliver the water produced by the Plant into Sydney's water supply system.

Further requirements for the Reliability Test Run are provided in Section 1.7.

Following satisfactory completion of the Reliability Test Run, and subject to the Contractor having satisfied every other pre-requisite for the issuance of the Certificate of Attainment of Completion, the Contractor may apply for the Certificate of Attainment of Completion to be issued in accordance with the document.

Following the issue of the Certificate of Attainment of Completion to the Contractor, the operation of the Plant will be turned over to the Operator, which will operate the Plant for the Term.

1.3 Performance Test Period

The Contractor must carry out those Performance Tests described in Section 1.4 over an uninterrupted period of 336 hours (14 days) (the Performance Test Period), during which the Contractor must operate the Plant at its Minimum Daily Output required to satisfy the Average Daily Output requirement of the Plant.

During this period, the Contractor must operate the Plant with only normal operator intervention. That is, those parts of the Plant required to operate automatically must operate automatically. Those parts of the Plant that would normally require some level of operator intervention must only receive that level of operator intervention.

During the Performance Test Period, the Contractor must ensure that all process and auxiliary plant and equipment, including all stand-by or redundancy plant and equipment operates for at least 25% of the time.

Desalinated water produced during this process will be deemed not fit for human consumption and must be disposed of to waste. It will be acceptable to remix the product water with the seawater concentrate and dispose of the resultant mix to sea via the seawater concentrate outlet.

Sydney Water's alliance participants, responsible for the design and construction of the Distribution Infrastructure, may desire to use the water produced during the Performance Test Period to complete commissioning of the drinking water pump station. In this event, the Contractor must cooperate with Sydney Water's alliance participants, which will have to comply with any reasonable requirements of the Contractor.

In the event that the Performance Test Period is interrupted (unplanned down-time) for longer than a total cumulative time period of six (6) hours prior to the completion of the 14-day period, all previous test results will be considered void and it must be restarted at day zero and the associated testing must be repeated.

The only exception to this protocol will be when external causes for which the Company has expressly accepted the risk under the D&C Contract have caused the interruption.

In such instances, the Contractor may apply to the Company to waive the requirement to recommence the 14-day period, and the Company may, at its sole discretion, allow the Performance Test Period to recommence with a credit allowance for the time already completed.

In the event that any Performance Test fails to meet its specified requirement, the Contractor must adjust or modify the Plant to ensure the specified requirement is reached, and the Performance Test Period must be recommenced at day zero and all Performance Tests repeated.

In the event that operator intervention beyond what would normally be required in the normal operation of the Plant is required, the Contractor must adjust or modify the Plant to ensure the additional intervention is no longer required, and the Performance Test Period must be recommenced from day zero, and all Performance Tests repeated at no cost to the Company.

1.4 Performance Tests

During the Performance Test Period, the Contractor must demonstrate by means of appropriate standard sampling, testing and analysis methods that the Plant, including related equipment and systems but excluding the Distribution Infrastructure, meets the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

Performance Tests for the Desalination Plant

These tests will confirm achievement of all warranted values during the Performance Test Period.

The performance test program must be based on ASTM D 4472 – Record Keeping for Reverse Osmosis Systems.

Six months prior to the proposed start of the Performance Test Period, the Contractor must submit all relevant test procedures for the Performance Test Period and for the Reliability Test Run. The draft procedures must be accompanied by a certificate of acceptance of the test procedures from the Operator and must include:

- Test standards;
- Test program;
- Type of tests to be conducted;
- Description of instrumentation to be used, including accuracy;
- Description of sampling and analysis to be carried out, including:
  - Frequency and methodology of sampling and listing of analysis standards;
  - Their precision and limit of detection;
- Method of data recording;
- Method used for adjustment of recorded data to the design conditions; and
- Staffing resource plan with roles and responsibilities.

The test procedures will be reviewed by the Company and any changes must be incorporated into the final procedures to be used for the Performance Test Period.

The Water Analyses to be carried out during the Performance Test Period must be in compliance with ASTM D 4195 "Standard Guide for Water Analysis for Reverse Osmosis Applications" and ASTM Standard Test Methods listed in this guide and the methods of the AWWA/APHA Standard Methods for the examination of water and wastewater.

In addition, the following standard procedures from the Annual Book of ASTM Standards – Section 11 must be used during the Performance Tests of the RO system:

- D 3739 – Calculation and Adjustment of the Langelier Saturation Index for RO;
- D 4189 – Silt Density Index (SDI) of Water;
- D 4194 – Operating Characteristics of RO Devices;
- D 4516 – Standardizing RO Performance Data;
- D 4582 – Calculation and adjustment of the Stiff and Davis Stability Index for RO;
- D 4692 – Calculation and Adjustment of Sulphate Scaling Salts for RO; and
- D 4993 – Calculation and Adjustment of Silica Scaling for RO.

Test Conditions

The minimum test conditions for Performance Tests and interpretation of results are set out below.

The Performance Tests will be carried out to check that the Plant functions correctly and meets the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

All sampling and laboratory analysis must be performed by accredited (NATA or equivalent) laboratories.

Once the Performance Test Period has started, the power consumption of all Plant consumers (excluding drinking water pump station) must be taken every 24 hours.

In addition, the following on-line readings must be taken every hour during the Performance Test Period:

- Permeate main lines:
  - Flow per main line;
  - Flow total;
  - pH per main line; and
  - Conductivity per main line;
- Drinking water prior to drinking water storage:
  - Flow per main line;
  - Flow total;
  - pH per main line;
  - Conductivity per main line;
  - Residual chlorine per main line;
  - M-alkalinity per main line; and
  - Fluoride per main line.

In addition, the following samples for laboratory tests must be taken every four (4) hours during the Performance Test Period:

- All permeate and product main lines with analysis in the laboratory of each sample for the following parameters:
  - pH;
  - Conductivity;
  - TDS;
  - Chlorides;
  - Bromide;
  - Boron;
  - Sulphates; and
  - Iron.

In addition, the following samples must be taken every twenty-four (24) hours during the Performance Test Period:

- Drinking Water downstream of both the drinking water storage tank and chloramination with analysis in the laboratory of each sample for the following parameters:
  - Turbidity;
  - True colour;
  - pH;
  - TDS;

- Chloride;
- Alkalinity;
- Boron;
- Bromide;
- Residual chlorine;
- Fluoride;
- CCPP;
- Guideline values for microbial quality according to the ADWG; and
- Health and aesthetic guideline values for the physical and chemical characteristics listed in Attachment 1 according to the ADWG.

In addition, the following samples must be taken once during the Performance Test Period:

- Drinking Water downstream of both the drinking water storage tank and chloramination with analysis in the laboratory of each sample for the following:
  - Guideline values for pesticides according to the ADWG.

If any pesticide is detected at or above the ADWG guideline value, a second sample must be taken and analysed for this pesticide. If any pesticide is also detected at or above the ADWG guideline value in this second sample, the source must be identified and action taken to prevent further contamination, until the pesticide is not detected at or above the ADWG guideline value in two consecutive samples taken at least twenty-four (24) hours apart.

In addition, the following warranted performance figures according to the Works Warranties Schedule are to be demonstrated during the Performance Test Period:

- Consumptions of all chemicals;
- Plant capacities:
  - Seawater feed flow to the Plant;
- Seawater intake system:
  - Particle size downstream of the screening plant;
  - Head loss of the screening plant;
- Pre-treatment plant:
  - Silt Density Index SDI_{15} of combined pre-treated seawater;
  - SDI_{15} of filtered water from individual filters;
  - Turbidity of pre-treated seawater;
  - Maximum internal water demand;
  - Maximum wastewater discharge;
  - Head loss of cartridge filters;
- Backwash water treatment plant:
  - Backwash water discharge volume to the seawater concentrate outlet; and
  - Maximum suspended solids in backwash water discharge to the seawater concentrate outlet.

The following parameters must also be demonstrated during the Performance Test Period as guidance:

- CO_2 Production (if utilised in the process):
  - CO_2 purity power consumption per ton CO_2 produced;

– Fuel consumption per ton CO_2; and
– Cooling water and water consumption at design load.

All instruments used during tests must be of adequate accuracy for the purpose in accordance with international standards. Test certificates for instruments used for the performance test must be submitted before executing the test.

The calibration of on-line instruments used for testing must be checked at Day 7 of the Performance Test Period in accordance with the manufacturers' requirements.

The readings and results of sample analyses must be compiled in a report presenting the results in graphs and tables and showing all necessary calculations and interpretation of the test results with respect to warranted figures and performance particulars as given.

Copies of the laboratories' accreditation valid for the duration of the analysis performed must be included in the report.

1.5 Assessment of Performance Test Results

The following methodologies will be used to assess if the Performance Test results comply with the Company's Requirements and the works warranties as specified in the Works Warranties Schedule:

Drinking Water Production

The quantity (volume) of Drinking Water produced in each 24-hour period must be equal to or greater than the Warranted Minimum Daily Output of Drinking Water. Where the Performance Test Period was interrupted during a 24-hour period, the quantity (volume) of Drinking Water produced during that period must be converted to an equivalent daily quantity (volume), which will be used to assess compliance.

Seawater Feed and Discharges to Sea

The quantity (volume) of seawater extracted and the quantity (volume) of seawater concentrate discharged to sea in each 24-hour period must comply with the Works Warranties Schedule. Where the Performance Test Period was interrupted during a 24-hour period, the quantities (volumes) of seawater extracted and seawater concentrate discharged during that period must be converted to equivalent daily quantities (volumes), which will be used to assess compliance.

Specific Energy Consumption

The Specific Energy Consumption must be calculated over each 24-hour period and must in all cases be less than or equal to the warranted Effective Specific Energy Consumption. The calculation of the warranted Effective Specific Energy Consumption must be as shown in the Works Warranties Schedule. The correction factors for temperature, TDS and average membrane lifetime (AMLT) must be based on the average values of these parameters recorded during that 24-hour period.

Chemical Consumption

For each chemical used, the specific consumption must be calculated over the Performance Test Period and must comply with the Works Warranties Schedule.

Water Quality Tests

All Drinking Water test results must comply with the Drinking Water Specification (100%ile values). In addition, at least 95% of the test results must comply with the Drinking Water Specification (95%ile values).

All other water quality test results must comply with the Works Warranties Schedule.

1.6 Reporting and Approvals

Following satisfactory completion of the Performance Tests the Contractor must:

- Prepare a report for the Company. This report must detail the outcomes of the Performance Test Period on a day-by-day basis. It must consolidate the multitude of tests and test results and must present all the data so derived in a series of comparison tables against the Company's Requirements and the works warranties as specified in the Works Warranties Schedule; and
- Obtain all requisite approvals to enable desalinated water to be introduced into the Sydney Water drinking water delivery system.

During this period of obtaining approvals and preparing reports and prior to the Contractor receiving approval to introduce Drinking Water to Sydney Water's water supply system, the Contractor must close down and demonstrate preservation of the RO trains (at least 2 RO-trains 1st pass and 1 RO-train 2nd pass), followed at the appropriate time by bringing the RO trains back on line in time for the Reliability Test Run.

1.7 Reliability Test Run

Following satisfactory completion of the Performance Test Period and satisfaction of all the nominated Performance Tests, and following receipt from the various Authorities, including Sydney Water, of all requisite approvals to allow desalinated water to be introduced into the Sydney Water water supply system, the Contractor must prepare for and then commence the Reliability Test Run.

Successful completion of the Reliability Test Run will be one of the pre-conditions for Completion.

The Reliability Test Run will be a period of 28 consecutive days during which the Plant must be operated by the Contractor in accordance with the Commissioning Management Plan over the full operating range up to the Minimum Daily Output of the Plant and must deliver the water so produced to the Delivery Point. As noted elsewhere, Sydney Water's alliance participants responsible for the design and construction of the drinking water delivery system will operate the drinking water pump station, under the Contractor's control, during this test.

In general, during the Reliability Test Run all the Plant equipment, including the stand-by units, must be checked under all conceivable loads and operating conditions to verify the adequacy of the design and reliability of the equipment. Part load, start-up times, turn-down times and stand-by unit's tests must be carried out during the initial tests.

During this period, the Contractor must operate the Plant with only normal operator intervention. That is, those parts of the Plant required to operate automatically must operate automatically. Those parts of the Plant that would normally require some level of operator intervention must only receive that level of operator intervention.

In the event that the Reliability Test Run is interrupted (unplanned down-time) for a longer than total cumulative time period of twelve (12) hours prior to the completion of the 28-day period, it must be recommenced at day zero and the associated testing must be repeated. The only exception to the protocol will be when external causes for which the Company has expressly accepted the risk under the D&C Contract have caused the interruption.

In such instances, the Contractor may apply to the Company to waive the requirement to recommence the 28-day period, and the Company may, at its sole discretion, allow the Reliability Test Run to recommence with a credit allowance for the time already completed.

Furthermore, the use of and/or switch-over to stand-by equipment will be allowed, provided that the Contractor informs the Company immediately of such actions and of the reasons therefor and provided that the cause for the use of the stand-by equipment is removed within twelve (12) hours. Non-availability of such a Plant component for longer than twelve (12) hours will be considered as an interruption of the Reliability Test Run.

In the event that any reliability test fails to meet its specified requirement, the Contractor must adjust or modify the Plant to ensure the specified requirement is reached, and the Reliability Test Run must be recommenced at day zero and all Reliability Tests repeated.

During the Reliability Test Run, the Contractor must carry out the following additional performance tests and measurements:

With the Plant producing desalinated water on-line readings (as far as possible) must be taken every hour during the Reliability Test Run of Drinking Water downstream of the drinking water delivery pump station. The following readings must be taken:

- Flow;
- Residual chlorine;
- Fluoride;
- pH; and
- Conductivity.

In addition, the following samples must be taken every twenty-four (24) hours during the Reliability Test Period:

- Drinking Water supplied to the Delivery Point with analysis in the laboratory of each sample for the following parameters:
  - Turbidity;
  - True colour;
  - pH;
  - TDS;
  - Chloride;
  - Boron;
  - Bromide;
  - CCPP;
  - Guideline values for microbial quality according to the ADWG; and
  - Health and aesthetic guideline values for the physical and chemical characteristics listed in Attachment 1 according to the ADWG.

All sampling and laboratory analysis must be performed by accredited (NATA or equivalent) laboratories.

In addition, the following must be confirmed during the Reliability Test Run:

- PLC/SCADA System:

  - Demonstrable records showing error-free or "bug" free performance in the form of trends, alarms, logs of Plant operating parameters;
- Start-up time to Minimum Daily Output:
  - From short-time shut down;
  - From long-time shut down;
- Minimum start-up time to 25 % of Minimum Daily Output:
  - From short-time shut down;
  - From long-time shut down;
- Turn-down time:
  - Minimum turn-down time to 25 % of Minimum Daily Output.

Following satisfactory completion of the Reliability Test Run and the associated Reliability Tests, the Contractor must prepare a final report for the Company. This report must update the previous report produced at the end of the Performance Test Period by inclusion of the details of the Reliability Test Run on a day-by-day basis. It must consolidate the previous tests and test results and the latter tests and test results obtained during the Reliability Test Run and must present all the data so derived in a series of comparison tables against the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

Copies of the laboratories' accreditation valid for the duration of the analysis performed must be included in the report.

Satisfactory completion of the Reliability Test Run and submission of an approved report in accordance with this section will be pre-requisites to the issuance of the Certificate of Attainment of Completion.

1.8 Additional Performance Test

An additional set of tests, incorporating the requirements of the tests to be conducted during the Performance Test Period and the Reliability Test Run, all as described in this document, will be carried out 22 months after the Date of Completion or 2 months prior to a Shutdown directed by the Company. These tests are the Proving Period Tests.

Performance Tests will be conducted over a period of 14 consecutive days in accordance with the requirements of the initial Performance Test Period as described in this document, except that Drinking Water will continue to be supplied to the Sydney Water reticulation system.

This series of tests will determine if the Plant continues to operate in accordance with the Company's Requirements and the works warranties as specified in the Works Warranties Schedule. Notwithstanding that this series of tests will be conducted by the Operator, the Contractor will be bound by the results of these tests as if it had conducted them itself.

To the extent that such tests evidence any shortcomings in the performance of the Plant, such shortcomings will be considered Defects in accordance with the document.

Following satisfactory completion of the Performance Tests, the Operator will conduct a further Reliability Test Run to confirm that the Plant continues to meet the Company's Requirements and the works warranties as specified in the Works Warranties Schedule. Notwithstanding that this test will be conducted by the Operator, the Contractor will be bound by the results of this test as if it had conducted it itself.

Attachment 1: Physical and Chemical Characteristics to be Tested

- Acrylamide
- Aluminium (acid-soluble)
- Ammonia
- Antimony
- Arsenic
- Barium
- Benzene
- Bromate
- Cadmium
- Carbon tetrachloride
- Chloroacetic acid
- Dichloroacetic acid
- Trichloroacetic acid
- 2-chlorophenol
- 2,4-dichlorophenol
- 2,4,6-trichlorophenol
- Chromium
- Copper
- Cyanide
- Cyanogen chloride
- 1,2-dichlorobenzene
- 1,4-dichlorobenzene
- 1,2-dichloroethane
- Dichloromethane (methylene chloride)
- Epichlorohydrin
- Ethylbenzene
- Ethylenediamine tetraacetic acid (EDTA)
- Hardness
- Iodide
- Iron
- Lead
- Manganese
- Mercury

- Molybdenum
- Monochloramine
- Nickel
- Nitrate
- Nitrite
- Tributyltin oxide
- Di(2-ethylhexyl) phthalate
- Benzo-(a)-pyrene
- Selenium
- Silver
- Sodium
- Styrene (vinylbenzene)
- Sulfate
- Taste and odour
- Temperature
- Tetrachloroethene
- Toluene
- Trichloroacetaldehyde (chloral hydrate)
- Trochlorobenzenes (total)
- Trihalomethanes (THMs) (Total)
- Vinyl chloride
- Xylene

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Volume

TS 05A

Design and construct contract:
Schedule 14 company's requirements

SYDNEY'S DESALINATION PROJECT

TS-05A Performance Testing – D&C Contract – Separable Portion 2

TS-05A Performance Testing

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1. Performance Testing and Reliability Testing

1.1 Introduction

This section prescribes the Performance Tests and Reliability Test Run that Separable Portion 2 will be required to pass as preconditions to the achievement of Completion.

Prior to commencing the Performance Tests, the Contractor must have carried out the relevant pre-commissioning, commissioning processes and operator training defined in the relevant Management Plan (the Commissioning Management Plan), and must have obtained all requisite approvals to enable desalinated water to be introduced into the Sydney Water drinking water delivery system at the full capacity of the augmented Plant. Following satisfactory completion of those processes, and with the augmented Plant operating at full capacity, it will, subject to the Contractor having satisfied every other pre-requisite for commencement of the Performance Tests, be satisfactory for the Contractor to commence the Performance Tests detailed in this document.

1.2 Sequence and Timing

The Performance Tests, as described elsewhere in Sections 1.3 and 1.4, will be conducted within a period of 14 consecutive days, during which the augmented Plant must be operated at 100% of its Minimum Daily Output required to satisfy the Average Daily Output requirement of the augmented Plant. The requirements for this period, the Performance Test Period, are defined in Sections 1.3 and 1.4.

Following satisfactory completion of the Performance Test Period, and satisfaction of all criteria of the Performance Tests, the Contractor must finalise and report on all test results. The Contractor must then prepare for and then commence the Reliability Test Run.

Following satisfactory completion of the Performance Test, the Contractor may commence the Reliability Test Run.

The Reliability Test Run will be a period of 28 consecutive days during which the Plant must be operated by the Contractor in accordance with the Commissioning Management Plan over the full operating range up to the Minimum Daily Output of the augmented Plant. Further requirements for the Reliability Test Run are provided in Section 1.5.

Following satisfactory completion of the Reliability Test Run, and subject to the Contractor having satisfied every other pre-requisite for the issuance of the Certificate of Attainment of Completion, the Contractor may apply for the Certificate of Attainment of Completion to be issued in accordance with the document.

1.3 Performance Test Period

The Contractor must carry out those Performance Tests described in Section 1.4 over an uninterrupted period of 336 hours (14 days) (the Performance Test Period), during which the Contractor must operate the augmented Plant at its Minimum Daily Output required to satisfy the Average Daily Output requirement of the augmented Plant.

During this period, the Contractor and Operator must operate the augmented Plant with only normal operator intervention. That is, those parts of the Plant required to operate automatically must operate automatically. Those parts of the Plant that would normally require some level of operator intervention must only receive that level of operator intervention.

During the Performance Test Period, the Contractor must ensure that all process and auxiliary plant and equipment, including all stand-by or redundancy plant and equipment, operates for at least 25% of the time.

Unless on-line testing indicates a failure to meet the Drinking Water Specifications, desalinated water produced during this process may be delivered to the Distribution Infrastructure. As noted elsewhere, Sydney Water's alliance participants responsible for the design and construction of the drinking water delivery system will operate the drinking water pump station, under the Contractor's control, during this test.

In the event that the Performance Test Period is interrupted (unplanned down-time) for longer than a total cumulative time period of six (6) hours prior to the completion of the 14-day period, all previous test results will be considered void and it must be restarted at day zero and the associated testing must be repeated. This condition will only apply for interruptions that are associated with the Separable Portion 2 or the integration of Separable Portion 2 with Separable Portion 1.

The only exception to this protocol will be when external causes for which the Company has expressly accepted the risk under the D&C Contract have caused the interruption or where the interruption has resulted from a failure of the works designed and constructed by Sydney Water's alliance partners responsible for the design and construction of the Distribution Infrastructure. In such instances, the Contractor may apply to the Company to waive the requirement to recommence the 14-day period, and the Company may, at its sole discretion, allow the Performance Test Period to recommence with a credit allowance for the time already completed.

In the event that any Performance Test fails to meet its specified requirement, the Contractor must adjust or modify the Plant to ensure the specified requirement is reached, and the Performance Test Period must be recommenced at day zero and all Performance Tests repeated.

In the event that operator intervention beyond what would normally be required in the normal operation of the Plant is required, the Contractor must adjust or modify the Plant to ensure the additional intervention is no longer required, and the Performance Test Period must be recommenced from day zero, and all Performance Tests repeated at no cost to the Company.

1.4 Performance Tests

During the Performance Test Period, the Contractor must demonstrate by means of appropriate standard sampling, testing and analysis methods that the augmented Plant, including related equipment and systems but excluding the drinking water pumping station and delivery system, meets the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

Performance Tests for the Desalination Plant

These tests will confirm achievement of all warranted values during the Performance Test Period.

The Contractor must conduct all performance tests in accordance with the requirements of TS-05 Performance Testing and Reliability Testing.

The following tests and readings will apply to the augmented Plant:

- On-line readings and analysis of samples of drinking water.

The following tests and readings will apply to Separable Portion 2 only:

- On-line readings and analysis of samples of permeate main lines.

In addition, the warranted performance figures according to the Works Warranties Schedule that are listed in TS-05 Performance Testing are to be demonstrated for the augmented Plant during the Performance Test Period.

The methodologies outlined in TS-05 Performance Testing will be used to assess if the Performance Test results comply with the Company's Requirements and the Works Warranties Schedule.

Following satisfactory completion of the Performance Tests the Contractor must prepare a report for the Company. This report must detail the outcomes of the Performance Test Period on a day-by-day basis. It must consolidate the multitude of tests and test results and must present all the data so derived in a series of comparison tables against the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

1.5 Reliability Test Run

Following satisfactory completion of the Performance Test Period and satisfaction of all the nominated Performance Tests, the Contractor must prepare for and then commence the Reliability Test Run.

Successful completion of the Reliability Test Run will be one of the pre-conditions for Completion.

The Reliability Test Run will be an uninterrupted period of 28 days during which the Contractor in association with the Operator must operate the augmented Plant in accordance with the Commissioning Management Plan over the full operating range up to the Minimum Daily Output of the Plant and must deliver the water so produced to the Delivery Point. As noted elsewhere, Sydney Water's alliance participants responsible for the design and construction of the drinking water delivery system will operate the drinking water pump station, under the Contractor's control, during this test.

In general, during the Reliability Test Run all the equipment in Separable Portion 2, including the stand-by units, must be checked under all conceivable loads and operating conditions to verify the adequacy of the design and reliability of the equipment. Part load, start-up times, turn-down times and stand-by unit's tests must be carried out during the initial tests.

During this period, the Contractor and Operator must operate the augmented Plant with only normal operator intervention. That is, those parts of the Plant required to operate automatically must operate automatically. Those parts of the Plant that would normally require some level of operator intervention must only receive that level of operator intervention.

In the event that the Reliability Test Run is interrupted (unplanned down-time) for a longer than total cumulative time period of twelve (12) hours prior to the completion of the 28-day period, it must be recommenced at day zero and the associated testing must be repeated. This condition will only apply for interruptions that are associated with Separable Portion 2 or the integration of Separable Portion 2 with Separable Portion 1.

The only exception to the protocol will be when external causes for which the Company has expressly accepted the risk under the D&C Contract have caused the interruption. In such instances, the Contractor may apply to the Company to waive the requirement to recommence the 28-day period, and the Company may, at its sole discretion, allow the Reliability Test Run to recommence with a credit allowance for the time already completed.

Furthermore, the use of and/or switch-over to stand-by equipment will be allowed, provided that the Contractor informs the Company immediately of such actions and of the reasons therefor and provided that the cause for the use of the stand-by equipment is removed within twelve (12) hours. Non-availability of such a Plant component for longer than twelve (12) hours will be considered as an interruption of the Reliability Test Run.

In the event that any reliability test fails to meet its specified requirement, the Contractor must adjust or modify the Plant to ensure the specified requirement is reached, and the Reliability Test Run must be recommenced at day zero and all Reliability Tests repeated.

During the Reliability Test Run, the Contractor must conduct all additional performance tests and measurements in accordance with the requirements of TS-05 Performance Testing.

In addition, the following must be confirmed during the Reliability Test Run:

- PLC/SCADA System:
  - Demonstrable records showing error-free or "bug" free performance in the form of trends, alarms, logs of Plant operating parameters.

In addition, the Contractor may at the Company's discretion be instructed to confirm the following during the Reliability Test run:

- Start-up time to Minimum Daily Output:
  - From short-time shut down;
  - From long-time shut down;
- Minimum start-up time to 25 % of Minimum Daily Output:
  - From short-time shut down;
  - From long-time shut down;
- Turn-down time:
  - Minimum turn-down time to 25 % of Minimum Daily Output.

Following satisfactory completion of the Reliability Test Run and the associated Reliability Tests, the Contractor must prepare a final report for the Company. This report must update the previous report produced at the end of the Performance Test Period by inclusion of the details of the Reliability Test Run on a day-by-day basis. It must consolidate the previous tests and test results and the latter tests and test results obtained during the Reliability Test Run and must present all the data so derived in a series of comparison tables against the Company's Requirements and the works warranties as specified in the Works Warranties Schedule.

Satisfactory completion of the Reliability Test Run and submission of an approved report in accordance with this section will be pre-requisites to the issuance of the Certificate of Attainment of Completion.

1.6 Additional Performance Test

An additional set of tests, incorporating the requirements of the tests to be conducted during the Performance Test Period and the Reliability Test Run, all as described in this document, will be carried out 22 months after the Date of Completion or 2 months prior to a Shutdown directed by the Company. These tests are the Proving Period Tests.

Performance Tests will be conducted over a period of 14 consecutive days in accordance with the requirements of the initial Performance Test Period as described in this document, except that Drinking Water will continue to be supplied to the Sydney Water reticulation system.

This series of tests will determine if the Plant continues to operate in accordance with the Company's Requirements and the works warranties as specified in the Works Warranties Schedule. Notwithstanding that this series of tests will be conducted by the Operator, the Contractor will be bound by the results of these tests as if it had conducted them itself.

To the extent that such tests evidence any shortcomings in the performance of the Plant, such shortcomings will be considered Defects in accordance with the document.

Following satisfactory completion of the Performance Tests, the Operator will conduct a further Reliability Test Run to confirm that the Plant continues to meet the Company's Requirements and the works warranties as specified in the Works Warranties Schedule. Notwithstanding that this test will be conducted by the Operator, the Contractor will be bound by the results of this test as if it had conducted it itself.

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TS 08

Design and construct contract:
Schedule 14 company's requirements

TS 08

SYDNEY'S DESALINATION PROJECT

TS-08 Security Requirements

TS-08 Security Requirements

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TS-09 Environmental Requirements – D&C Contract

TS-09 Environmental Requirements

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1. Introduction

1.1 General

The environmental requirements contained in this Technical Schedule:

- may be in addition to, but are not in substitution for, any other requirements of any legislation or regulations or of any condition in the Project Documents; and
- will not be taken to limit the powers of the Company nor the liabilities and responsibilities of the Contractor under the D&C Contract.

The Contractor must integrate and achieve the documented environmental assessment outcomes, commitments and approval obligations for the Project.

The Contractor must, at all times, exercise any necessary and reasonable precautions appropriate to the nature of the work and the conditions under which the Project is to be performed to protect the Environment.

The Contractor must provide equipment, materials, training, personnel and documentation necessary to meet the requirements of the D&C Contract. The Contractor must comply with the above requirements and must provide evidence of such compliance upon request by the Company as a precondition of continued access to the Site.

The Contractor should note that the Company will provide resources to:

- Manage the ongoing relationship between the Contractor and the Company in relation to environmental management requirements and responsibilities (the “Environmental Portal” role); and
- Provide a point of contact with regulatory agencies in relation to planning and other approvals, unless otherwise determined by the Company.

2. Environmental Management Systems

The Contractor must develop, maintain and implement (for the full period of the D&C Contract) an Environmental Management System (EMS) in accordance with AS/ANZ ISO 14001:2004. The EMS must be developed (or adapted) specifically for the Project. The scope of the EMS must be clearly defined and must:

- Address all elements and phases of the Project;
- Achieve effective management of all environmental impacts and risks;
- Ensure compliance with all regulatory and policy obligations;
- Provide an overarching system to achieve the environmental management outcomes for the Project and address all of the Statement of Commitments (SoC), the Planning Approval and any environmental regulatory or due diligence;
- Include an Environmental Policy that is signed by the Chief Executive(s) of the Contractor and is consistent with Sydney Water's Environmental Policy.

The Contractor must develop a Management Review process as part of the EMS. The Management Review process will be required to ensure the scope of the EMS is maintained to apply to all inputs, outputs and activities under the D&C Contract and identify opportunities for continual improvement. The Contractor must include the Company's participation in the Management Review process. The Management Review procedure must require review of the system on an annual basis or such other frequency as agreed to by the Company.

The Contractor must establish the extent of the Company interfacing deemed necessary to implement its systematic environmental management approach for the Project.

2.1 Integration of Management Systems

Sydney Water maintains an EMS certified to ISO 14001:2004. The Contractor's EMS must be integrated with applicable aspects of Sydney Water's EMS. This requirement must continue to apply whether or not Sydney Water continues to maintain certification of its EMS. The Contractor is referred to the SWEMS guidance documents included in Appendix A. The Contractor's EMS must facilitate smooth transfer of reporting information to meet Sydney Water's EMS reporting obligations.

The Contractor's EMS must be integrated with the Contractor's project controls and systems for the Project including, but not limited to quality systems, document control, community consultation processes, and occupational health and safety systems. The Contractor's EMS must integrate environmental management activities of the Contractor and any sub-contractors. The Company will consider proposals for an integrated management system (IMS) addressing any combination of project management aspects, however certification of any such IMS must include certification to ISO 14001:2004.

The EMS must detail measures to ensure it is integrated with the Operator's EMS to cover any period of overlap such as testing or commissioning.

2.2 EMS Documentation

The Contractor must commence preparation of the Project specific EMS immediately upon award of the D&C Contract. The Contractor and Operator must produce two separate EMSs.

The EMS documentation must be finalised prior to the commencement of construction. Following verification by the Independent Verifier and prior to commencement of construction, the Contractor must provide the Company with a complete final EMS that addresses all activities of the design, procurement, construction and commissioning phases of the Project. The final EMS must include all relevant environmental strategies, plans, programs, procedures and work methods relevant to the activities to be performed during these phases.

The Contractor must prepare (and implement) the EMS in accordance with AS/ANZ ISO 14001:2004.

3. Environmental Risk Assessment

Prior to the commencement of each stage of design and construction, the Contractor must conduct an Environmental Risk Assessment/s and record the outcomes in a register. A meeting must be arranged and chaired by the Contractor, with the Company and other stakeholders, as determined by the Contractor, in attendance. The purpose of the meeting is to ensure that the environmental risks associated with the Project are identified, properly assessed and effective risk control measures developed and agreed upon.

The Environmental Risk Assessment/s must be carried out in accordance with AS/NZS 4360:1999 for all activities for the Project, and must include:

- Assessment of the likelihood and consequences of environmental risks;
- Identification of environmental measures to eliminate or minimise the environmental risks; and
- Nomination of persons responsible for implementing the risk control measures and timeframes.

To the extent that it is not relevant to design or construction phase considerations, review of risk associated with operational and maintenance activities may be undertaken separately, prior to commencement of the operations phase or could be mitigated during the design phase of the Project.

The Contractor must review the environmental risk assessment at regular intervals throughout the duration of the D&C Contract and immediately following any incident or significant change in scope of activities to ensure that it remains up-to-date and effective for the Project.

The Contractor must conduct additional environmental risk assessment if the design and construction activities change so as to have additional environmental impact/s, which are not already considered in the existing risk assessment.

4. Design Phase Considerations

The Contractor must implement a design process and design management planning that addresses all known and potential environmental impacts, risks and obligations identified by (but not limited to) the following:

- Environmental Assessment;
- DEH referral (including additional information submitted) and the Commonwealth Minister's decision;
- Results/findings from monitoring program/s;
- Preferred Project Report, including the amended statement of commitments;
- Minister's Conditions of Approval (at both Concept and Project levels);
- Sydney Water Operating Licence;
- Contractor's Project specific EMS;
- Related approvals, permits, licences, concurrences, authorisations, etc; and
- Other relevant regulatory requirements.

The Contractor must consult with (and obtain the approval of) the Company for any proposed design changes to the Contractor's Proposal that potentially affect the environment in a manner not consistent with that documented in the earlier phases of Project planning. The approval of the Company will not reduce the responsibility of the Contractor for the design.

The design process must incorporate life cycle considerations in order to obtain demonstrated future environmental benefits during the construction, commissioning, operations and maintenance phases of the Project. Life cycle consideration in design must include consideration such as ease of disassembly for reuse or recycling, extent of recycled content in manufacture, maintenance, energy requirements, durability, service life, waste generation and raw material consumption.

Specific environmental considerations relevant to the Design Management Plan include but are not limited to the following:

- Design the Desalination Plant such that it can be constructed and implemented in stages (MCoA 1.7 Desalination Plant approval);
- Design of the Desalination Plant to incorporate energy recovery systems and energy efficient equipment to optimise energy efficiencies of the Desalination Plant operations (MCoA 2.1 Desalination Plant approval);
- During detailed design, opportunities for habitat connection on the Site should be considered (MCoA 2.4 Desalination Plant approval);
- Submit to DoP, for the approval of the Director General, details of the external façade of the building and structures (MCoA 2.15 Desalination Plant approval);
- Develop an Operational Noise Management Plan to outline monitoring, management procedures and measures to minimise total noise emissions from the project (MCoA 4.6(a) Desalination Plant approval);
- Discharge design requirements (MCoA 2.7 seawater intake and discharge system);
- Intake design requirements (MCoA 2.10 seawater intake and discharge system);
- Design and location of the seawater intake (MCoA 2.11 seawater intake and discharge system);

- Optimisation of the discharge design (MCoA 3.1(d) – (i) seawater intake and discharge system);
- Configuration of the design of the Desalination Plant to protect endangered ecological communities and threatened species within the conservation area (SoC 3);
- The design and layout of the Desalination Plant will retain the identified conservation area to avoid potential impact to indigenous archaeological values (SoC 9);
- Designs will be developed so that the seawater concentrate meets water quality criteria for relevant chemical and non-chemical parameters at the edge of the mixing zone (SoC 12);
- Seawater intake designs will be developed to reduce potential for marine biota, including larval species, to be drawn into the intake structures during operation (SoC 16);
- Design and construction of the Desalination Plant to minimise intake of marine debris as far as practicable and meet POEO Act provisions for no offensive odour emitted from the premises during operation (SoC 37);
- Stormwater management measures on all Project sites will be designed and constructed to effectively provide onsite detention and drainage generally in line with relevant guidelines (SoC 39);
- Intake and outlet tunnelling and any drilling activities will be designed and work practices developed to protect groundwater and sensitive groundwater dependent ecosystems from draining or migration of contaminants for implementation during construction (SoC 42);
- Tunnels will be designed and operational maintenance procedures developed to ensure no significant alteration of existing groundwater regime and groundwater use during operation (SoC 44);
- Visual impact of the Desalination Plant designed not to adversely impact on the identified Kurnell Peninsula National Heritage values and the conservation values of the Botany Bay National Park (SoC 45);
- Designs of the Desalination Plant will be developed that are consistent with the visual landscape from local and regional vantage points (SoC 51);
- Further screening of hazards associated with the Desalination Plant designs will be undertaken and a Preliminary Hazard Analysis undertaken (SoC 53);
- Measures to manage chemical use and storage risks will be developed for implementation during design and operation (SoC 54);
- Measures to reduce bushfire hazard risks to people and property in relation to the Desalination Plant will be developed (SoC 55);
- Maritime structures will be designed to minimise impacts on navigation, fishing activities and recreation use where practicable (SoC 61);
- Design measures and management procedures will be developed for implementation during construction to prevent or suitably mitigate, damage to properties, structures and infrastructure (SoC 62); and
- Designs will enable operation of the Desalination Plant as an interruptible energy supply, if required (SoC 64).

4.1 Ecotoxicity Assessment

Schedule 8 (Planning Approvals, Table 1, condition 2.7) identifies that the Company will provide performance specifications in relation to ecotoxicity and the Contractor must ensure its design meets the specifications. The specifications will be developed following from the ecotoxicity assessment undertaken by Sydney Water in its pilot testing program.

The Contractor will be responsible for any further ecotoxicity assessment (ie. beyond that undertaken by Sydney Water's pilot testing program) necessary to demonstrate compliance with MCoA 2.7, subject to the following occurring.

If chemicals and/or dosing rates different to those used in the pilot plant testing are proposed for the full scale plant and Authorities request additional testing, then the Contractor will bear (in full) any time and/or cost impacts arising from the potential need for any further ecotoxicity testing

If the results of Sydney Water's ecotoxicity assessment are inconclusive or flawed and result in the Authorities requiring the assessment to be repeated, the Company would be responsible for any related time and/or cost impacts.

5. Environmental Management Planning

5.1 Hierarchy

The Contractor's environmental management planning for the Desalination Project must be hierarchically structured upon the Requirements for Management Plans and the Contractor's Project specific EMS. Environmental management planning is to be reflected in all Project Phase Management Plans (ie. design, procurement, construction, commissioning).

The Contractor's EMS must provide the first tier of environmental management planning, by identifying which environmental aspects, impacts, risks and obligations are required to be managed. The Contractor's EMS must clearly document this requirement, in a manner that translates effectively to lower tier environmental management planning.

The Contractor's Construction Environmental Management Plan (CEMP) forms the second tier of the Contractor's environmental management planning for the Project. The CEMP must provide a centralised mechanism through which all environmental aspects, impacts, risks and obligations are to be managed. The CEMP must not duplicate environmental management planning documentation associated with issue specific management plans. Appendix B provides more information regarding the Company's general requirements for the Contractor's CEMP.

The third tier of environmental management planning must take the form of issue specific environmental management plans. The Contractor is required to develop and implement issue specific environmental management plans arising from the MCoA obligations and PPR commitments including the following:

Plan required	Relevant Minister's Conditions of Approval (MCoA) and/or Statement of Commitment (SoC)
Biodiversity Protection Plan	MCoA Plant – 4.2b
Conservation Area Management Plan	MCoA Plant – 4.6b. Note that MCoA refers to this as an Operational Environmental Management Plan but the Company seeks to have this developed in the construction phase and to be applicable to both phases
Construction Dust Management Plan	SoC 36
Construction Erosion and Sedimentation Control Plan	SoC 38 MCoA Plant – 2.11 MCoA I/O – 2.3
Construction Noise Management Plan	MCoA I/O – 4.2b MCoA Plant 4.2d SoC 19(a) SoC 31(c)-(d)

Operational Noise Management Plan	MCoA Plant – 4.6a (i)-(iv)
Construction Surface Water Management Plan	MCoA Plant – 4.2c
Construction Traffic Management Protocol	MCoA Plant – 4.2e SoC 34(a) SoC 34(c)-(h). In accordance with the SoC, this needs to cover traffic management associated with intake and outlet works in addition to the Desalination Plant.
Contaminated Soil and Acid Sulphate Soil Management Plan	SoC 41 (excluding 41(b) MCoA I/O – 4.2a MCoA Plant – 4.2a
Spoil Management and Disposal Strategy	MCoA Concept – 5.3
Spoil Management Plan	MCoA I/O – 4.2c SoC 27(a)-(g) SoC 28(a)-(d)
Waste Management Plan	SoC 57

There are other management measures in the Statement of Commitments that Sydney Water has not identified as being part of a management plan. The Contractor may choose to incorporate any of these items into a relevant management plan as listed above.

Additional issue specific environmental management plans may be required, as a consequence of the Contractor's environmental risk assessment and future environmental regulator consultation.

5.2 Conservation Area Management Plan

Condition 4.6(b) of the MCoA – Desalination Plant, requires a Conservation Area Management Plan (Plan) to be developed in consultation with the Department of Environment and Conservation (DEC) and to be submitted for approval by the Director-General of the Department of Planning (DoP) prior to the commencement of operations.

Sydney Water will develop the Plan (in consultation with DEC) and get the Plan approved. The Contractor should note that during the last two seasons WIRES volunteers have been involved in the ongoing management of the Grey-Headed Flying-Fox camp in the Conservation Area. WIRES volunteers have been assisting in the fly out counts, ongoing monitoring of the camp and in consideration of a protocol for heat stress events. As such the Company has a preference for the continued involvement of WIRES in the management of the Conservation Area. WIRES will be approached by the Company to continue their involvement in the management of the Conservation Area, and specifically for the Grey-Headed Flying-Fox camp. In the event that, subsequent to the engagement of the Contractor and Operator, WIRES is no longer able or interested in continuing to do this, an equivalent native fauna care group, or groups, must be approached by the Contractor and Operator. Sydney Water will be responsible for management of the Conservation Area in accordance with the Conservation Area Management Plan until execution of the D&C and O&M

Contracts. The Contractor and Operator will be responsible for managing the Conservation Area in accordance with the Conservation Area Management Plan after execution of the D&C and O&M Contracts for the duration of the respective Contracts.

5.3 General requirements

The Contractor's environmental management planning must be prepared and implemented in accordance with (but not limited to) the requirements of the D&C Contract and, as a minimum, be consistent with the assessment findings, commitments and obligations arising from the following:

- Outcomes of the Contractor's Environmental Risk Assessment;
- Environment Management Plans developed by the Contractor or Sydney Water's Contractors for pilot plant operation, the Plant site, conservation area, geotechnical and contaminated site investigations and any other work undertaken prior to the award of the D&C and O&M Contracts;
- Environmental Assessment of the Concept Plan for Sydney's Desalination Project;
- DEH referral of the Desalination Project;
- CEMP requirements contained in Appendix B, to the extent that they are not otherwise covered by the MCOA;
- Preferred Project Report, including amended statement of commitments;
- The Minister for Planning's Conditions of Approval (MCoA); and
- The requirements of any Law.

The Contractor's environment management planning must detail all applicable work under the D&C Contract, including sub-contracted work. The Contractor's environment management planning must take into account the interfaces with the Company's and Sydney Water's ongoing operations and with the work of any other contractors or persons who may be undertaking work simultaneously on the Site. The Contractor will remain fully responsible for the development and implementation of all environmental management planning, including that involving any sub-contracted Project activity.

Environmental management planning documents required by the MCoA, which require approval by DoP, must be submitted by the Contractor to the Company in draft format for review, comment and endorsement, at least 10 business days prior to their submission to the DoP for approval. The Company will require five business days for review, comment and endorsement of these documents.

Environmental management planning documents required prior to commencement of construction by the MCoA, which do not require approval by DoP, must be submitted by the Contractor to the Company following verification by the Independent Verifier and prior to the commencement of the project activity to which they apply.

Environmental management planning documents required prior to commencement of construction by the SoC must be submitted by the Contractor to the Company following verification by the Independent Verifier and prior to the commencement of the project activity to which they apply.

A similar approach would be implemented should additional environmental management plans be required as a result of future environmental regulator consultation. Endorsement by the Company of the environment management planning document/s is not to be taken by the Contractor as evidence that the Contractor complies with the terms of the D&C Contract or any Law.

The Contractor must implement the Contractor's environment management planning, including monitoring the work and carrying out adequate audits and site inspections to ensure that environmental control measures are in place and that any environmental risk arising out of or in connection with the performance of the D&C Contract. The Contractor must ensure that its employees and sub-contractors are familiar with the requirements of the Contractor's environmental management plan/s. A copy of the Contractor's environmental management plan/s must be readily available on the Site.

The Contractor must ensure that its employees and subcontractors are familiar with the requirements of the Contractor's environment management planning measures/documents. A copy of the Contractor's environment management plan/s must be readily available on the Site and at relevant design offices.

Changes to the reviewed and signed off Contractor's environment management plan/s may be made by the Contractor at any time. However, any changes must be submitted to the Company no less than 14 days before their implementation unless otherwise agreed by the Company. The Company may also request changes to the Contractor's environment management plan/s at any time.

The Contractor must review the Contractor's environment management plan/s at regular intervals throughout the duration of the D&C Contract and ensure that they are up-to-date. The Contractor must revise the environment management plan/s when any of the following occurs (but not limited to the following):

- An inconsistency with environmental requirements is detected through monitoring and audits;
- Identification of improvement opportunities;
- The Contractor's environment management planning does not adequately reflect the environmental management requirements of the D&C Contract or adequately respond to environmental risks and compliance requirements identified within the EMS;
- The Contractor amends its Project design, construction method, implementation or Project program; or
- The scope of works as identified in the Environmental Assessment and the PPR changes due to design factors or due to other requirements of the Company.

The Contractor must conduct additional environmental management planning at any time under the D&C Contract if the design and construction, activities change so as to have additional environmental aspects, impacts, risks and obligations which are not already considered in the existing environmental management planning.

5.4 Environment Incidents

The Contractor must develop an environment incident management plan as part of the EMS to prepare for and respond to potential emergency situations and accidents to prevent or mitigate associated environmental impacts. The plan must be integrated with any Project Incident Management Plan.

The environmental incident management plan must include protocols that identify how sampling required to respond to incidents is to be managed by the Contractor, with appropriate involvement and/or notifications to the Company. All incidents must be reported to the Company within agreed timeframes.

The Contractor must review the environmental incident management plan and relevant risk register at regular intervals throughout the duration of the D&C Contract and at a minimum immediately following any incident to ensure that it is up-to-date.

6. Environmental Monitoring

The Contractor must identify, scope and perform ongoing environmental monitoring for environmental management of the Project and to verify compliance with the Environmental Assessment (EA), Preferred Project Report (PPR), Referral to Department of Environment and Heritage (DEH), Minister's Conditions of Approval (MCoA) and Statement of Commitments (SoC) during design and construction. The Contractor's environmental monitoring responsibilities must include but not be limited to:

- All monitoring requirements of the MCoA and SoC identified as the responsibility of the Contractor in Schedule 8;
- All monitoring identified by the Contractor as being required to verify compliance with any licences, approvals, concurrences and/or permits, including the EA, PPR, Referral to DEH, MCoA and SoC;
- All monitoring required under any licences, approvals, concurrences and/or permits obtained by the Contractor;
- All monitoring associated with environmental management plans for the project;
- Collection of data required by Clause 7.1 of Sydney Water's Operating Licence in relation to the Project, in a format suitable to the Company and Sydney Water (see Appendix C);
- Identification of the need for further terrestrial monitoring (and the extent of this monitoring if it is required) based on the results of monitoring undertaken by the Company or Sydney Water (e.g. in relation to groundwater, flora, fauna, surface water, soil/land contamination);
- Monitoring required by the Conservation Area Management Plan.

The Contractor must ensure that the monitoring that it proposes to undertake does not duplicate the monitoring to be undertaken by the Company and is consistent with the requirements of the Marine and Estuarine Monitoring Program (MEMP), which is a requirement of Condition 3.1 of the MCoA – Intake and Discharge System. Sydney Water and the Company will develop and implement the MEMP (including consultation with DEC and DPI and submission to relevant agencies), with the exception of the following which are the responsibility of the Contractor:

- The monitoring of all construction phase activities with the potential to impact on the marine and estuarine environment (as per the MEMP). ;

The extent, nature, timing and implications associated with all environmental monitoring for the Project are iterative and must inform ongoing environmental management. The Contractor will need to remain flexible with respect to this aspect of environmental management.

The Contractor must submit its final program and procedures for environmental monitoring as part of the EMS documentation. The Contractor must submit to the Company on a monthly basis the results of all monitoring carried out in the previous month for Operating Licence reporting and the Company's record.

7. Environmental Induction

The Contractor must provide all of its employees and sub-contractors adequate environmental induction and training to ensure all activities/tasks are undertaken in a manner that minimises the risk to the Environment. The Contractor’s Environmental Induction may be reviewed by the Company prior to its implementation.

8. Site Inspections

The Contractor must conduct regular site inspections to ensure that environmental controls are in place, the risks are identified and that the Contractor's employees and subcontractors properly implement the Contractor's EMS and environmental management programs. The Company may also conduct site inspections, which will not relieve the Contractor's responsibilities.

9. Environmental Audits

The Contractor must undertake routine and random compliance and systems audits to verify that the work under the D&C Contract complies with the Contractor's EMS, environmental management planning and the relevant regulatory requirements to prevent potential environmental incidents, improve management practices and demonstrate due diligence.

The first D&C phase compliance and systems audit must be within 3 months of the commencement of construction activities and then at least every 6 months thereafter. The Independent Verifier and/or the Company may require more frequent auditing if an environmental audit indicates significant deficiencies with the Contractor's environmental management.

The Independent Verifier and/or the Company may audit the Contractor's EMS and environmental management plans at any time to evaluate the effectiveness of the EMS/Plans and the level of compliance with them. The Independent Verifier and/or the Company may report any identified non-conformance to the Contractor. Audits of the Contractor's systems may be undertaken by third party auditors in relation to certification of Sydney Water's EMS and compliance with the Operating Licence.

On request of the Independent Verifier and/or the Company, the Contractor must make available all relevant environmental records including those of its subcontractors for auditing against the requirements of the Contractor's EMS and environmental management plans. The Contractor must provide all reasonable assistance during the audits, including attendance during the audit.

10. Non-conforming work practices

The Contractor must establish and maintain documented procedures to address nonconforming work practices and product for all phases of the Project in accordance with relevant clauses of ISO 9001:2000 and/or Clause 4.5.2 of AS/ANZ ISO 14001:2004.

The Contractor must establish a system of non-conformance reports to record all non-conformances detected and corrective actions. Should the Contractor detect a non-conformance which presents potential or actual significant or material environmental harm, the Contractor must immediately notify the Company, cease the nonconforming practice, rectify the nonconforming practice and implement corrective action to prevent reoccurrence. Corrective action must include at a minimum full investigation and review of any relevant manuals, procedures and plans following identification of any non-conformance.

11. Reporting and performance evaluation

The Contractor must assess environmental performance of itself and its subcontractors. This assessment must conform with established environmental performance evaluation standards/practices.

12. Regulatory requirements and legislative compliance

12.1 Identifying and obtaining approvals

Sydney Water has reached agreement with the Department of Planning for staging of pre-construction compliance obligations (refer Sydney Water letter to Department of Planning dated 27 February 2007 and Department of Planning letter to Sydney Water dated 15 March 2007).

All necessary approvals, licences, permits and concurrences not obtained by Sydney Water or the Company must be obtained by the Contractor prior to the commencement of any work that relates to each approval, licence, permit or concurrence.

In seeking/obtaining an Environment Protection Licence under the *Protection of the Environment Operations Act 1997*, the Contractor must provide the initial terms of such a licence to the Company for review, comment and endorsement prior to agreeing to such terms. The Contractor should allow 15 business days for the Company's review, comment and approval and must provide the Company with a copy of such licences.

In seeking/obtaining or seeking to amend or modify any approvals, licences, permits and concurrences, the Contractor must provide the initial terms of any approval, licence, permit or concurrence for the Company's review and comment prior to agreeing to such terms. The Contractor should allow five business days for the Company's review and comment and must provide the Company with a copy of such approvals, licences, permits and concurrences.

12.2 Environmental Planning and Assessment Act

Infrastructure locations as indicated in the environmental assessment documents are indicative only. The design of the Project remains the responsibility of the Contractor. Designs must be consistent with the Project description and extent of impact described in the Environmental Assessment and PPR for the Planning Approval to be valid for the design.

The Contractor must advise the Company as soon as possible of any inconsistency of its preliminary and final design with the Project description or extent of impact as described in the Environmental Assessment and PPR. Any design that has impacts that have not been identified or addressed in the environmental assessment for the Project to date, and result in the need for any modification of existing planning approvals or the need for additional planning approvals, will be at the Contractor's own risk. The Company retains discretion as to whether or not to seek any such approvals. The Contractor must be responsible for undertaking all additional environmental assessment and preparation of associated documentation required to support any such modifications or additional approvals.

Should the Contractor wish to alter the design including location of any of the infrastructure the Company may require the undertaking of further Environmental Impact Assessment to assess consistency with the Planning Approval. The Company retains discretion as to whether or not to seek any modification of approval. No additional time for the contract will be allowed above that provided for a conforming design.

12.3 Environmental Impact Assessment Procedures

The Contractor must develop and implement environmental impact assessment (EIA) procedures, should the need arise for further environmental assessment of the Project. The Contractor's EIA procedures must comply with the requirements of the EP&A Act and all environmental laws and must be consistent with the relevant environmental impact assessment procedures contained in Sydney Water's EMS. The Contractor must submit any draft EIA procedures for review and endorsement by the Company prior to commencing the EIA. The Contractor should allow 10 business days to obtain endorsement of the procedures.

12.4 Environment Protection and Biodiversity Conservation Act

The Commonwealth Minister for Environment and Heritage has determined that the Project as described in Sydney Water's referral to the Commonwealth is not a controlled action and hence does not require approval from the Commonwealth. The Contractor's design must be consistent with the Project description and extent of impact described in the Environmental Assessment and PPR, to avoid the need for Commonwealth approval being required for the design.

The Contractor must advise the Company as soon as possible of any inconsistency of its design with the Project description or extent of impact in relation to matters of national environmental significance as described in the Environmental Assessment, PPR and the DEH referral documentation. At the Company's discretion, the Company will be responsible for making any additional referrals or seeking any approvals under the EPBC Act from the Minister for Environment and Heritage. Any design that has impacts that have not been identified or addressed in the DEH referral and result in the need for an additional DEH referral/s will be at the Contractor's own risk. The Contractor will be responsible for undertaking all additional environmental assessment required to support any such referral/s.

12.5 Sydney Water's Operating Licence

Sydney Water is granted an Operating Licence by the Governor of New South Wales to enable it to lawfully provide services within its area of operations. To demonstrate compliance with its Licence conditions Sydney Water is required to report to a range of agencies on its operations. (Clause 11.1.2 of the 2005-10 Operating Licence specifies that contracting out of services does not relieve Sydney Water of its responsibilities to comply with its obligations under its licence.) Thus the Contractor must comply with the quality and performance standards in the Operating Licence and maintain records and systems that are sufficient to enable it to measure accurately its performance against Operating Licence requirements.

Appendix C sets out the relevant licence conditions, the potential reporting requirement and current reporting frequency for Sydney Water.

Sydney Water is subject to an annual operational audit of its Operating Licence, conducted by the Independent Pricing & Regulatory Tribunal (IPART). The Contractor must provide information requested by IPART for the purpose of any audit, including information which is confidential or privileged.

Sydney Water prepares a six monthly and annual report to the Minister on its performance against the Operating Licence. These reports are due in March and September each year. The Contractor must provide their information in time for the Company and Sydney Water to meet these deadlines.

12.6 Monitoring Compliance

The Contractor must monitor and evaluate compliance with all applicable legal requirements during all phases of the Project. The Contractor must develop and implement a documented compliance monitoring system that addresses all aspects of environmental compliance, including (but not limited to) the following:

- Environmental Assessment;

- DEH referral (including additional information submitted) and the Commonwealth Minister's decision;
- Preferred Project Report, including the amended statement of commitments;
- Minister's Conditions of Approval (at both Concept and Project levels);
- Environment Protection Licensing;
- Sydney Water Operating Licence;
- Related approvals, permits, licences, concurrences, authorisations, etc; and
- Other relevant regulatory requirements.

13. Independent verification

An Independent Verifier will be engaged by the Contractor and the Company under the terms of the Independent Verifier Deed.

The Independent Verifier's functions and responsibilities for environmental management and compliance are defined within the Independent Verifier's Deed and D&C Contract.

In order to guarantee compliance with the Company's environmental obligations and commitments, the Company may provide a further verification function to any of the services defined in the Independent Verifier's scope, including, but not limited to, the following:

- Joint or co-verification and surveillance, liaising and interacting with both the Contractor and the Independent Verifier on an as needs basis (particularly in relation to endorsement of certificates issued in accordance with the Contractor's Compliance Management Plan and the issuing Certificate of Completion);
- Review of the level and efficacy of surveillance being carried out by the Contractor /Independent Verifier and the associated decisions/judgements made in relation to environmental performance and compliance;
- Attend audits of the Contractor's Management Plans and inspect (sites) and audit both the Contractor and the Independent Verifier independently if required;
- Review Independent Verifier Project Control Group reporting and contribute to relevant discussion;
- Independent reporting to the Project Control Group on environmental performance and compliance;
- Independent liaison with stakeholders/regulators to gauge the level of satisfaction being achieved by the Contractor and/or the Independent Verifier (eg, in the compilation of design phase management plans) and stakeholder/regulator views and opinions regarding the level of compliance and environmental performance being achieved by both the Contractor and the Independent Verifier; and
- Direct liaison with the Company Project Manager on matters presenting high risk to Sydney Water's reputation and/or material harm to the environment.

Appendix A

Sydney Water EMS guidance documents

SW Environment Policy

SW Environmental Management System Manual

SW Operating Licence

SWEMS0001.01 – EMS Steering Group Charter

SWEMS0001.03 –- Responsibility Matrix by Position

SWEMS0002 – Environmental Aspects and Impacts Procedure

SWEMS0003 – Legal and Other Requirements Procedure

SWEMS0003.01 – External and other Requirements Procedure

SWEMS0005 – Environmental Risk Management Procedure

SWEMS0007 – Communications Procedure

SWEMS00010 – Monitoring and Measurement Procedure

SWEMS0011 – Records Management Procedure

SWEMS0013 – Audit Procedure

SWEMS0014 – Management Review Procedure

SWEMS0015 – OC Managing Environmental Issues in SWC Contracts Procedure

SWEMS0015.04 OC GS 03 Environmental Management

SWEMS0015.09 OC Environmental Work Method Statement.

SWEMS0015.10 OC EMR Roles and Responsibilities.

SWEMS0016 – OC Environmental Purchasing Procedure

SWEMS0017.01 Record of Pesticide and Herbicide Use Form.

SWEMS0026.01 – CEMP Template

SWEMS0031 – Heritage Management Procedure

SWEMS0033 – Property Maintenance Activities Procedure

SWEMS0034 – OC Environmental Considerations for Property Acquisition Procedure

SWEMS0035 – OC Environmental Considerations for Property Disposal Procedure

SWEMS0036 – Heritage Maintenance Procedure

SWEMS0038 – Significant Environmental Impacts

SWEMS0051 – Environmental Education Program

Appendix B

Management Plan Requirements

Contractor’s Environmental Management System

The Contractor’s Construction Environmental Management Plan (**CEMP**) must include information that places the CEMP within the context of the Contractor’s Environmental Management System.

1. Contractor’s Construction Environmental Management Plan (CEMP)

1.1 Scope of Contractor’s CEMP

The Contractor’s CEMP must:

- address construction activities associated with all key construction sites, including staging and timing of the proposed works;
- contain the Management Plans required by the Minister’s Conditions of Approval (MCoA) and Statement of Commitments (SoC) as presented in the Preferred Project Report (PPR); and
- include:
  - Identification of the regulatory, statutory and other obligations relevant to the works under this document, including all licences, permits, approvals and consultations/agreements required from authorities and stakeholders;
  - The role of the Environmental Management Representative (EMR) as detailed in SWEMS0015.10 OC EMR Roles and Responsibilities, and the role of the Contractor’s Environmental Representative (CER);
  - Definition of the role, responsibility, authority and accountability for personnel relevant to the Contractor’s CEMP;
  - Measures identified in the Environmental Assessment (EA), PPR and SoC to avoid and/or control environmental impacts;
  - Monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental management of the activities under this Contract, including performance criteria, specific tests, protocols (eg. frequency and location) and procedures to follow;
  - Environmental management procedures and Work Method Statements (WMS) for all activities and processes that rank as 'high environmental risk' following completion of the Environmental Risk Assessment complex environmental control processes which do not follow common practice or where the absence of such instructions could be potentially detrimental to the environment;
  - Steps the Contractor intends to take to ensure that all plans, procedures and WMS are being complied with;
  - Consultation requirements with relevant government agencies; and
  - Community consultation and notification strategy (including local community, relevant government agencies, relevant councils), and complaint handling procedures.

The Contractor's CEMP must include all the requirements detailed in SWEMS0015.04 OC GS 03 Environmental Management.

The Contractor must provide one bound copy and one unbound copy of the Contractor's CEMP to the Company following verification by the Independent Verifier and prior to commencement of construction.

1.2 Contractor's CEMP template

The Contractor is referred to the following template documents as a guide to Contractor CEMP development:

- Sydney Water's Construction Environmental Management Plan (CEMP) template, (SWEMS0026.01 OC Construction EMP Template); and the
- NSW Department of Infrastructure Planning and Natural Resources (DIPNR) Guideline for the Preparation of Environmental Management Plans.

1.3 Work site maps

The Contractor must provide maps in the Contractor's CEMP which illustrate:

- Location of work sites, offices and compounds;
- Location of Site access points;
- Stockpiles (including waste skips and stockpiles for recycling);
- Location of areas to be cleared;
- Areas of environmental sensitivity, including threatened species and habitat areas and vegetation cover both native and exotic;
- Topographic features including slopes, watercourses and drainage lines;
- Location of heritage items, including potential archaeological deposits (PADS);
- Location of environmental controls; and
- Monitoring sites.

1.4 Regulatory requirements

The Contractor must fully comply with the requirements of all Law.

The Contractor must attach a copy of all relevant regulatory approvals, permits, licences, conditions and agreements to the Contractor's CEMP.

Each necessary approval, licence and permit not obtained by the Company's representative must be obtained by the Contractor prior to the commencement of any work that relates to that approval, licence or permit. This constitutes a HOLD POINT.

1.5 Resources

The Contractor must provide a sufficient level of resources at the Site(s) to ensure effective environmental management throughout the duration of the Contract.

The Contractor must indicate the names, responsibilities and authority of the Contractor's site management personnel who have primary responsibility for implementing the Contractor's CEMP, monitoring its effectiveness, rectifying any environmental deficiencies, controlling further construction activities until deficiencies are rectified and keeping the contractor's environmental records. A record is to be maintained of the qualifications of each individual primarily responsible for environmental management.

1.6 Contractor's Environmental Representative

The Contractor must employ a designated Contractor's Environmental Representative (CER) that must responsible for:

- Ensuring the system of environmental management is planned, documented, implemented and maintained in accordance with the requirements of this Contract;
- Reporting to the company's representative on the Contractor's environmental performance, including non-conformances, and compliance with all regulatory requirements including the MCoA;
- Ensuring the details of the Contractor's CEMP accurately reflect the Contractor's construction activities;
- Facilitating environmental induction and training of all site personnel including subcontractors; and
- Undertaking routine and random site inspections and audits. Site inspections must be undertaken daily unless otherwise agreed by the Company.

The CER must have the authority to:

- Stop work immediately if in the view of the CER an unacceptable impact is likely to occur or to require other reasonable steps to be taken to avoid or minimise any adverse impacts, at no cost to the Company; and
- Report any such occurrences to the Company's representative, as soon as practicable, or no later than 24 hours from the commencement after stopping work.

The Contractor must give prior notice of critical construction activities to ensure the Company's representative, the Environmental Management Representative (EMR), is present on-site.

The relationship between the Company's EMR and the CER, as well as the CER's internal reporting structure, must be detailed in the Contractor's CEMP. Refer to SWEMS0015.10 OC EMR Roles and Responsibilities.

The CER must have appropriate environmental undergraduate and/or postgraduate qualifications, at least 5 years suitable industry experience and demonstrated experience in construction environmental management. The representative must have qualifications complying with the principles of AS/NZS ISO 14012:2004 Guidelines for Environmental Auditing: Qualifications Criteria for Environmental Auditing.

The CER must be allocated to the project on a fulltime basis and must be located on site, and be available to travel to any area on a daily basis as needed.

The CER must not be changed without the prior acceptance by the Company's representative.

1.7 Subcontractors

The Contractor must ensure all requirements of the Contractor's CEMP and this document are communicated to subcontractors and included in the subcontractors contract or agreements.

The Contractor must undertake appropriate monitoring of each subcontractor's work to ensure the specific environmental requirements are effectively implemented.

The Contractor must maintain a list of each subcontractor's duties and responsibilities for planning, implementing and monitoring environmental protection measures.

1.8 Training, awareness and competence

The Contractor must ensure that all staff and subcontractors working on the Site are provided with site-specific environmental training to achieve a level of awareness and competence appropriate to their assigned activities.

The Contractor must train relevant employees to use plant and materials efficiently and minimise all potential environmental impacts which will include but is not limited to noise, air and water quality, waste and contamination.

The Contractor must establish and maintain a register of environmental training carried out, including dates, names of persons trained and trainer details.

1.9 Work Method Statements

Work Method Statements (WMS) for critical construction activities must be prepared for all work activities identified at the environmental risk assessment meeting (as per GS-03.4) as carrying a high environmental risk. The WMS must be prepared in accordance with SWEMS0015.09 OC Environmental Work Method Statement and must be incorporated in the Contractor's CEMP. WMS must be developed in accordance with Contractor's CEMP provisions.

The adequacy of each WMS must be reviewed by the Contractor at the site prior to commencement of the work and revisions must be made as necessary to address any risk posed by changed conditions.

The Contractor must ensure that all its employees, subcontractors and consultants are familiar with and follow the requirements of the relevant WMS. A copy of the relevant WMS must be readily available on the site.

The WMS must include the method of restoration in each particular area. The WMS must be submitted to the Company following verification by the Independent Verifier and prior to commencement of a high risk construction activity. All work must be carried out in accordance with the approved WMS.

The Contractor must ensure that WMS incorporate the main environmental system elements that may be affected which include, but are not limited to: noise and vibration; air quality; water quality; erosion and sedimentation; access and traffic; property acquisition and/or adjustment; aboriginal and non-aboriginal heritage; groundwater; acid sulphate soils; stockpiling and disposal; waste/resource management; weed management; flooding and stormwater control; visual screening; landscaping and rehabilitation; hazards and risks; energy use; spoil management; contamination resource use and recycling, and utilities.

1.10 Record of pesticide and herbicide use

The Contractor must provide to the Company's representative records of pesticides and herbicides use in accordance with the requirements of the Pesticides Amendment (Records) Regulation 2001. The Contractor must supply the relevant records in the format indicated in SWEMS0017.01 Record of Pesticide and Herbicide Use Form. Records must be verified by the Contractor's relevant on-site supervisor.

(Note that records of pesticides and herbicides use are unnecessary if all of the following criteria are satisfied:

- The pesticide or herbicide is available to everyone for home and garden use, and

- The pesticide or herbicide is used in small quantities:
- For outdoor use – Quantities not more than 5 litres/5 kilograms of concentrated product, nor 20 litres/20 kilograms of the ready-to-use product, or
- For indoor use – Quantities not more than 1 litre/1 kilogram of concentrated product, nor 5 litres/5 kilograms of the ready-to-use product, and
- The pesticide or herbicide is applied by hand or by using hand held equipment only).

2. Contractor's CEMP Implementation

The Contractor must develop management plans as part of the Contractor's CEMP. Each plan must contain:

- A description of actions required to implement, monitor or maintain control measures;
- Persons responsible for these actions;
- Timeframe and frequency required to implement, monitor or maintain control measures;
- Acceptance criteria or performance indicators;
- Reference to specific records and relevant procedures (if applicable); and
- Relevant requirements listed in the MCoA.

Reference must be made to TS–09 for a table of management plans required for construction by the MCoA and SoC. Management plans required by the MCoA and SoC must be appended to the CEMP. The CEMP must not duplicate measures detailed in the management plans required by the MCoA and SoC.

The CEMP must also include management measures and strategies for environmental issues relating to the construction phase arising from the following:

- Outcomes of the Participant's Environmental Risk Assessment;
- EA of the Concept Plan for Sydney's Desalination Project;
- DEH referral of the Desalination Project;
- PPR including the amended SoCs;
- MCoA; and
- The requirements of any specific licences, approvals and permits required for this project.

All sampling and analysis must be in accordance with Department of Environment and Conservation's (DEC) approved analytical methods. All laboratories undertaking the analysis of samples should be accredited by the National Association of Testing Authorities Australia (NATA).

Particular measures to protect the environment which are specified herein may, with The Company's representative's approval, be substituted for measures which achieve the same environmental result but which are preferred because of cost or operational efficiency.

2.1 Air quality management

The Contractor must plan and implement measures to ensure that all its construction facilities and work sites, including stockpiles, are designed and operated to minimise the release of noxious emissions, exhaust smoke, odour, cement dust and other substances into the atmosphere.

The Contractor must identify strategies to minimise air emissions to meet or exceed regulatory requirements, including the National Environmental Pollution Measure for Air Quality (NEPM) (http://www.ephc.gov.au/nepms/air/air_nepm.html), the EPA Odour Policy (2001): Assessment and Management of Odour from Stationary Sources in NSW (http://www.epa.nsw.gov.au/air/odour.htm) and the POEO Act part 5.4.

All construction vehicles must be maintained and covered as needed to prevent any loss of load, whether in the form of dust, liquid, solids or otherwise. The vehicles must be maintained and facilities installed at exit points of all unsealed areas such that vehicles will not track mud, dirt or other material onto any street or road which is opened and accessible to the public. In the event of a spill, material must be removed within 24 hours.

The Contractor must ensure that all plant and equipment at the site, or used in connection with construction works, are maintained and operated in a proper and efficient manner.

2.2 Waste and resource management

The Contractor must ensure that the generation of waste as a result of construction activities is avoided (where possible) and/or minimised. As a secondary measure, waste reuse, recovery and recycling is maximised.

2.3 Energy management

The Contractor must minimise the environmental impact of energy use by ensuring all construction activities include appropriate controls to minimise the consumption of all forms of energy (fuels, electricity).

Appendix C

Operating Licence Reporting

Sydney Water Operating Licence conditions requiring reporting from the Contractor and/or Operator

Operating licence condition	Summary of reporting requirement	Current frequency of reporting
3.1 Drinking water quality — standards **3.2 Drinking water quality — monitoring** **3.2 Drinking water quality — reporting**	Monitoring and reporting to be consistent with the NHMRC and ARMCANZ *Australian Drinking Water Guidelines 1996* for health and aesthetic guideline values, and with any additional requirements requested by the NSW Department of Health. NB: From 1 June 2006, compliance will be measured according to the 2004 Australian Drinking Water Guidelines.	Frequency of monitoring is dependent on the individual water quality parameter and the recommendations of the ADWG. Water is tested for Cryptosporidium and Giardia according to a monitoring plan agreed to by NSW Health. Monitoring varies by site depending on a risk assessment. For example, for Warragamba, Orchard Hills and Prospect WFPs, raw and treated water is sampled and analysed 6 days a week. At most other sites, raw water is sampled and analysed weekly, while treated water is sampled weekly but analysed only if raw water is positive. These arrangements may be subject to change during the life of the annual water monitoring plan. Sydney Water is required to report quarterly on water quality test results. Sydney Water must also comply with requests by NSW Health to provide additional information.
3.5 Drinking water — incident management	The Licence requires Sydney Water to immediately report any information or event in its operations that may have risks for public health. Accordingly the operator will be subject to the same condition.	As required

Operating licence condition	Summary of reporting requirement	Current frequency of reporting
4.7 Service quality and system performance indicators **Schedule 1 – 1 Drinking water quality**	The percentage of water tests that meet the Australian Drinking Water Guidelines 1996 (for system performance monitoring for indicator organisms). See also the requirements of clause 3.2	Quarterly
4.8 Asset management obligation **4.9 Reporting on the asset management system**	Summary of asset performance against agreed specifications.	TBA
6.1 Internal Dispute Resolution **6.2 External Dispute Resolution** **Schedule 2 Customer Service Indicators**	Notification of any complaints received and action taken or pending. Internal complaint handling procedures to be based on Australian Standard AS 4269 1995 Complaint Handling. Reporting of complaints is also required to meet indicators 1 and 7 of the Customer Service Indicators.	Six monthly
7.1 Environmental indicators **Schedule 3 Environmental Performance Indicators**	Each year Sydney Water must monitor, record, compile data and report on the environmental performance indicators in Schedule 3 for the immediately preceding financial year.	
1. Potable water drawn	1a. Total volume of potable water drawn by Sydney Water from all sources.	Six monthly

Operating licence condition	Summary of reporting requirement	Current frequency of reporting
7. Breaches of Statutory Instruments	7b. Total number of breaches of conditions relating to environmental impacts under licences issued by DEC for the water treatment plants. 7cTotal number of prosecutions and Notices (including Penalty Notices) issued to Sydney Water under the *Protection of the Environment Operations Act 1997*. 7d. Total number of prosecutions and Notices (including Penalty Notices) under the *Protection of the Environment Operations Act 1997* issued to contractors engaged by Sydney Water.	Six monthly
12. Water treatment residuals	12a. Total mass of water treatment residuals produced by Sydney Water. 12b. Water treatment residuals reused (where the reuse delivers a net environmental benefit) expressed as a percentage of total mass produced.	Six monthly
14. Waste	14a. Solid waste generated by Sydney Water 14b. Waste recycled or reused expressed as a percentage of solid waste generated.	Six monthly
15. Greenhouse gases	CO_2 equivalent emissions through purchases of electricity, fuel and gas	Six monthly
16. Electricity	16a. Total electricity consumed by Sydney Water. 16b. Total electricity consumption by water assets expressed as a function of water supplied (KWh/ML of water supplied). 16d. Electricity consumption from renewable sources or generated by Sydney Water expressed as a percentage of total electricity consumption.	Six monthly

Operating licence condition	Summary of reporting requirement	Current frequency of reporting
17. Contaminated land	Number of sites under the control of Sydney Water that present a significant risk of harm as defined under the *Contaminated Land Management Act 1997.*	Six monthly
19. Flora and Fauna	19a. Total area of clearing of native vegetation. 19b. Total area of native vegetation gain due to site rehabilitation, restoration or replanting by Sydney Water.	Six monthly
21. Noise	Total number of noise complaints generated from Sydney Water's construction or operational activities.	Six monthly
9.2 Demand Management Strategy	Information related to the water balance, particularly volumes supplied and any losses (similar to Environmental Indicator 1).	

Note: Any reporting must be undertaken in accordance with the *Monitoring and Reporting Protocol* (Independent Pricing and Regulatory Tribunal and Sydney Water, commencing 23 December 2005) or the version of that document applying at the time reporting is required. The Company can arrange to provide the Contractor with a copy of this document after execution of the D&C Contract.

Appendix D

Not Used

2

Volume

TS 011

Design and construct contract:
Schedule 14 company's requirements

TS 11

SYDNEY'S DESALINATION PROJECT

TS-11 Project Communications Requirements

TS-11 Project Communications Requirements

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1. Purpose

The purpose of the Project Communications for the Project is to:

- Ensure all stakeholders are appropriately informed about the Project and its impacts, including potential impacts, in a timely manner;
- Ensure information is available and accessible to the community and identified key stakeholders;
- Strategically engage with stakeholders to achieve Project objectives;
- Achieve seamless communications outcomes between the Contractor, the Operator, the Company, Sydney Water and its Alliance for the Distribution Infrastructure;
- Effectively position desalination within the context of the Metropolitan Water Plan (MWP) initiatives; and
- Reinforce public confidence in drinking desalinated water.

The Statement of Commitments contained in the Preferred Project Report for the Project must be met or exceeded. These include ensuring:

- The community and stakeholders have a high level of awareness of all processes and activities associated with the Project;
- Provision of accurate and accessible information; and
- High levels of responsiveness to issues and concerns raised by the community.

2. Outcomes

A successful communications program will achieve the following outcomes:

- Increased level of community trust;
- Sydney Water maintains and improves credibility with stakeholders and regulators;
- Enhanced corporate reputation for all parties;
- Community attitudes and behaviours aligned with key messages;
- Effective relationships built and maintained with the community;
- Minimal publicity about lack of consultation or communication;
- Benefits of the Project are broadly and regularly communicated;
- Potentially affected communities are aware of the likely impacts on their area;
- All stakeholders likely to be affected are advised of the Project and its likely impacts, clearly and regularly;
- All stakeholders groups likely to be affected are identified and alternative arrangements identified/proposed, as appropriate;
- All key stakeholders are identified and informed of Project activities; and
- General communications are current and accurate and readily available to any interested stakeholders.

3. Contractor and Operator Roles and Responsibilities

The Company will engage with the Contractor and the Operator to deliver the communications program. Each party's role is outlined in the following table.

Sydney Water is the approving authority for all and any communications, and communication related activities. The Company will nominate staff with appropriate authority and delegation to approve designated items and activities. The Company will identify to the Contractor and the Operator those consultation activities, meetings and events that it wishes to attend throughout the D&C and O&M Contract periods.

The Company will provide the Contractor with a Communications Strategy. The Communications Plan must be developed by the Contractor in collaboration with the Operator. This Plan must be developed and implemented by the Contractor during the D&C Contract and continue to be implemented by the Operator during the O&M Contract.

3.1 Roles Schedule

The Company	Contractor/Operator
Provide a Project Communications Strategy that covers all Project communications	Develop and implement a Project Communications Plan in support of the Project Communications Strategy and associated plans in consultation with the Company
Provide clear direction and guidelines on all aspects of Project branding	Implement all branding as prescribed by the Company
Provide guidelines for the customer service behaviours of contracted staff.	Exhibit behaviours that reflect Sydney Water's values and key messages and respect Sydney Water customers and provide them with a high standard of service
Provide Sydney Water Customer Complaints Procedure	Manage all complaints in accordance with procedure provided by the Company Report on all customer and stakeholder contacts All staff perform in a manner appropriate to the Sydney Water framework
Provide Sydney Water policy and procedure for issues management	Manage all issues in accordance with Sydney Water policy All staff perform in a manner appropriate to the Sydney Water policy and procedure
Coordinate the strategic direction for the Project Contracts	Work cohesively with the Company, Sydney Water and their contractors engaged in the Sydney Desalination Project

The Company	Contractor/Operator
Manage all external interfaces with all stakeholders. Attend all major communication and stakeholder engagement activities.	Provide staff and resources for communication and stakeholder engagement activities
	Provide logistics and operational support for events and stakeholder engagements
	Provide reports on events and engagement activities
Approve all Project communication activities	Submit all documents, events and activities for approval before they are finalised or actioned.
Provide Sydney Water guidelines for incident management	Design and manage incident management processes to implement Sydney Water guidelines
Manage all media contact and provide clear direction and guidelines on all aspects of media management	Comply with all directions and guidelines from the Company for media management Develop media management protocols for the information of all Project staff
Act as a champion and spokesperson for the Project at all times and liaise with key political stakeholders	Develop support materials and background information to support Project engagements
Maintain a 1800 freecall number and a Project-specific email account for desalination enquiries	Provide appropriate resources to staff the desalination telephone line and email account

4. Roles – Specific functions

4.1 Branding

Sydney Water's reputation must be protected and the strength of its brand maintained and improved as a result of the communications for this Project.

The Company will provide clear direction and guidelines on all aspects of Project branding. The Contractor must implement the branding strategy as provided by the Company during the D&C Contract, and the Operator must maintain this during the subsequent O&M Contract.

4.2 Complaints Management

The effective management and resolution of complaints is a key component of Sydney Water's Customer Service Strategy. It should be noted that a contact is considered to be a complaint if the issue is clearly or likely to have resulted from an action, omission, error, failure or policy of Sydney Water or its contractors or agents. A customer can make this contact at any time with any staff member or Sydney Water contractor e.g. in the field, in the office, at an event or a field trip.

The Sydney Water Customer Complaints Procedure provides a systematic approach to the management and resolution of all complaints from consumers external to Sydney Water received by employees or agents of the Corporation.

The overall outcomes of this procedure are to:

- Provide an effective process to respond to and resolve complaints;
- Ensure a high level of satisfaction on the outcome of a customer's complaint;
- Provide a transparent method of measuring and reporting customer complaints; and
- Provide a framework for continuous business improvement based on customer complaint information received.

The Company will provide guidelines for customer service behaviours. The Contractor and the Operator must exhibit behaviours that reflect Sydney Water's values and key messages and respect Sydney Water customers and provide them with a high standard of service.

4.3 Issues Management

The nature of the Project attracts ongoing interest from the media, community and other stakeholders. It is therefore essential that an issues management program be implemented on the Project.

The Company will provide its policy and procedures for issues management. The Contractor must design and implement issues management processes and procedures to identify and manage all issues in accordance with the framework provided by the Company during the D&C Contract. The Operator must continue to implement and maintain these processes during the O&M Contract.

The Issues Management Framework will include:

- The Issues Management Policy;
- The process for identifying and escalating an issue;
- Key points of interaction with the Company; and

- Process for monitoring issues.

4.4 Incident Management

Clear communication processes and protocols must be in place in the event of an incident. The Company will provide guidelines for the communications support required in an incident. The Contractor must design and implement incident management processes to implement the Company's guidelines during the D&C Contract. The Operator must continue to implement and maintain these processes during the O&M Contract.

4.5 Media Management

Sydney Water will at all times maintain control of all statements to media including in the event of an emergency, incident or regular media presence.

To ensure Sydney Water is maintained in a position of trust and credibility, it is essential that communications to media are accurate and timely. The Contractor and the Operator must comply with all directions and guidelines from Sydney Water for media management. The Contractor must develop and implement media management protocols for the term of the D&C Contract. The Operator must continue to implement and maintain these protocols for the Term of the O&M Contract.

The media management protocols must include:

- Media protocols for all staff;
- The approvals process for information prepared by the participant for provision to the media; and
- The processes for identification of positive news stories to be used in proactive media opportunities.

5. Sydney Desalination Project Communications Plan (Plan)

This Plan, prepared by the Contractor to implement Sydney Water's Communications Strategy, will provide for meaningful and appropriate communications throughout both the D&C and O&M Contracts. To this end the plan must be prepared by the Contractor in consultation with the Operator to allow a seamless transition of communications activities and responsibilities between the D&C Contract and the O&M Contract phases of the Project.

This Plan must detail all public and staff communications including:

- Website – internet and intranet;
- Fact sheets;
- Community newsletters;
- Staff communications;
- Correspondence;
- Community displays;
- Public meetings; and
- Presentations.

5.1 Contents – Overview

The Plan should include:

- Methodology;
- Project plan;
- Stakeholder identification;
- Issues analysis;
- Stakeholder database;
- Key messages;
- DCALB communications;
- Advertising;
- Monitoring and evaluation;
- Communication plan review;
- Resource plan
- Risk assessment; and
- Document profile.

5.2 Methodology

This section must detail the methodology, which must cater for both the D&C and O&M Contract periods, which may have varying needs and issues due to their different scopes of work and impacts. It should include:

- Statement of objectives and guiding principles;
- An outline of the communication approach; and
- A synopsis of communication tools to be used in the Project.

5.3 Project Plan

This section should include:

- Identification of each stage of communication activities;
- Identification of key milestones; and
- For each stage:
  - Communication objectives;
  - Communication milestones;
  - Communication tools to be employed;
  - All communication and stakeholder engagement activities to be implemented;
  - Identified issues and response;
  - Risks and opportunities for communications and engagement;
  - Key messages; and
  - Detailed responsibilities and resource plan.

5.4 Stakeholder Identification

The purpose of stakeholder identification in the Project is to:

- Understand the operating environment of the Project and the past, present and likely future positions and opinions of key stakeholders;
- Position Sydney Water and the Company to negotiate outcomes with key stakeholders who may or may not support Sydney Water's agenda;
- Develop and/or maintain effective engagement with key stakeholders; and
- Streamline stakeholder engagement against priority issues.

Stakeholders include those groups or individuals who support the program as well as those groups or individuals who oppose the program. Stakeholders may include:

- Local impacted individuals;
- Local impacted communities;
- Community groups;
- Peak bodies;
- Industry associations;
- Local councils;
- Local councillors;
- Members of parliament;
- Political parties;
- Political groups;

- Government agencies;
- Lobby groups;
- Special interest groups;
- Communities and individuals in those areas that may be impacted by the Project through receiving desalinated water or in the Plant construction zone; and
- Community of greater Sydney who are interested in the issue of desalination.

A 'stakeholder' of a project or activity may:

- Have an interest in local community issues;
- Live next door to or near the proposed activity;
- Be a key regulator of Sydney Water's business operations; or
- Be a government agency (state or local) with interests in Sydney Water activities.

At a project level:

- Represent a key customer group;
- Have strong or direct influence on strategic decisions in Sydney Water (eg through political process, or by legislation or other regulatory powers);
- Be able to strongly influence political opinion/direction/decision making on key strategic issues (eg PENGOs);
- Be politically active or has political affiliations;
- Be able to influence or control Sydney Water decisions about major capital expenditure; or
- Be able to influence or direct operational/technical decisions in Sydney Water.

This section should include:

- Identification of all stakeholders and the rationale for that selection;
- Procedures and protocols for engagement;
- The objectives of engagement with identified stakeholders;
- Guiding principles for stakeholder engagement;
- Procedures and protocols for engagement;
- A timetable of engagement; and
- Identification of staff with clear accountability for engagement with each stakeholder.

5.5 Issues Analysis

An essential component of the plan is an analysis of stakeholder issues. The analysis should be applied to all identified stakeholders and reference the tools and strategies to be employed to manage those issues. This section should include:

- Identification of key issues;

- The tools and techniques to identify, respond to and manage issues through the life of the Project; and
- The process to facilitate understanding of the issues amongst the Project team.

This section should also include desktop research on projects within Australia and overseas, which may have similar impacts in which the community and/or stakeholders would be interested and from which the Company and Sydney Water can learn.

5.6 Stakeholder database

An appropriate computer software application will be nominated by the Company. All stakeholder information relevant to the Project will be managed within this environment. All relevant team members will have access via this database to information about stakeholder contact, and also have the facility to record stakeholder contact information. All stakeholder details identified in section 5.4 must be entered into the nominated database.

5.7 Key Messages

Key messages are an integral part of all Project communications. They will provide a point of reference for all staff dealing with stakeholders and the community by articulating Sydney Water's Project objectives. This section should include:

- Key messages for the Project including details of the issues or actions that prompt them;
- Key messages relevant to a geographic area or targeted community;
- Process of approvals for key messages;
- Staff roles with primary task responsibility for preparation and approval of key messages; and
- Timetable for review and reissue of key messages.

5.8 DCALB communications

This section of the plan must detail the strategies for communicating with people of Diverse Cultural and Linguistic Backgrounds (**DCALB**). It should include:

- Guiding principles for communicating with DCALB individuals and communities;
- Procedures and protocols for communicating with DCALB communities and individuals;
- Communication tools and strategies for communicating with communities and individuals from a non-English speaking background; and
- Proposed use of translation services.

As a minimum, these strategies must meet NSW Government requirements and be responsive to local community characteristics.

5.9 Advertising

Although the NSW Government's advertising policy does not formally apply to State Owned Corporations, Sydney Water does operate within a context where the Government is its principal stakeholder. Sydney Water must approve all advertising prior to production throughout the life of the Project. This section of the plan should include:

- An advertising policy;
- Advertising objectives including an overview of how paid advertisements link with and will contribute to the communications plan;
- Advertising budget including media and production components;
- Details of the style, size and content of advertisements;
- Advertising Schedule including identified publications, target audience, publication circulation, readership, timing and frequency;
- A DCALB strategy; and
- Approvals process for development of advertising material.

5.10 Monitoring and Evaluation Program

The communications plan must include a program of measures to ensure it remains relevant through the life of the Project. This should include a schedule of update/review throughout the Project and the process for communicating the results of the review to relevant staff. This section should include:

- Timetable for reporting including complaints reporting;
- Appropriate monitoring and reporting tools;
- Staff with responsibility and accountability for reporting on the implementation of the Plan;
- Evaluation tool/s; and
- Schedule of evaluation/s.

5.11 Resource Plan

A comprehensive resource plan detailing all staff engaged in the communications team must be provided. This should include:

- An organisation structure for all stages of the Project;
- A plan that demonstrates staff numbers and roles across all phases of the Project; and
- Approvals procedures.

If applicable, this section should also include a Table of Responsibilities to nominate any area of activity that is the responsibility of the Company, and Sydney Water. This Table must clearly define:

- The tasks nominated;
- How the points of interaction will be managed;
- Points of review;
- Processes of approval;
- Calendar of activities; and
- Where applicable, notation of primary responsibility and supporting responsibility.

5.12 Risk Assessment

The purpose of a communications risk assessment is to identify and mitigate possible negative impacts on the Project. The assessment must identify the risk and detail appropriate mitigation and risk reduction strategies to reduce the possible impacts on the Project. The assessment should include the impact of:

- Communication materials that may be incomplete, inappropriate or incorrect;
- Staff who are ineffective, inappropriately skilled or not available; and
- Identification of key dependencies.

Key considerations for the assessment:

- The risk assessment process must adopt a consultative approach with relevant internal stakeholders;
- An appropriately qualified facilitator must lead risk assessment workshops;
- Risk assessment workshops must utilise appropriate risk assessment techniques; and
- Risk assessment records documenting actions and recommendations must be kept and made available for regular review.

5.13 Document profile

A table of all documents, including written, verbal and web-based communications, must be provided. This profile should include:

- Document/presentation title;
- Application of the document ie in what stage of the Project it will be used; and
- Proposed distribution.

Sydney Water will continue to host the Project Internet website. Written communications for the Project should include:

- Website;
- Fact sheets;
- Community newsletters;
- Written correspondence;
- Internal (Sydney Water) communication;
- Project team communications;
- Community displays; and
- Public meetings.

Verbal communications for the Project should include:

- Community meetings;
- Community displays;

- Public meetings; and
- Presentations.

6. Communication Activities

The communications plan must allow, as a minimum, for completion of the activities outlined in Tables 6.1 and 6.2.

Table 6.1 Communication Activities – D&C Contract

Activity	Deliverable	Details
Internal communications	Establishment of an intranet website	
	Monthly staff newsletter	Single, folded A3 size colour print
Photography	Photographic record of key milestones in building of the Plant. Include use of underwater and marine photography	Allow 4 hours per fortnight for the duration of D&C. This should include underwater and marine photography as required. Include also photography for the Plant opening. Photographs should be available in digital format.
Video	Document key milestones in development of the Plant	Allow 4 hours of a cameraman per month for the duration of D&C. This should include underwater and marine video as required. Include also video for the Plant opening. Video should be available in digital format.
DVD during D&C	Web-ready DVD style presentations for use on the Sydney Water website - professionally edited	A 2 minute edited video presentation that can be published to the Sydney Water website - refreshed every 2 months
DVD on completion of D&C Contract Works	Edited video and photography as required to produce a show-reel.	A 5 minute edited presentation
Signage	Display signage for the Site during D&C and O&M	Allow for a Site entry sign during D&C phase, PLUS a Site entry sign for O&M phase PLUS appropriate directional and locational signage at Plant completion. This item should include design, graphics and production of signs. It should also include an allowance for graffiti management
Community newsletter	Monthly publication, A4, full colour, letterbox dropped to ensure delivery date	Allow 50% of cost to produce and deliver for Kurnell community

Activity	Deliverable	Details
Graphics	High quality design and layout skills required to ensure compliance with Sydney Water corporate guidelines	Include graphic design for fact sheets, newsletter, advertisements, banners, presentations (PowerPoint), letterheads
Meeting facilities		Include 6 x hire of an appropriate meeting room in Kurnell area
Advertising		
• Sutherland Shire Leader	1/4 page adverts/advertorials, monthly	Allow equivalent of 1/4 page adverts/advertorials, monthly
• Sutherland Shire Leader	Public notices	Allow 12 public notice style adverts over the duration of D&C phase, PLUS 1 page advert for the Plant opening
• SMH & Daily Telegraph	1/4 page display adverts, quarterly	Allow equivalent of 1/4 page display adverts, twice per year for the duration of D&C phase, PLUS 1/2 page advert for the Plant opening
• Stakeholder magazines and newsletters	eg. Whale watchers, recreational fishers, commercial fishers	Allow equivalent of 2 x 1/4 page display adverts in relevant publications over the D&C phase
• Koori Mail		Allow equivalent of 2 x 1/4 page advertisements annually for the duration of D&C phase
1800 telephone number	1800 number will be shared between Alliance and JV	Allow 50% of the establishment cost for the 1800 number
Email	Establishment of appropriate email account for receipt of customer contacts	
Fact sheets	Designed, pdf'd & uploaded for use on the website. 6 x fact sheets, updated regularly as required. Printed as downloads as required	Designed, pdf'd & uploaded for use on the website. Minimum 6 x fact sheets, updated regularly as required. Printed as downloads as required
Notification of works	Hard copies of notifications, letterbox dropped	20 letterbox drops to affected residents/business/communities, PLUS print cost of notification flyers

Activity	Deliverable	Details
Banners	Design & production of 3 banners + include allowance to update as the Project progresses	3 x retractable style information/display banners. Allow budget to update banners as required as the Project progresses
Media events/key milestones	3 events per year. Associated collateral, advertising, catering	Allow for 30 people, marquee, catering, PA etc
Display site for D&C duration	Contribution of banners and advertising	
Plant Opening	Allow for 100 people	Include advertising, marquee, catering, PA

Table 6.2 Communication Activities – O&M Contract

Activity	Deliverable	Details
Media events/key milestones	1 event per year for 3 years. Associated collateral, advertising, catering	Allow for 30 people, marquee, catering, PA etc

2

Volume

TS 012

Design and construct contract:
Schedule 14 company's requirements

TS 12

SYDNEY'S DESALINATION PROJECT

TS-12 Safety Management Requirements

TS-12 Safety Management Requirements

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1. Occupational Health and Safety

1.1 General

The Occupational Health and Safety requirements contained in this Technical Schedule:

(a) may be in addition to, but are not in substitution for, any other requirements of any Law or regulations or of any condition in the D&C Contract or the O&M Contract; and

(b) will not be taken to limit the powers of the Company or the liabilities and responsibilities of the Contractor and Operator under the D&C and O&M Contracts respectively.

Attention is drawn to the requirements of the D&C and O&M Contracts where the Contractor and Operator are required to observe all the statutory/regulatory safety requirements and to provide for the protection of persons and property as part of the Contracts.

Attention is drawn to the NSW Occupational Health and Safety Act 2000 and Regulation 2001, which require that employers and employees ensure the health, safety and welfare of persons in the workplace.

The Contractor and Operator must, at all times, exercise any other necessary and reasonable precautions appropriate to the nature of the work and the conditions under which the D&C and O&M Contracts are to be performed for the safety of all persons on the Site, or in the vicinity.

Notwithstanding any other provisions of the D&C and O&M Contracts, the Contractor and Operator must cooperate where directed with any reasonable request by any representative of the Company to stop work where that representative considers the work to be unsafe.

The Contractor and Operator must provide equipment, training, personnel and documentation necessary to satisfy the requirements of the relevant Contract.

The Contractor and Operator must comply with the above requirements and must provide evidence of such compliance upon request of the Company as a precondition of continued access to the Site.

This Technical Schedule incorporates as attachments Sydney Water's General Safety Principles and Rules together with a number of specific Sydney Water OHS procedures. The Company has agreed to implement, and to require the Contractor and Operator to implement, these principles and rules and OHS procedures. Accordingly the Contractor and Operator must implement and comply with Sydney Water's principles and rules and OHS procedures as if they were the Company's principles and rules and OHS procedures. The Contractor and Operator, where necessary for the proper understanding and interpretation of the principles and rules and OHS procedures, is to replace "Sydney Water" with the "Company".

2. Design

The following subclauses apply to the extent that the Contractor is responsible for design.

2.1 Risk Assessment in Design

The Contractor's design process must meet the intent of the Key Requirements of Sydney Water's procedure for Risk Assessment in Design (attached).

2.2 Hazard Reduction / Elimination

The Contractor must consider the hazards to health & safety in relation to the whole 'life cycle' of the Works (ie; construction, operation, maintenance and eventual decommissioning / disposal / demolition) so as to eliminate or reduce such hazards as far as practicable during the design process.

Attention is drawn to the hazard identification, risk assessment and control requirements applicable to designers contained in the NSW OHS Act 2000 and especially the requirements and particular risk control measures outlined in clauses 84 to 97 (incl.) of the NSW OHS Regulation 2001.

2.3 Emergency Stops

The Contractor must undertake a risk assessment for all machines to be installed under the Contract.

The risk assessment must take into account future maintenance requirements. If elimination of the risk cannot be achieved, the Contractor must follow a hierarchy of controls (such as substitution, engineering controls, etc.) so as to provide a safe outcome.

Emergency stops must not be designed for use for isolation purposes.

<u>Emergency stops used for personnel safety</u> must be designed to be incapable of malfunction:

- They must have red pushbuttons on a yellow background, pull to reset, be non-locking, with a large emergency stop label comprising black letters on a yellow background.
- For Treatment Plant SCADA, the circuits must be based upon Sydney Water's standard template circuit TE100E and the requirements of Sydney Water's Automation and SCADA standards, copies of which are available from the Company.
- For all other assets, the circuits must be in accordance with Sydney Water's Instrumentation & Control Manual and Sydney Water's Telemetry Operations Group requirements.

<u>Emergency stops that are not used for personnel safety</u> must be referred to as "latch stops" to aid distinction as to their function and to avoid confusion as to their purpose with regard to the NSW OHS Regulation 2001:

- They must include a red mushroom head button against a grey background, pull to reset, non-locking, with no label.
- For Treatment Plant SCADA, the circuits must be based upon Sydney Water's standard template circuit TE100E and the requirements of Sydney Water's Automation and SCADA standards, copies of which are available from the Company.
- For all other assets, the circuits must be in accordance with Sydney Water's Instrumentation & Control Manual and Sydney Water's Telemetry Operations Group requirements.

3. Consultation

The Contractor and Operator must ensure that consultation arrangements are established with the Contractor's and the Operator's employees and Subcontractors in accordance with the requirements of the NSW Occupational Health & Safety Act 2000 and Regulation 2001, and must participate in consultation arrangements agreed with the Company.

In the absence of an Occupational Health and Safety (OHS) Workplace Committee, the Company may direct that a Safety Coordination Committee be established.

The Safety Coordination Committee must be chaired by the Company or the Company's nominee and must comprise representatives of the Company, the Contractor/Operator, and employees on the Site or such one or other of those as the Company may direct.

4. Work Environment Compliance

The Contractor and Operator must comply with the NSW OHS Act 2000 with respect to providing a suitable work environment. Attention is drawn to section 8 of the NSW OHS Act 2000 and part 4.3 of the NSW OHS Regulation 2001, in particular the Contractor's and Operator's responsibility for ensuring:

- Other people such as the general public and the Company's employees are not exposed to risks to their health and safety as a result of the Contractor/Operator's works or activities.
- Sufficient workspace is provided including adequate access and egress.
- Floors and surfaces are constructed and maintained so as to minimise the possibility of slips, trips and falls.
- Persons are unhindered and able to move safely around the workplace.
- Adequate lighting is provided.
- Consideration is given to risks associated with working in hot or cold environments.
- Persons are not subjected to excessive noise levels or exposure to atmospheric contaminants.
- Persons or materials do not fall from heights.
- Risks from fire and / or explosion are controlled.
- Electrical hazards are eliminated or adequately controlled and electrical installations are regularly inspected, tested and maintained.

5. Fire Prevention & Hot Work Procedure

For work outdoors, the Contractor and Operator must routinely confirm the status of Total Fire Bans (TOBAN). No hot work is to be carried out in the open during days of a TOBAN. The Contractor or Operator must apply for an exemption to the Commissioner of NSW Rural Fire Service if the Company deems the hot work activity to be "essential work". The Contractor or Operator is to provide a copy of any application for exemption to the Company. If no exemption is obtainable for any particular TOBAN day, the TOBAN day will be viewed as "inclement weather" and dealt with in a similar way to a wet weather day.

The term "hot work" includes all work associated with welding, thermal or oxygen cutting, heating and other fire or spark producing operations.

The Contractor and Operator must take all necessary precautions to prevent the spread of fire as a result of work under the D&C Contract or the O&M Services and when carrying out hot work, the Contractor or Operator must meet the intent of the Key Requirements of Sydney Water's procedure for Control of Hot Work (attached).

Besides meeting the key requirements of this Procedure, the Contractor and Operator must also comply with the following requirements involving the use of oxyacetylene or similar welding for cutting apparatus or blow lamps or torches when they are in use:

5.1 General

- The area in which the work is to be carried out is free from movable combustible material before operations commence.
- The area on the other side of a wall or partition where work is being carried out is inspected to ensure there are no combustible materials directly or indirectly in danger of ignition.
- Appropriate fire extinguishing appliances are kept near the scene of work for immediate use.
- An examination in the vicinity is carried out after each period of work to ensure that there is no danger of fire breaking out.
- A suitable employee is appointed to be responsible for fire safety for each period of work.
- Blow lamps and blow torches are lit strictly in accordance with manufacturers' instructions and not left unattended while alight.

5.2 Gas or Electric Welding and Cutting Apparatus

- The work area is adequately segregated by use of fire resistant materials.
- Combustible floors and fixtures in the work area are protected with overlapping sheets of non-combustible materials or covered with sand.
- The stub ends of welding rods do not come into contact with combustible materials.
- Gas cylinders not being used for the work in hand are kept outside the building in or on which the work is carried out and away from obvious fire hazard.

The Contractor and Operator must also comply with the requirements of Australian Standard AS1674.1-1997: Safety in Welding.

6. Sydney Water's OHS Rules and Procedures

6.1 Safety Rules

Whilst engaged on any work in connection with the D&C Contract or the O&M Contract, all the Contractor's and Operator's employees, Subcontractors, and consultants, and all visitors must abide by Sydney Water's general and site specific safety rules. A copy of the Safety Rules are attached.

6.2 Confined Spaces

Where the work under the D&C and O&M Contracts involves entry to confined spaces, the Contractor's and Operator's Safety Management Plans must make specific reference to Sydney Water's procedure for Safe Entry and Working in Confined Spaces, including the following requirements:

(a) The Contractor and Operator must comply with the Confined Space Provisions of the OHS Regulation 2001, AS 2865-2001 and Sydney Water's procedures relating to work in confined spaces. In circumstances where these are in conflict, the more stringent requirements will apply. The Contractor and Operator must comply with the Company's directions regarding these matters.

(b) The Contractor and Operator must maintain, and make available on request, documentation to demonstrate compliance with the Company's requirements for safe entry and work in confined spaces. As a minimum, the information to be maintained must include the following:

   (i) The names of all personnel required to enter confined spaces

   (ii) Evidence that personnel have completed Sydney Water Corporation approved training courses dealing with entry to confined spaces

   (iii) A record of original courses attended by all personnel and any further update courses attended

   (iv) Results of an assessment system to evaluate the aptitude and physical competence of personnel who will be required to enter confined spaces

   (v) A record of confined space activities performed.

6.3 Permit to Work

The Contractor/Operator must obtain a *Permit to Work Certificate* from the Company prior to the commencement of any work on the Company's sites where permit to work requirements apply.

6.4 Isolation Procedure

The Contractor and Operator must comply with Sydney Water's isolation procedures wherever work is to be carried out on assets requiring isolation. No work is to commence on live sites of the Company prior to proper isolation being carried out in accordance with these procedures.

6.5 Tagging

The Contractor and Operator must comply with Sydney Water's lock out / tag out procedures whenever working on Sydney Water's assets requiring lock out / tag out.

6.6 Other Procedures where Key Requirements apply

Where additional hazards apply, the Contractor and Operator must have in place systems of work that meet the intent of the Key Requirements outlined in the relevant Sydney Water's procedures. These procedures and their key requirements are listed in Appendix 1.

7. Contractor/Operator Safety Management System Requirements

7.1 Hazard Identification and Risk Assessment Meeting

Following award of the relevant Contract, the Contractor/Operator must participate in a Hazard Identification and Risk Assessment (HIDRA). A meeting must be arranged and chaired by the Contractor/Operator, with the Company and other stakeholders as determined by the Company in attendance. The purpose of this meeting is to ensure that the OHS hazards associated with the relevant Contract have been identified, the risks properly assessed and proposed controls identified.

7.2 Safety Management Plan

Following the Hazard Identification and Risk Assessment meeting, the Contractor/Operator must prepare a Safety Management Plan, which must include appropriate controls to minimise the risks of those OHS hazards identified at the HIDRA meeting. The Plan must detail the OHS systems and procedures that will apply during the term of the relevant Contract for all relevant aspects of the work, including sub-contract work.

The Plan must be prepared in accordance with Appendix 2.

The Plan must take into account the interfaces with ongoing operations of the Company and Sydney Water and with any other persons who may be undertaking other work simultaneously on the Site.

Where multiple sites are involved in work under the relevant Contract, and where directed by the Company, a Site Specific Safety Plan for each site must be incorporated in the Plan.

The Contractor/Operator must submit the Plan for review and formal sign-off by the Company prior to the Kick-off Meeting (Section 7.5).

If the Plan does not meet the Company's requirements, the Company must notify the Contractor/Operator who must revise and resubmit the Plan prior to commencement of Site works.

The Contractor/Operator must implement the Plan, monitor the work and carry out workplace inspections as defined in the Plan to ensure that controls are in place and any OHS risks arising while work is in progress are promptly addressed.

The Contractor/Operator must review the Plan at frequent intervals throughout the relevant Contract to ensure that it is maintained in an up-to-date condition. Revisions to the Plan must be submitted to the Company in a timely manner. In preparing the revisions, the Contractor/Operator must take into account any changes to the Hazard Identification and Risk Assessment.

The Plan will form the basis by which the Contractor/Operator's OHS performance will be monitored and audited by the Company.

The Contractor/Operator must provide its Subcontractors with copies of the Plan, appropriate site-specific safety management plans and safe work method statements.

The Contractor/Operator must ensure that all its employees, Subcontractors and consultants are inducted into and follow the requirements of the Plan. A copy of the Safety Management Plan must be readily available on the Site.

7.3 Work Method Statements

Work Method Statements must be prepared for all work activities identified in the Hazard Identification and Risk Assessment as carrying a significant safety risk. The Work Method Statements must be prepared in accordance with the format shown in Appendix 3.

Where generic Work Method Statements are developed for regular or repetitive work, their adequacy must be reviewed at the Site prior to commencement of the work, and revisions must be made as necessary to address any hazards posed by changed conditions. Where necessary, a further site-specific Work Method Statement must be developed at the Site prior to commencement of the relevant work.

The Contractor/Operator must ensure that all its employees, Subcontractors and consultants are inducted into and follow the requirements of relevant Work Method Statements. A copy of relevant Work Method Statements must be readily available on the Site.

7.4 Pre-commencement Hazard Check

The Contractor must ensure that a documented pre-commencement hazard check is conducted each day during the D&C phase before work commences on Site.

7.5 Kick off Meeting

The Contractor/Operator must attend and participate in a *Kick-off Meeting*, which must be conducted by the Company and attended by other stakeholders nominated by the Company. In part, the purpose of the meeting is to ensure that all OH&S controls required to be deployed prior to Site possession are in place and that all attendees understand Contract OHS responsibilities. The agenda must include key OHS issues associated with the Site, the work and the Contractor/Operator's Safety Management Plan.

7.6 Contractor Induction

It is a legislative requirement that all employees receive adequate induction and training to ensure tasks are undertaken in a manner that minimises the risk to their health and safety.

Following the Kick-off Meeting, the Contractor/Operator will be inducted in accordance with Sydney Water’s OHS Induction Process detailed in Appendix 4.

7.7 Site Possession and Commencement of Work

When the Company is satisfied that the Contractor's Safety Management Plan addresses all requirements of the Company, the Contractor must demonstrate to the Company’s satisfaction that all the OHS controls are properly deployed and all the required inductions have been delivered. Thereafter the Company will grant the Contractor possession of the Site or that part of the Site sufficient to enable the Contractor to commence work.

Notwithstanding any other provisions of the D&C Contract, the Contractor will not be granted possession of the Site until the Company has acknowledged in writing to the Contractor that the Safety Management Plan meets Company requirements.

At the Company’s discretion, prior to this acknowledgment, the Contractor may be granted access to parts of the Site to commence defined preliminary work, provided that the Company is satisfied that the OHS controls associated with that work are agreed and properly implemented, and that all the required inductions for that work have been delivered.

The Contractor must not commence work on the Site prior to possession of the Site or part thereof being granted by the Company.

7.8 Site Inspections

The Contractor must conduct regular Site inspections to ensure that OHS controls are in place, OHS risks are identified and that OHS systems are implemented by the Contractor/Operator's employees and Subcontractors.

The Company may also conduct Site inspections, which will not relieve the Contractor/Operator of responsibility for OHS.

7.9 OHS Audits

The Company may audit the Contractor/Operator's Safety Management Plan at any time to evaluate implementation, effectiveness and level of compliance with the Plan. The Company will report any non-conformance issues to the Contractor/Operator. The Company will appraise the Contractor/Operator's performance for the Company's records.

The Contractor/Operator must make available, on request of the Company, all relevant OHS records including those of Subcontractors and suppliers, for auditing against the requirements of the Safety Management Plan. The Contractor/Operator must provide all reasonable assistance during the audits including attendance by the Contractor/Operator.

7.10 Failure to Conform

If the Company notifies a non-conformance to the Contractor/Operator, the Contractor must rectify the non-conformance within the timeframe specified by the Company.

7.11 Incident Reporting

The Contractor/Operator must inform WorkCover of any notifiable incidents as outlined in the notification process relating to work-related incidents at www.workcover.nsw.gov.au. A copy of any notification must immediately be supplied to the Company where applicable.

The Contractor/Operator must immediately inform the Company and any nominated local Site representative of the Company of any lost time injury or significant near miss involving its employees, Subcontractors or members of the public. All other accidents including those resulting in medical treatment, near misses or property damage must be reported to the Company within 24 hours. First Aid incidents may be reported on a monthly basis via the Contractor/Operator's monthly performance report.

If requested the Contractor/Operator must supply a written report to the Company in the form directed by the Company.

For the purpose of incident reporting, the following definitions (from Sydney Water's Incident Recording System) will apply:

Term	Abbreviation	Definition
Lost Time Injury	LTI	A work related occurrence that results in a fatality, permanent disability or time lost from work of one day/shift or more, not including the day of the incident. Lost time injury(s) must be verified by the presence of a medical certificate, as appropriate.

Term	Abbreviation	Definition
Medical Treatment Injury	MTI	An injury that resulted in a visit to medical professional. Time lost – MTI in which there is an absence from the work site eg to attend doctor, but which is not a lost time injury. No time lost – MTI in which there was no absence from the worksite (ie if a person attended doctor (etc) in their own time).
First Aid Injury	FAI	Where first aid (initial care of the injured or sick) has been sufficient to treat the injury/illness.
Near Miss	NM	An unplanned event, which although not resulting in any injury or illness, had the potential to cause injury or illness to any person or damage to any plant, vehicles, equipment, property, infrastructure or the environment.

7.12 Incident Investigation

The Contractor/Operator will be required to investigate all incidents and provide an incident report to the Company. The Company will be notified of investigations and will participate in contractor investigations at its discretion. The Company may also conduct its own investigations of serious incidents and the Contractor/Operator must cooperate in this process.

The Contractor/Operator's incident investigation must meet the intent of the Key Requirements of Sydney Water's incident investigation procedure. The Contractor/Operator must appoint a suitably qualified, competent and independent incident investigation leader and investigation team, based on the incident classification level. The Contractor/Operator must inform the Company in writing of the name of the appointed incident investigation leader. If the Company reasonably objects to the person appointed, the Contractor/Operator must replace that person.

7.13 Contractor/Operator Performance Reporting

The Contractor/Operator must supply a Contractor/Operator OHS Performance Report to the Company on a monthly basis, or at such frequency as accepted in the Contractor/Operator's Safety Management Plan. The report must be as per the Contractor/Operator OHS Performance Report format shown in Appendix 5.

8. OHS Performance Assessment by Senior Management

In addition to any other OHS reporting requirements, once each six months during the relevant contract period, the Contractor/Operator must prepare and provide to the Company a six-monthly Contract OHS Performance Assessment Report. The report should be in both hardcopy and electronic form. Its delivery must be followed within two weeks by a joint meeting of both the Contractor/Operator's senior management and senior management from the Company.

The report should include:

a) Audit/Inspections Summary

A listing of all the OHS audits/Site inspections planned and conducted by the Contractor/Operator and Site surveillances carried out by the Company (as provided by the Company to the Contractor/Operator). Listing should include date, location, type of audit/Site inspection/surveillance, person conducting the audit, number of actions arising, etc.

b) OHS Incidents Summary

A summary table of OHS incidents/injuries/near misses that have occurred to date on the relevant Contract, all OHS related Action Requests issued by the Company or the Contractor/Operator and all OHS related non-conformances or otherwise issued within the Contractor/Operator's quality system. This summary should include date, location and description of the event, summary of the root cause leading to the event, status of corrective action taken, rehabilitation, etc.

c) Progress on Actions / Improvements

A summary table of all OHS related Action Requests issued by the Company or by the Contractor/Operator and all OHS related non-conformances, improvement opportunities or otherwise issued within the Contractor/Operator's quality system. This summary should include date, location and description of the event, summary of the root cause leading to the event, status of corrective action taken or improvement made.

d) Summary of OHS Initiatives Completed and Planned

Report on the Contractor/Operator's progress on OHS improvement initiatives it has undertaken over the quarter and / or plans for the following quarter.

The subsequent meeting is then intended to provide the senior management of both the Contractor/Operator and the Company with the opportunity to review and assess the performance of both parties in ensuring a safe workplace. This meeting would be in addition to any Site surveillance carried out by senior management of both parties.

Appendix 1

Safety Requirements

The Company's OHS Procedures

The Safety Management Plan must comply with the following Sydney Water OHS Procedures:

- Sydney Water's Confined Space Procedure,
- Sydney Water's High Voltage Procedure,
- Sydney Water's Asset Management Permit to Work Procedure,
- Sydney Water's Asset Management Flow Isolation Procedure,
- Sydney Water's Asset Management Lock Out / Tag Out Procedure.

The Safety Management Plan must meet the intent of the Key Requirements of any other Sydney Water Procedures identified as applicable to the scope of work under the contract listed below:

- Risk Assessment in Design,
- Incident Notification and Reporting,
- Incident Investigation,
- Hazard Identification and Risk Assessment,
- Communication and Consultation,
- First Aid Management,
- Injury Management – Return to Work.
- Excavation Break In
- Asbestos Management
- Control of Hot Work
- Working Safely Near Overhead Electrical Apparatus

In addition, the Safety Management Plan must include other procedures required to form part of the controls for all high risk activities relevant to the nature of this contract (eg; work at heights, asbestos removal, working over water).

The Contractor/Operator and Contractor/Operator employees and Subcontractors must comply with the requirements of any such procedures referenced in the Safety Management Plan.

Appendix 2

Guidelines for the Preparation of Contractor/Operator's Project Safety Plan

A guide to the elements to be addressed in the Project Safety Plan is provided below. Column B enables the Contractor/Operator to cross reference required Project Safety Plan elements where they have a Project Safety Plan which follows a different format or an integrated Project Management Plan. In this case the Contractor/Operator should complete column B and attach this document to their Project Safety Plan or integrated Project Management Plan.

REQUIREMENT	Integrated Management System reference (if applicable)
1. MANAGEMENT RESPONSIBILITY	
This element defines responsibilities for:	
Managing overall compliance on Site to OHS requirements & legislation	
Reviewing service providers' Project Safety Plans	
Monitoring service providers' compliance with Project Safety Plan requirements	
Acquiring and communicating OHS information & Site Safety Rules	
Providing OHS training and induction	
Identifying hazards and assessing and controlling risks	
Managing illness/injury and emergency procedures and facilities	
Monitoring work on Site and conducting Site inspections	
Organising inspection and testing of plant, equipment and materials	
Workplace injury management and rehabilitation	
Managing communication between OHS Workplace Committees	
Ensuring interaction with SWC procedures and operating systems	
Ensuring appropriate interactions with other contractors, the Company or SWC personnel entering the Site	

REQUIREMENT	Integrated Management System reference (if applicable)
Reporting / investigating OHS illness/injury/incidents, including to the Company	
Implementing corrective actions	
2. COMMUNICATION and CONSULTATION	
This element shows how:	
Agreed consultation arrangements have been established to share OHS information	
Appropriate OHS representation has been determined for workgroups	
OHS representatives are elected and trained	
OHS consultation arrangements are recorded and publicised	
Site Safety Rules and OHS training requirements are communicated on Site	
Emergency procedures are communicated on Site	
Regular tool box meetings/ talks are conducted on Site	
3. SERVICE PROVIDERS	
This element outlines procedures for:	
Identifying and addressing the requirements for a Company contractor	
Selection of service providers on their ability to comply with OHS requirements	
Providing service providers with the project OHS management plan, applicable site-specific safety management plans and safe work method statements	
Ensuring service providers prepare and implement compatible site-specific safety management plans and safe work method statements	
Monitoring work undertaken by service providers and verifying their compliance with project OHS and site-specific safety plans and safe work method statements	
Managing service providers' poor OHS performance	

REQUIREMENT	Integrated Management System reference (if applicable)
4. PURCHASING	
This element outlines procedures for:	
Ensuring that purchases and deliveries of plant, equipment and materials comply with OHS specifications	
Obtaining appropriate OHS information from suppliers	
5. DESIGN	
Where applicable, this element defines responsibilities and outlines procedures for:	
Verifying design compliance with OHS legislative requirements	
Designing and reviewing designs to identify, assess and control OHS risks during the whole life cycle of the designed asset / product	
Reviewing and approving design changes	
6. RISK MANAGEMENT	
This element clearly defines procedures for:	
Identifying OHS hazards, assessing risks and developing / implementing appropriate controls	
Managing OHS incidents, illness/injury and emergencies	
Developing and implementing safe work method statements	
Developing and communicating Site safety rules	
The Project Safety Plan includes:	
A documented Hazard identification and risk analysis for all works associated with the project.	
Work Method Statements or equivalent, (which meet the intent of NSW WorkCover pro-forma for writing Work Method Statements - attached,) for all activities identified in the hazard identification and risk assessment as 'significant risk'	
A process for the conduct of daily on Site pre-commencement hazard checks which ensure Work Method Statements are relevant to the work and conditions on Site	
A process to ensure that all service providers have appropriate risk assessment and risk management processes in place	
Processes to ensure that an on Site risk assessment is carried out for emergency or unplanned activities	

REQUIREMENT	Integrated Management System reference (if applicable)
7. TRAINING	
This element clearly defines procedures for:	
Identifying the training needs of management, supervisors and workers	
Providing OHS induction training, task training and refresher training	
Providing specific training to conform with other OHS legislative requirements	
Providing training in emergency procedures	
Keeping appropriate records of OHS training	
8. INSPECTION, TESTING and SERVICING	
This element outlines procedures for inspection, testing and (where appropriate) servicing which address:	
Incoming materials, plant and equipment	
Work Site environment monitoring	
Hazard and risk control measures	
Adherence to Safe Work Methods and Site safety rules	
Access and egress	
Protective measures	
Electrical safety	
Plant and equipment	
Keeping appropriate records of inspections, tests and servicing	
The Project Safety Plan includes:	
Inspection, testing and servicing plans for the project	
Requirements for the Contractor/Operator's service providers to provide inspection, testing and servicing plans when they deliver these services on the project.	

REQUIREMENT	Integrated Management System reference (if applicable)
9. INCIDENT MANAGEMENT and CORRECTIVE ACTION	
This element clearly defines procedures for:	
Reporting and investigating incidents and injury / illness	
Managing incidents of non-compliance	
Quarantining and disposal of non-conforming materials and substances	
Implementing injury management and return to work plans	
Implementing corrective actions	
Monitoring the status and keeping records of corrective actions	
The Project Safety Plan documents how OHS issues will be managed where the project is conducted at multiple sites including:	
OHS roles and responsibilities	
Consideration of Site specific OHS issues and hazards	
OHS inspection and review requirements	
Induction requirements	
Where appropriate to the nature and duration of the work and the Site, the Plan includes:	
Site Safety Rules which, where appropriate, are integrated with SWC operating procedures, Site Safety Rules and Permit to Work Certificates	
Agreed protocols for safe interaction between the Contractor/Operator and other persons who may enter the Site during the work (eg other contractors, SWC personnel, SWC agents, and visitors).	
Separate site-specific safety plans for separate sites	
The Plan outlines:	
Who will be available (both during and outside normal working hours) to prevent, prepare for, respond to and recover from incidents	
Procedures for contacting these person(s) and how these are communicated	
Accident and emergency procedures, incl first aid facilities and how these are communicated	

REQUIREMENT	Integrated Management System reference (if applicable)
10. HANDLING, STORAGE, PACKAGING and DELIVERY	
This element outlines procedures for:	
Verification that persons engaged in hazardous processes are appropriately licensed and competent	
Checking that hazardous substances are appropriately labelled and accompanied by Material Safety Data Sheets	
Safe handling, storage, use and disposal of products, including hazardous materials and dangerous substances	
Assessment and control of manual handling risks	
Compliance with relevant regulations, standards and codes	
11. INTERNAL REVIEWS	
This element outlines procedures for:	
Conducting regular systematic reviews of the plan and its implementation	
Identifying and communicating to appropriate persons any deficiencies found	
Effective implementation of corrective actions	
12. OHS RECORDS	
This element outlines procedures for controlling, approving, disseminating, withdrawing, storing and disposing of OHS documents, data and records for the project. Requirements are defined for keeping records of:	
Training and induction	
Skills, competencies and licenses	
OHS meeting minutes	
OHS audit reports	
Internal OHS reviews	
OHS design reviews	
Hazard identification and risk assessment reports	
Incident / injury / illness reports	
Incident / injury / illness investigations	
Injury / illness statistics	
Corrective actions	

REQUIREMENT	Integrated Management System reference (if applicable)
Personal protective equipment issued	
Hazardous substances used	
Inspection and test reports	
Plant and electrical equipment used	
Servicing records (where relevant)	
Work permits issued	
Tool box meetings	

Appendix 3

Work Method Statements

Work Method Statements are required for all activities identified as having a significant safety risk.

A Work Method Statement ("WMS") must include the following elements:

- A description of the work
- Identification of potential hazards associated with the work
- The actual step by step sequence involved in doing the work (may reference Standard Operating Procedures (SOP) and safety related process steps eg inductions, pre-commencement hazard checks, communication protocols, isolation hold points etc)
- The foreseeable hazards and risks for each step listed
- The safety controls that will be in place to minimise these hazards
- All precautions to be taken to protect health and safety
- All health and safety instructions to be given to employees involved with the work
- The names and qualifications of those who will supervise the work
- The names and qualifications of those who will inspect and approve work areas, work methods, protective measures, plant equipment and power tools
- Description of what training is to be given to those doing the work
- The names and qualifications of those responsible for training workers in the requirements of the work method statements
- Identification of health and safety related standards or codes applicable to the work, and where these are kept
- Identification of the plant and equipment that will most likely be used on the project
- Details of inspection and maintenance checks that will or have been carried out on the equipment

A pro forma for a Work Method Statement is attached over page.

WORK METHOD STATEMENT PRO FORMA

Work Method Statement (Part 1) Contractor:	Signed off: ___________________ Date: _____________ No: _______________
Project:	Accepted: Yes/No
Job:	Area:

Procedure (in steps):	Possible Hazards:	Risks	Risk Ranking	Safety Controls:
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

WORK METHOD STATEMENT PRO FORMA

<table>
<tr><th colspan="3">Work Method Statement (Part 2)</th></tr>
<tr><td>Personal Qualifications and Experience:</td><td>Personnel, Duties and Responsibilities:</td><td>Training Required to Complete Work:</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td colspan="2">Engineering Details/Certificates/WorkCover Approvals:</td><td>Codes of Practice, Legislation:</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">Plant/Equipment:</td><td>Maintenance Checks:</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td colspan="3">Read & Signed by relevant Employees on Site:</td></tr>
<tr><td colspan="3">Employee Name (printed)</td></tr>
<tr><td colspan="3">Employee Signature</td></tr>
</table>

Ref: NSW WorkCover – Guidelines for writing work method statements in plain English

Appendix 4

Guidelines for Contractor/Operator OHS Induction

All Sydney Water contractors, subcontractors and their employees must be properly inducted before commencing work on any Sydney Water site or project. Specific responsibilities for delivery of inductions are outlined below. The Contractor/Operator's OHS induction responsibilities must be developed from these guidelines and incorporated in the Project Safety Plan.

The following guidelines provide an outline of the content of inductions to be delivered to all persons working on Sydney Water contracts and the responsibilities for delivery of different induction components. They also outline the requirements for the issue of a Sydney Water Induction Pass / Passport.

Sydney Water Contractor Safety Induction Process

The Sydney Water Contractor Induction Process consists of three components as follows:

- Sydney Water General Safety Induction
- Sydney Water Site Induction (manned and unmanned sites)
- Contractor's Project Induction

These three components of OHS induction relate to work on Sydney Water projects and/or sites and are additional to the construction safety induction requirements of the NSW OHS Regulation 2001 for projects or site activity involving construction work. Delivery of Sydney Water's Contractor Safety Induction modules in no way relieves employers or Contractors of their obligations under this Regulation.

Sydney Water General Safety Induction

All Contractors, Sub-Contractors and their employees must receive a Sydney Water General Safety Induction. Sydney Water will provide a General Safety Induction to the Contractor and his nominated key representatives at the Kick-off meeting.

Printed copies of the Sydney Water General Safety Induction will be provided to the Contractor at this time. The Contractor shall incorporate the Sydney Water General Safety Induction content into its Project Induction for its employees and Sub-Contractors.

Site Induction

All Contractors, Sub-Contractors and their employees shall receive a Site Induction before they commence work on any Sydney Water site or project.

The Site Induction for the Contractor and his nominated representatives will be conducted by Sydney Water at the Kick-off meeting, or at another time as agreed.

The Site induction shall be delivered as follows:

(a) Where the site is a manned Sydney Water site, the Site Induction for the Contractor and all Sub-Contractors and their employees will generally be conducted by the Sydney Water site owner or his/her representative. In some cases, by agreement with the site owner, this responsibility for induction may be delegated to the Contractor. The Contractor shall ensure all employees and Sub-Contractors have received a Site Induction before they commence work on site.

(b) Where the site is an unmanned Sydney Water site, the Site Induction for the Contractor and nominated representatives will be conducted in the first instance by Sydney Water at the kick-off meeting. A copy of the Site Induction content will be provided by Sydney Water to the Contractor. The Contractor shall incorporate this content into its Project Induction for its employees and sub-Contractors. Only Contractor's personnel who have been Inducted by a Sydney Water representative may pass on the content of the Site Induction to other Contractor employees and Sub--Contractors. The Contractor shall ensure all its employees and Sub-Contractors receive the Site Induction material, as part of the Contractor's Project Induction, before they commence work on site.

The Site Induction for unmanned sites may include a visit to at least one such site.

(c) Where the site is not under the control of Sydney Water (eg. a greenfield construction site) appropriate site induction shall be prepared and delivered by the person who has overall responsibility for and control of the site. This will generally be the Contractor.

For the purpose of these induction guidelines the following definitions apply:

- A 'manned' Sydney Water site is an asset, facility or building where Sydney Water staff or their agents are on site on a full time basis (eg. most sewage treatment plants, office buildings, depots etc). Sites which, although unmanned at times, would always have Sydney Water staff on site when a Contractor is working there (eg some smaller sewage treatment plants) are also 'manned sites' for the purpose of these guidelines.
- An 'unmanned' Sydney Water site is an asset, facility or building where Sydney Water staff or agents responsible for the management of the site are not present on a full time basis (eg pipelines, valve chambers, sewer pumping stations, water pumping stations, reservoirs etc). Where a Sydney Water asset is located on the same grounds as a depot housing a work team unrelated to the management of that asset (eg a reservoir in the same grounds as a maintenance depot) the asset is an 'unmanned site' for the purposes of these guidelines.

- A site 'not under the control of Sydney Water' is a site where the Contractor or a party other than Sydney Water has management responsibility for the site and there is no Sydney Water asset, facility or building within the site perimeter (eg a greenfield construction site, a national park, the ocean or other locations).

Contractor's Project Induction

The Contractor shall ensure that all its employees and Sub-Contractors have received a Project Induction before they commence work.

The Project Induction will be tailored to the project and work activities and detailed in the agreed Project Safety Plan. The Project Induction will include as a minimum:

- Project Safety Plan key contents
- Work Method Statements relevant to the project
- Codes of Practice applicable to the project
- Sydney Water General Safety Induction content (as provided by Sydney Water to the Contractor) for those employees and Sub-Contractors who did not attend the kick-off meeting
- Site Induction material if applicable (as provided by Sydney Water to the Contractor) for those employees and Sub-Contractors who did not attend the kick-off meeting.

The Contractor shall deliver a suitably modified Project Induction to any Sydney Water representative requiring access to the work site other than as an accompanied visitor.

Induction Records

The Contractor shall keep records of all inductions received by the Contractor, the Contractor's employees and Sub-Contractors. Specific inductions received by each individual shall also be recorded in each individual's Sydney Water Induction Passport or Pass (refer Sydney Water Contractor Induction Passport System below).

Records of employee inductions shall be made available by the Contractor when requested by Sydney Water.

Sydney Water Contractor Induction Pass / Passport System

Induction Passes / Passports

The Sydney Water Induction Pass is a single card used to record the individual's personal details and indicating which types of inductions he/she has received.   It is valid for a specific project only.

The SWC Induction Passport is a booklet containing the individual's personal details and signed pages indicating which types of inductions he/she has received and the current validity of those inductions.   The Induction Passport allows transportability of some types of induction between projects (eg Sydney Water General Safety Inductions and Manned Site Inductions), within the period of validity.

The Contractor and all his employees and Sub--Contractors must carry their Induction Pass / Passport in person with proof of identity eg. a driver's licence, at all times while working on any Sydney Water site or project.

Issue of Passes / Passports

A Sydney Water Induction Pass or Passport will be issued to the Contractor, the Contractor's employees or a Sub--Contractors the first time they are inducted to a Sydney Water project.

A Sydney Water Induction Pass or Passport may be issued by Sydney Water or the Contractor.

Sydney Water will provide the Contractor with sufficient blank Induction Passes / Passports for issue to all employees and Sub--Contractors it inducts.

After each induction the appropriate sections of the Pass or Passport will be filled in and signed by the person giving the induction and signed by the person being inducted.

Validity of inductions

The validity period for any induction type will be determined by Sydney Water generally as follows, but in any case shall not exceed one year.

Sydney Water General Safety Induction is valid for 12 months .

Sydney Water Site Inductions are generally valid for 12 months , except for unmanned site inductions which may be valid only for the duration of the project.

The Contractor's Project Induction is valid for the duration of the project only, subject to agreed extensions of time.

The validity period for each induction type delivered will be entered on the Induction Record page at the time of induction.

Each type of induction must be renewed at the end of its validity period as shown in the Pass / Passport. The Contractor shall ensure that the Passes / Passports of all employees and Sub-Contractors are maintained valid.

Appendix 5

Contractor/Operator OHS Performance Report

To be completed by the Contractor/Operator each month or at the end of the relevant Contract:

Contract Name:	Report for the month of:
Contract Number:	Prepared by:
Contractor:	Date:

1. Performance Indicators

Indicator	**No of Occurrences (incl. Sub-Contractors & employees)**			
	Current Month	**Financial Year to Date**	**Total to date on contract**	**Details reported to SWC during month? (yes / no)**
Lost Time Injuries (5 working days & over)				
Lost Time Injuries (1-4 working days)				
Total No. of Days Lost to above LTI's				
Medical Treatment Injuries				
First Aid Injuries				
Near Misses				
Notifiable Occurrences reported to WorkCover				
Property Damage				
Accident Reports to WorkCover				
Improvement Notices from WorkCover				
Prohibition Notices from WorkCover				
Fines from WorkCover				
Workplace Inspections Planned				
Workplace Inspections Carried Out				
Total hours worked by Contractor **				
Total hours worked by Sub-Contractors **				

2. Details Of First Aid Injuries During Month*

Name	Date	Injury Description	Root Cause

3. OHS Corrective Actions Arising from Contractor's OHS System

Nature of Corrective / Preventive Action	›ue Date	Open or closed	Source	Comments

4. OHS Inspections/Audits: Comments/Outcomes

5. Comments On OHS Performance

6. Date of last review of Contractor's Project Safety Plan ____/____/____

7. Contractor's Representative (Name / Signature / Date): ____________________

8. SYDNEY WATER Project Manager: Notes: ____________________

Date of last review of Project Manager's Safety Plan ____/____/____

Contractor OHS Performance Report complete and verified ? ____________________

TO BE SENT TO ………………………..…………WITHIN ….... WORKING DAYS AFTER END OF MONTH.

* Details of all other incidents should have been reported to the Sydney Water Project Manager within 24 hrs, and immediately for significant incidents (Lost Time Injuries, serious near misses, WorkCover events or incidents notifiable to WorkCover).

** Hours worked should include all hours of work which contributed to the project, including the hours of work of designers and interim service providers (consultants), which were spent on the project. This work may have been off site or on site.

Attachments

A. SYDNEY WATER'S GENERAL SAFETY PRINCIPLES AND RULES

B. SYDNEY WATER HEALTH AND SAFETY PROCEDURE – HSP-001 SAFE ENTRY AND WORKING IN CONFINED SPACES

C. SYDNEY WATER ASSET MANAGEMENT PROCEDURE – PERMIT TO WORK

D. SYDNEY WATER HEALTH AND SAFETY PROCEDURE HSP 070 – ASSET ISOLATION

E. SYDNEY WATER HEALTH AND SAFETY PROCEDURE HSP 049 – LOCKOUT/ TAGOUT

F. SYDNEY WATER HEALTH AND SAFETY PROCEDURE HSP 058 – RISK ASSESSMENT IN DESIGN

G. SYDNEY WATER TREATMENT PLANT SCADA STANDARDS APPENDIX N – EMERGENCY STOPS POLICY

H. SYDNEY WATER HEALTH AND SAFETY PROCEDURE HSP-026 – CONTROL OF HOTWORK

I. SYDNEY WATER HEALTH AND SAFETY PROCEDUREHSP 030 – INCIDENT INVESTIGATION

SYDNEY WATER's GENERAL SAFETY PRINCIPLES AND RULES

- **Think** about what you have to do, what could go wrong (the risks) and what you need to do to protect yourself and others.
- **Maintain** a drug and alcohol free work site.
- **Do Not** smoke in any Sydney Water indoor area or vehicle, or in any other areas designated as non-smoking.
- **Maintain** a tidy workplace. Do not leave tools lying around where they may constitute a hazard.
- **Use** the right tools and equipment for the job, use them safely and replace them when faulty.
- **Observe** all danger notices, warning signs, safety notices and isolation tags.
- **Do Not** operate Sydney Water electrical, pressure or other live systems unless specific authorisation or supervision is provided.
- **Do Not** interfere with fire fighting or other safety equipment.
- **Observe** all local area safety requirements.
- **Be aware** of and follow local emergency procedures.
- **Report** immediately to your supervisor any condition or practice you think might cause injury to any person or damage to equipment.
- **Report** immediately any accident or near miss, no matter how minor, to your supervisor.

HEALTH AND SAFETY PROCEDURE

HSP-001 SAFE ENTRY & WORKING IN CONFINED SPACES

1. SCOPE

Entry and working in confined spaces is an identified risk activity for Sydney Water.

WorkCover, via the OHS Regulation 2001, have defined a confined space and impose specific requirements on confined space work.

This Sydney Water Procedure specifies minimum requirements to ensure the safety of Sydney Water personnel who may be required to enter or perform work in or near a confined space.

Contractors/ Service Providers to Sydney Water are required to meet the requirements of this procedure through their own safe systems of work.

2. KEY REQUIREMENTS

Management requirements

- Each business unit shall identify confined spaces that are under their management control.
- Each business unit that manages confined space assets shall ensure that there is a documented risk assessment for that asset or asset type.

Recognition of Confined Spaces

Confined spaces are defined in Clause 66 of the OH&S Regulation 2001 as:

Confined space, in relation to a place of work, means an enclosed or partially enclosed space that:

a) is not intended or designed primarily as a place of work, and

b) is at atmospheric pressure while persons are in it, and

c) may have an atmosphere with potentially harmful contaminants, an unsafe level of oxygen or stored substances that may cause engulfment, and

d) may (but need not) have restricted means of entry and exit.

To recognise a confined space proceed through the following 4 steps.

Step 1: Is the area enclosed or partially enclosed? If **No -** Not a confined space.

Step 2: Is the area intended or designed primarily as a place or work (eg office areas or workrooms)? If **Yes** - Not a confined space, hazards must be controlled by other processes.

Step 3: Is the area at atmospheric pressure? If **Yes -** Go to **Step 4** (In SW all confined spaces made ready for entry would be at atmospheric pressure).

Step 4: Does the atmosphere have potential for harmful contaminants (eg sewer gasses or volatile environmental spillage) **or**

Is there an unsafe oxygen level or potential for (eg underground chamber with rusting metal) **or**
Are there substances that may cause engulfment (eg flooding of a chamber)?

If **Yes** to any the area is a **CONFINED SPACE**

Some examples

Structure	Status	Guidance
Tank bunds	Not generally confined spaces	If tank content is a hazardous material & leaks into the bund refer to MSDS for health & safety advice on management of the leak.
Excavations	Generally not confined spaces. Confined space provisions may apply where the excavation enters foul or contaminated ground or opens a live sewer.	The guidance material *• Code of Practice: Excavation* is available from WorkCover NSW:
Machinery Wells	SW has deemed these to be confined spaces unless assessed by a competent person as not meeting the requirements of a confined space.	Refers to machinery wells under normal operating conditions ie not under construction.
Access chambers	Confined spaces if any conditions in Step **4** apply	These are enclosed or partially enclosed spaces not intended or designed primarily as a place of work and are at atmospheric pressure
Pipes, sewers & covered drains	Confined spaces if any conditions in Step **4** apply	These are enclosed or partially enclosed spaces not intended or designed primarily as a place of work and are at atmospheric pressure

Identification of confined spaces

Confined spaces should be identified and, where practicable, signposted.

All confined spaces should be signposted when occupied.

Any identified confined space in a public place should be secured.

Design Requirements for Confined Space

Sydney Water management shall seek methods of eliminating entry into confined spaces through the application of new technology and design improvements where practicable.

The construction of or modification to existing Sydney Water Assets should avoid the creation of confined spaces that will need to be entered for system operation or routine maintenance purposes.

The construction of or modification to existing Sydney Water assets should facilitate entry to any unavoidable confined spaces which may need to be entered by the provision of appropriate access hatches, anchor points etc. Refer to Australian Standard 2865 for further information.

Hazard Identification and Risk Assessment

A Hazard Identification and Risk Assessment (HIDRA) shall be carried out following SW *Hazard Identification and Risk Assessment Process*, prior to ANY works being carried out on or near Sydney Water's Assets.

Should the HIDRA identify a Confined Space or potential Confined Space a Risk Assessment shall be undertaken by a competent person or persons before ANY work associated with the confined space is begun. Refer *HSG on Confined Space Risk Assessment.*

Risk Control

If the risk assessment identifies a risk to health or safety arising from work in a confined space, the risk shall be managed by the implementation of appropriate risk control measures.

The risk control measures shall follow the hierarchy of control

1. **Eliminate** the need to enter the confined space.
2. **Substitution** with less hazardous process.
3. Reduction of the risk by **separating the hazard from the person**.
4. Reduction of the risk through **engineering controls**
5. Reduction of the risk through **administrative controls**.
6. Reduction of the risk through **personal protective equipment**.

Emergency response

Emergency procedures must be relevant to the site, planned, established and rehearsed. Equipment required to implement the rescue procedure shall be available on site.

Entry permit

An entry permit in a suitable format shall be completed by the Responsible Person prior to entry to the confined space. A suitable format to record the risk assessment and entry permit is given in Appendix 2 to this procedure.

The permit must be revised as and where necessary and closed at completion of the occupancy.

Any additional permits such as Permit To Work, Hot Work Permit shall also be completed.

Work team requirements

All persons working in, on or near a confined space must be trained and competent to perform their duties in safety. The team size, fitness and competence must be adequate to perform the work and implement the site emergency response plan.

Fitness to work in a confined space must be assessed annually against SW *Confined Spaces Fitness & Aptitude Assessment Guidelines*.

Competency to perform confined space work shall be assessed annually or prior to performing confined space work.

3. PROCEDURE

Confined Space Entry Process

3.1 HIDRA PROCESS

Hazard identification - confined space entry

Refer to the site hazard register (where available) and carry out a site-specific hazard identification prior to entry.

Risk assessment applied to SW confined spaces

A risk assessment shall be undertaken by a competent person or persons before work associated with the confined space is carried out. The assessment shall be in writing and follow SW guidance note *Confined Space Hazard Identification And Risk Assessment*.

Safe systems of work

Risks shall be controlled prior to entry in a confined space. The residual risk as assessed by Sydney Water's *Hazard Identification and Risk Assessment Process* (HIDRA) shall be acceptable to the work team and their line management.

Communication

Communication must be maintained between the work team and the standby person(s). Where visual and audible means are inadequate, radios, signal lamps etc should be used. The safe work method should specify actions to be taken where communication fails between the confined space work team and the standby person.

Fitness to work in a confined space

Sydney Water has resolved that employees required to enter a confined space have an adequate level of fitness to perform these duties without risk to their health.

All persons on the work team must be able to demonstrate an appropriate level of fitness. Refer to Sydney Water's *Confined Spaces Fitness & Aptitude Assessment Guidelines*.

Persons who fail the Sydney Water confined space fitness assessment should be managed by processes documented in Sydney Water's *Injury Management Procedure*

Persons whose fitness level is inadequate to demonstrate competency during training or reassessment will not be assessed as competent.

Contractors are responsible for devising and implementing their project safety plan. Where the contract involves confined space work, the project manager's site inspections should check that a suitable process is documented and followed for ensuring persons are fit to work in a confined space.

3.2 FMAIP PROCESS - Flow management and asset isolation

Entry to Sydney Water assets used for the transfer or processing of water, wastewater and similar substances must follow Sydney Water's *Asset Isolation Procedure*.

3.3 LOTO PROCESS

Mechanical and electrical isolations required to access a confined space must follow Sydney Water's *LockOut/TagOut Procedure*.

3.4 CLEANING PROCESSES

Where practicable, a confined space should be cleaned prior to entry, even where entry is required to effect final cleaning. The hazards of the cleaning process, eg high pressure water, steam, chemicals, must be managed.

3.5 AIR QUALITY HAZARD

Unsafe atmospheres

The following air quality limits apply for entry to or continued occupancy of a confined space without breathing apparatus for periods up to 8 hours.

Hydrogen sulphide	Not greater than 10ppm
Oxygen content	Not less than 19.5% or Not greater than 23.5%.
Carbon Monoxide	Not greater than 30 ppm
Flammable gas	Not greater than 5% of the lower explosive level of that gas or vapour
Volatile Organic compounds (VOC)	Not Greater than 20 ppm measured on a Photo ionisation detector calibrated on isobutylene
Other Substances identified as hazards	Not greater than the workplace exposure standard for that substance
Microbiological aerosols	Not present

Controls to be applied

- DO NOT ENTER a confined space or other workplace where flammable contaminants exceed 5% of the lower explosive level, or oxygen levels exceed 23.5% or the concentration of any contaminant exceeds the IDLH (Immediately dangerous to life and health) concentration for that substance.
- Where the risk assessment indicates a contaminated atmosphere, the confined space is to be ventilated while occupied and tested for the relevant gases or vapours prior to entry. Continued monitoring is necessary where the atmosphere could change during occupancy.
- Refer HS guidance note *Confined Space Ventilation & Gas Detection* for Information on exposure standards, ventilation, gas testing machines and competencies for gas testing machine operators
- Should ventilation fail to guarantee acceptable air quality, air supplied breathing apparatus conforming with AS 1716 and used in accordance with AS 1715 is to be worn whilst working in the confined space. Refer to Sydney Water's *Critical Safety Tools & Equipment Standard*
- A Self-Rescue Air Supplied Breathing Apparatus conforming with AS 1716 is to be carried ready for use where a process failure or an incident may result in an atmosphere harmful to health before all persons can exit the confined space. A secondary source of breathing air is to be carried when working in an airline breathing apparatus. SCBA does not require a secondary source of breathing air. Refer to Sydney Water's *Critical Safety Tools & Equipment Standard.*

Fire and explosion

Unless flammable gas has been eliminated in the hazard identification or risk control measures, electrical apparatus used in the confined space must be certified for use in explosive atmospheres.

3.6 ACCESS HAZARD

Fall Prevention

Entry to any confined space where the access does not conform to AS 1657 must follow Sydney Water's *Fall Prevention Standard*.

Where safety harness and rescue line is identified as part of the safe work method, the safety harness should be of the 'confined space' type unless a 'work positioning' set is required. The rescue line and associated lifting equipment should be providing a straight lift to a secure area. If this is not possible, the emergency procedure must manage this issue. Refer to Sydney Water's *Critical Safety Tools & Equipment Standard*.

Minimum hatch and chamber sizes

The minimum hatch size for entry is 450mm x 400mm rectangular, 450m circular or 450mm x 400mm elliptical. This hatch should not be obstructed by ventilation ducting, service hoses etc.

A hatch with a minimum dimension of 750mm x 700mm is necessary if use of self-contained breathing apparatus is required as part of the safe work method or the emergency response plan.

The minimum chamber dimension for entry and working is 750 mm in the smaller dimension.

Where flowing sewage is present, the minimum height of the conduit is 900mm. The minimum headroom over silt, flowing sewage etc. within the conduit is to be 750 mm.

3.7 TASK RELATED ISSUES AND OTHER HAZARDS

Electrical equipment must comply with the Workcover *Code Of Electrical Practices For Construction Work*.

In preparing or reviewing safe work methods for Cleaning, Welding or other hot work in confined spaces; ensure compliance with the specific requirements of AS 2865.

Hot work in Confined spaces and Confined Spaces which are also flammable gas hazardous areas must follow Sydney Water's *Control of Hot Work Procedure*.

Consider and control any other site hazards that may impact on safe working in a confined space. The relevant safe work method is additional to any confined space risk controls. Examples include but are not limited to Asset isolation, Flow management, Excavation safety, Flammable Gas Hazardous areas, Fall prevention, Traffic control, Noise management, Manual handling, Lighting.

3.8 EQUIPMENT

- Refer to Sydney Water's *Critical Safety Tools & Equipment Standard* for information on Portable gas detection equipment, Portable ventilation equipment, Fall arrest systems, Oxygen self-rescue breathing apparatus (OSR), Rope access systems, Safety harness, Self contained breathing apparatus (SCBA), Tripod/ davit assemblies.
- Refer to Sydney Water's *Occupational Personal Protection Standard* for information on other items of safety and protective equipment for confined space work.

3.9 CONFINED SPACE EMERGENCY RISK MANAGEMENT AND SW EMERGENCY RISK MANAGEMENT (ERM)

Introduction

The *OHS Regulation 2001, clause 17*, requires that arrangements are in place for managing an emergency.

The *OHS Regulation clause 74* has additional specific requirements for the management of emergencies in a confined space, including the availability of emergency equipment, the need to plan, establish and rehearse emergency procedures, and the need to ensure that the access hole is large enough to permit the rescue of all persons who may be in the space.

This document provides guidance for meeting these requirements in confined space entry.

Emergency Risk Management (ERM)

A site emergency plan should be developed. It must include:

- The information to be given when requesting a response from an emergency service.
- The safety and emergency equipment to be available on site prior to starting work'
- The responsibilities of onsite management and the workteam to manage a confined space incident.
- Appropriate response to foreseeable emergency.

Planning

The following need to be considered when developing a safe work procedure

1. Possible emergency events and suitable responses for these events.
2. Likely incident response scenarios developed and rehearsed as part of the site safety plan.
3. The equipment, training and adequacy of the team to provide an emergency response to foreseeable events where delay could be serious.
4. The need for a high level of fitness and equipment operation skills. These should be considered in selection and training of the confined space work team.
5. The difficulties to be overcome by an emergency service provider in accessing the site and providing casualty stabilization/ transport. Where necessary, liase with the relevant emergency service providers as part of the job planning. In remote areas and anywhere else an emergency service response could be delayed, consider the need for additional on site capability in first aid or rescue in the work team or others on site
6. The feasibility of removing an injured person, eg the clear size of hatches and other entry points, the feasibility of a direct lift or direct haul to open air.

Self rescue

Typical workteam response equipment

- "Escape set" respiratory protection available for each person may save lives if the air in the confined space becomes contaminated.
- Fire extinguisher/ water supply available when conducting hotwork.
- Additional ventilating equipment to blow fresh air into an occupied area.
- Having battery powered lighting available in the event of failure of installed lighting. This emergency lighting should be of an intrinsic safe design unless a possibility of a flammable atmosphere has been eliminated in the hazard identification.
- Where a direct lift or horizontal drag is possible for the work area, the individual should work in safety harness attached to an retrieval line and suitable lifting gear such that they can be removed from the confined space without the need for another person to enter the confined space and connect the individual to the retrieval line.

Equipment to enable communication to summon an emergency service response and equipment to enable communication between the standby person and the workteam must be available at the confined space entry. The standby person must be competent to operate this equipment and have sufficient English language skills to effect these communications.

Workteam rescue

Where conditions have deteriorated and individuals are unable to self-rescue, what is an appropriate role for the workteam pending the arrival of an emergency service response?

Example 1 – A person apparently overcome by oxygen deficiency requires removal to a respirable atmosphere, and may then require Cardiopulmonary resuscitation (CPR). Brain damage may have occurred prior to emergency service arrival. The workteam must have appropriate personnel, equipment and skills to effect this rescue.

Example 2 - An injury or disease event (eg broken limb or heart attack) may result in an individual being unable to self-exit a confined space or other workplace. Although medical attention may be needed, evacuation can wait for the arrival of specialist resources and stabilisation of the casualty.

3.10 INCIDENTS

Any need to evacuate a confined space should be recorded as a near- miss as per Sydney Water's *Incident Notification & Recording Procedure.*

The incident may require notification to Workcover under the *OHS regulation, Clause 341 (e) or (j)*.

Any serious injury or need to involve emergency services should be declared an "incident" within Sydney Water's Emergency Risk Management process (ERM).

Any disruption to Sydney Water normal operations caused by a confined space incident should be declared an "incident" at the appropriate ERM response level.

Appropriate incident investigation processes should be followed. Refer to Sydney Water's *Incident Investigation Procedure.*

3.11 CONFINED SPACE ENTRY PEMIT

Entry permits

A risk assessment and entry permit must be completed by the Responsible person prior to any entry by the work team into a Sydney Water controlled confined space. This permit must be revalidated whenever there is: -

- significant change in the hazards
- change in the person responsible for the work in the confined space,
- significant break in the occupancy of the confined space.

Suitable formats for recording a confined space risk assessment and entry permit are given in Attachment 2 to this procedure

3.12 CONFINED SPACE RECORDS

All confined space records shall be maintained in accordance with Sydney Water's *Document and Records Management Procedure* and the OHS Regulation 2001 clauses 78 and *171*.

- Entry permits and risk assessments are to be retained for 30 years because they contain air monitoring information.
- Training records are to be maintained fro the duration of employment plus 5 years.

4 COMPETENCIES

Confined space training

The *OHS Regulation 2001, clause 77*, requires an employer to provide training to all persons who are required to work in or on a confined space, or are associated with such work.

" *Persons shall be trained and assessed as competent to carry out their activities where they—*

(a) perform work in or on confined spaces;

(b) perform confined space assessments;

(c) issue written authorities;

(d) design and lay out the workplace;

(e) manage and/or are responsible for the direct control of the work in confined spaces;

(f) maintain equipment used for ensuring the safety of persons in the confined space;

(g) provide, fit, wear and maintain personal protective equipment;

(h) are on stand-by; and

(i) are involved in emergency response and first aid procedures."

Persons entering a Sydney Water controlled confined space must be trained and achieve appropriate competencies in the relevant "*core training elements for the national standard for safe working in a confined space",*

Sydney Water requires that persons responsible for the design, construction and management of confined spaces have received training and are competent to discharge their duties relating to confined spaces.

Persons completing specific duties such as completing an entry permit, performing gas testing, functioning as standby person, must demonstrate understanding of this instruction and relevant legislation in addition to the core competencies

In order to admit untrained visitors to a confined space, the risks must be eliminated or adequately controlled so that sufficient information can be conveyed at a site induction and no specific skills are required to enter or exit under foreseeable emergency conditions.

5 DEFINITIONS

Confined space	Confined Space – in relation to a place of work, means an enclosed or partially enclosed space that: a. is not intended or designed primarily as a place of work, and b. is at atmospheric pressure while persons are in it, and c. may have an atmosphere with potentially harmful contaminants, an unsafe level of oxygen or stored substances that may cause engulfment, and d. May (but need not) have restricted means of entry and exit. Examples of confined spaces are as follows (i) storage tanks, tank cars, process vessels, boilers, pressure vessels, silos and other tank-like compartments; (ii) open-topped spaces such as pits and degreasers; (iii) pipes, sewers, shafts, ducts and similar structures; shipboard spaces entered through a small hatchway or access point, cargo tanks, cellular double bottom tanks, duct keels, ballast and oil tanks, and void spaces, (but not including dry cargo holds). Confined spaces identified within SW water and wastewater operations include traversable sewers, traversable water mains, covered stormwater drains, most access chambers, most process vessels and conduits, all storage tanks, some sewer pump dry machinery wells, all sewer pump wet wells.
Contaminant	Any dust, fume, vapour, biological matter, gas or other substance in liquid or solid form, the presence of which may be harmful to health and safety
Entry to a confined space	When a person's head or upper body in within the boundary of the confined space.
Workteam Roles	
Competent persons	A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to perform correctly a specified task.
Gas Tester	A workteam member or other competent person who has been trained and assessed as proficient in evaluating the air quality of confined space.
Responsible person	A competent person, authorised by their management to allow entry into confined spaces.
Specialist gas tester	A person with appropriate technical qualification, who has been trained and assessed as competent to evaluate site air quality hazards, ventilation and air quality in a confined space.
Standby person	A competent person assigned to remain on the outside of, and in close proximity to, the confined space and capable of being in continuous communication with and, if practical, to observe those inside. In addition, where necessary, initiate emergency response procedures, operate and monitor equipment used to ensure safety during entry and work in the confined space.
Workteam member	A person who has, through a combination of training and experience, acquired knowledge and skills enabling that person to perform correctly their allocated task.

6 RESPONSIBILITIES

Senior managers	are responsible for: • Minimising the creation of new confined spaces that need to be entered for operation or maintenance. • In refurbishing existing structures, reducing the need to enter confined spaces for operations or maintenance • In refurbishing existing confined spaces, reducing the hazards of confined space entry.
Managers with asset management responsibility	are responsible for: • Ensuring within their area of responsibility that all confined spaces are identified where practicable and secured against unauthorised entry • Ensuring that hazards associated with all confined spaces are identified and signposted or this information is otherwise conveyed to anyone who may enter that confined space.
Business Managers	are responsible for ensuring that persons under their control or direction (including contractors) who are required to enter confined spaces are: • Consulted about the hazards of the confined space entry and the adequacy of the control measures employed. • Trained in confined space entry • Have the appropriate level of skill for the work they are required to undertake. • Equipped with suitable equipment for confined space entry • Required to follow agreed safe work method statements
Workteam Members	are responsible for: • participating in training and achieving appropriate levels of competence • Identifying the hazards associated with their work in the confined space and carrying out a risk assessment on their activities prior to (and during, if required) any entry. • Following agreed procedures

7. REFERENCES

LEGISLATION and SW RESOURCES

NSW *OHS Regulation, 2001*, Chapter 4 Work Premises And Working Environment - part 4.3, division 5 Atmosphere, Division 9 Working in confined spaces
WorkCover NSW Safety guides: Code of practice – *Excavation* (Publication no 312) *Toxic gas generated by micro-organisms in confined spaces* (Publication No. 417.1) To download WorkCover Codes of Practice, visit *http://www.workcover.nsw.gov.au/publications/safety guides* then click on the relevant code.

Sydney Water Corporate Standards and Procedures: *Asset Isolation* *Boating and Water Safety* *Control of Hot Work* *Critical Safety Tools & Equipment* *Document and Records Management* *Electrical Safety* *Emergency Preparedness* *Excavation Safety* *Fall Prevention* *First Aid Management* *Hazard Identification and Risk Assessment Process* *Hearing Conservation and Noise Management* *Incident Investigation* *Incident Notification & Recording* *Injury Management* *LockOut/TagOut* *Manual Handling* *Occupational Personal Protection* *Safe Working on Roads* *Working Safely Near Overhead Electrical Apparatus* Available on ConnectNet > Health & Safety > Health & Safety Standards/Procedures
Sydney Water Health and Safety guides: *Classification and Management of Flammable Gas Hazardous Areas* *Confined Spaces Fitness & Apptitude Assessment Guidelines* *Confined space Ventilation & gas detection* *Flammable Gas Guidelines* *Hazard Identification & Risk Assessment in Confined Spaces* *How to recognise a Confined Space* *Needlestick Injuries Safety Guidelines* *Protective Equipment and Safety Equipment for Working with Sewage* *TG 506 - Water Flow Management Isolation Procedure* *TG 507 - Wastewater Flow Management Isolation Procedure* *TG 508 - Treatment Plant Flow Isolation Procedure* Available on ConnectNet > Health & Safety > Guides and checklists
Sydney Water substance MSDS *MSDS - Dewatered Sewage Sludge*) *MSDS - Lime Amended Biosolids* *MSDS - Raw Sewerage* *MSDS - Recycled Industrial Water (Bluescope Steel)* *MSDS - Recycled Water (North Head)* *MSDS - Sewage Screenings & Grit* Available on ConnectNet > Health & Safety > Guides and checklists
Emergency Risk management guide and policy manual Available on ConnectNet > Workplace information > emergency risk management> plans, policies and procedures

AUSTRALIAN STANDARDS

This lists only Australian standards and related documents referenced in this document. Other standards are referenced in the applicable health and safety standard, procedure or technical guidance note. Refer AS 2865 for a full list of standards applicable to confined space work.

AS 1319 Safety signs for the occupational environment

AS 1674.1 Safety in welding and allied processes Part 1: Fire precautions

AS/ NZS 2865 Safe working in a confined space

RELATED DOCUMENTS

WELDING TECHNOLOGY INSTITUTE OF AUSTRALIA. *Health and Safety in Welding.* Technical Note 7.

NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION *Core Training Elements for the National Standard for Safe Working in a Confined Space*. (1996) Australian Government Publishing Service Canberra.

NATIONAL FIRE PROTECTION ASSOCIATION –[*NFPA 820*] (1999). National Fire Protection Association Quincy, MA, USA

8. DOCUMENT CONTROL

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Date of approval:	**28 Aug 2006**

9. HISTORY

Replaces Health & Safety Procedure HSP-001 issue B revision 0 issued 16 Jul 2006, which is now cancelled.

10. ATTACHMENTS

Attachment 1 - Confined space sign

Attachment 2 - Confined Space Risk assessment and entry permit forms

Attachment 3 – Confined Space Emergency Risk plan Shell

Confined space sign

A sign or signs, complying with AS 1319 safety signs for the occupational environment, shall be fixed in a position to indicate that the enclosure accessed by this door, hatch etc is a confined space. Additional signage may be fitted to warn of the particular hazards of this confined space.

A temporary sign may be used where it is not reasonably practicable to apply a permanent sign

RISK	RISK ASSESSMENT			CONTROL	REVISED RISK ASSESSMENT		
	Consequenc	Likelihood	Risk		Consequenc	Likelihood	Risk
Flooding, engulfment etc							
Mechanical movement, requiring isolation							
Contact with electricity							
Chemicals in confined space							
Structure contaminated by chemicals or sewage							
Contaminated air							
Unsafe level of oxygen							
Flammable gas or substances							
Risk of falling							
Restricted size of access							
Restricted size of chamber							
Unknown or doubtful structural integrity							
Skin contact hazards							
Hotwork							
Emergency management							
Isolated or remote area							
Activities of other worker teams							

CONSEQUENCE	LIKELIHOOD:				Risk ranking	Actions
	Very Likely	Likely.	Un likely	Very Unlikely	1	Unsafe to enter. Additional controls necessary to enter confined space Consider other business impacts.
Catastrophic	1	1	2	3	2	Unsafe to enter. Additional controls necessary to enter confined space.
Major	1	2	3	4	3	Apply appropriate controls or consider the need for additional controls
Moderate	2	3	4	5	4	Apply appropriate controls or justify acceptance of this risk.
Minor	3	4	5	6	5	Proceed with assessment process.
Insignificant	4	5	6	6	6	This risk is normally acceptable.

Confined Space Entry Permit and Risk Assessment		Permit Number Date Valid:
Site:		
Address:		
Location:		
Team Leader/Responsible Person:		SW / Contractor
Standby Person(s):		SW / Contractor
Entry personnel:		SW / Contractor
		SW / Contractor
		SW / Contractor

Description of work to be under taken...

....

Atmospheric Test Requirements - Undertake initial testing prior to entry to confined space

Contaminant/ Gas	Response test	Limit	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Oxygen		19.5 – 23.5%						
Carbon monoxide		30 ppm						
Hydrogen sulphide		10 ppm						
Flammables		5 % LEL						
VOC		20 ppm						
Other		Standard						

Authorisation

The confined space described above is in my opinion are in a safe condition for the work to be done, provided that the precautions above are fully observed and all persons trained in confined space procedures.

Responsible person.......………………………… **Valid from:**...………………...am/pm

Issued for: ……../……../……. **to:**..………………...am/pm

I/we understand the procedures required for entry and work in the confined space and the protective measures and equipment to be used.

Name	Sign In	Time	Date	Sign Out	Time	Date

All work is complete/suspended, equipment is removed and persons have vacated the confined space

Responsible person	**Date:** ……../……../……. **Time :**...………………...am/pm

CONFINED SPACE EMERGENCY RESPONSE PLAN SHELL

A site-specific emergency response plan shall be developed for any confined space entry.

This document provides guidelines to prepare a suitable plan. Where an activity involves entry to a number of confined spaces with a similar risk, a generic emergency response plan may be developed.

Information be given when requesting an emergency service response

Site identification and Address:

Nearest cross street:

Additional information needed to locate this site and the place where the incident occurred:

Nature of emergency and services required:

Number of persons requiring assistance:

Foreseeable emergency in this confined space

All persons working in or near an occupied confined space should be made aware of the history of multiple fatalities in confined space incidents, the limitations of respiratory protective equipment and the need to control danger prior to entry as an incident response.

Flooding:

Advise whether flooding of this confined space is possible, identify sources eg

- *Adverse weather*
- *Failure of isolations or flow controls*
- *Catastrophic failure of engineered structures or fluid containing systems.*
- *Other event - specify*

Advise appropriate actions which may include

- *Evacuate confined space*
- *Restore failed isolations.*
- *Minimise community impact*
- *Minimise environmental impact*

Contaminated or oxygen deficient atmosphere

A confined space should not be entered until ventilation has purged a contaminated or oxygen deficient atmosphere, and this has been confirmed by gas testing. This atmosphere may need to be maintained by ongoing ventilation and continuous gas monitoring.

Advise possible causes of an unsafe atmosphere in this confined space on this occasion, eg:

- *Failure of the ventilation system*
- *Release of additional contaminants from disturbing sediments*
- *Release of additional contaminants from the work processes*
- *Change in the nature of the liquid flow. In a sewer, this could be caused by customer discharge or operation of a sewage pumping station.*
- *Other event – specify*

Advise appropriate actions eg:

- *Immediate use of air supplied breathing apparatus (escape set)*
- *Evacuate confined space*
- *Restore failed ventilation or isolations.*
- *Perform work in air supplied breathing apparatus (work set)*
- *Minimise community impact*
- *Minimise environmental impact*
- *Assist the evacuation of persons apparently overcome by the unsafe atmosphere.*

Entrapment

Advise possible causes of entrapment in this confined space eg:

- *Entanglement of a lifeline in equipment*
- *Catastrophic structural failure*
- *Uncontrolled discharge of fluid or flowing solid*
- *Failure of isolation on moving machinery.*
- *Other event - specify*

Advise appropriate actions eg:

- *Release trapped persons*
- *Provide first aid*
- *Evacuate confined space*
- *Restore failed isolations.*
- *Remove lifeline and exit the confined space.*

Incapacitation injury or acute disease incident

A person working in a confined space may be unable to exit that confined space as a result of an event such as

- A fall
- Heart attack or similar incapacitating disease
- Injury to a limb etc

The person is unable to exit the confined space unaided, requires medical attention but is not at immediate danger from the confined space conditions. Appropriate actions may include

- Render appropriate first aid
- Cease work that may hinder the emergency service response
- Assist the emergency service response if requested

Asset Management Procedure Permit to Work

1. SCOPE

This procedure has been developed to ensure that work undertaken on Asset Management sites commences only after authorisation by appropriate personnel. Authorisation to commence work can only be given following hazard identification, risk assessment and the implementation of adequate controls. Authorisation may be given by Asset Management personnel on manned sites or involve self-authorisation by service providers on unmanned sites.

2. DEFINITIONS

Permit to Work Certificate (PTWC):	A document which sets out the work to be done, the hazards involved and the precautions or controls to be taken. It is used on sites where operational control of the work is controlled by Asset Management employees (ie on manned sites)
Job Card	A document which sets out the work to be done, the hazards involved and the precautions or controls to be taken. It is used on sites where work undertaken is under the control of the service provider (ie unmanned sites)
Authorising Officer (AO):	A Sydney Water employee or service provider who has been trained, assessed as competent and authorised to issue PTWC/sign job cards to allow work to proceed on an Asset Management site.
Greenfield Site:	Self-contained area of land or facility which is not part of an operating site. Where possible, it shall be defined by fences, markers or other physical barriers.
Manned Site:	A defined processing or operational establishment that is normally attended by Sydney Water staff. e.g. Sewage Treatment Plants, Water Treatment Plants, large Water Pumping stations, Head Office, Satellite Depots & Offices.
Service Provider:	The personnel or company assigned to undertake the work on the asset. This may be an internal Sydney Water employee or an external contractor.
Hierarchy of Controls	If Elimination of the hazard is not possible then, in order of effectiveness, 'Substitution – Engineering Controls – Procedural or Administrative – Personal Protective Equipment'
Project Safety Plan	Plan developed by the contractor which outlines how OHS&R will be managed for the duration of the project.
Work method statement(WMS) / job safety analysis (JSA)	A document that describes the step-by-step method for carrying out work. The WMS/JSA identifies and records the hazards for each step, the risk due to those hazards, the controls that must be in place before work is undertaken and the required qualifications of people who will undertake the work. A WMS / JSA must be developed in consultation with those people who will be undertaking the work.

3. GENERAL REQUIREMENTS

Overview

- The Permit to Work process is designed to address three key areas:
  - To ensure that a hazard identification and risk assessment is undertaken before any work is carried out on Asset Management sites or assets.

Asset Management Procedure
Permit to Work

- To eliminate or control foreseeable hazards and risks associated with working on Asset Management sites and assets.
- To maintain control of all work on Asset Management assets by ensuring that any task undertaken is authorised prior to commencement.

- The process uses Permit To Work Certificates on manned sites which detail the work to be carried out, the hazards and the controls for the work, and give authorisation by Asset Management for the work to commence.
- On unmanned sites the same process is used, however the work is carried out under a self-authorisation by the service provider. This self-authorisation, recorded on a job card for the work, is an acknowledgement by the service provider that they have carried out all the required steps to ensure that the work is undertaken in a safe manner.

Risk Assessment

- All work performed on Asset Management sites shall have a risk assessment conducted prior to commencement.
- The risk assessment shall be conducted in accordance with Sydney Water's Hazard Identification and Risk Assessment (HIDRA) Corporate Procedure (CP KP 014). The risk matrix from this procedure is provided in Appendix 1.
- All risk assessments shall be conducted in consultation with relevant site / operations personnel and service providers. The aim of the risk assessment is to identify hazards and implement controls appropriate to the level of risk identified.
- On unmanned sites the HIDRA process must take into account hazards identified on the site's Hazard Sheet.
- The HIDRA score will determine the level of documentation required for the job to proceed per table 1 below:

Table 1: Documentation requirements for tasks performed at asset management sites

HIDRA score	1-2	3-4	5	6
Documentation requirements	• PTWC / job card and • Job specific WMS or equivalent (eg JSA)	• PTWC / job card and • Generic* WMS or equivalent (eg JSA)	• PTWC / job card	• No PTWC (manned sites) • Job card (unmanned sites)

*NB: Generic WMSs must be assessed for their applicability to the job by the service provider and any additional hazards identified, assessed and controlled. These shall be documented on the WMS, the PTWC / Job Card or the Maximo docket.

- When considering controls for identified hazards, elimination of the hazard must always be considered. If elimination of the hazard is not possible then the hierarchy of controls should be used to reduce the risk to the lowest possible rating.
- If the following hazards are identified (asbestos / hazardous substances / manual handling / working on live electrical equipment) then a work method statement including a task specific risk assessment must be undertaken before the job proceeds to ensure that effective controls are in place. The requirement for a work method statement and risk assessment must be recorded on the PTWC/job card.

- When identifying hazards care should be taken to ensure that hazards such as those due to plant, work premises, work practices, biological hazards, physical working environment, and workplace violence are also considered.

Site inspection

- Prior to work commencing, the AO shall inspect the plant, equipment or area/s where the work is to be performed.

Isolation of assets

- It is the responsibility of the AO to ensure that equipment to be worked on is correctly isolated including locking and tagging in accordance with the Asset Management Lock Out Tag Out (LOTO) procedure. This includes physical inspections of the isolations.
- All isolations performed shall be documented on the PTWC/job card or Maximo docket for the job.
- Isolations shall remain locked and tagged until all relevant PTWCs / job cards have been closed and the equipment is ready to return to service.

4. MANNED SITES - PTWC PROCEDURE

- The following work always requires a PTWC:
  - The work is assessed with a HIDRA score 1-5
  - The work is not performed by people (including contractors) under the direct supervision of the personnel with operational control of the area.
  - The work involves any of the following activities:
    - ❑ Excavation or break into concealed spaces
    - ❑ Hot work
    - ❑ Entry into confined spaces
    - ❑ Use or work on sources of ionising radiation
    - ❑ Work on (or in the vicinity of) High Voltage Equipment and Systems
    - ❑ Work on (or in the vicinity of) Live Low Voltage Equipment
    - ❑ Potentially contaminated equipment
    - ❑ Work at Heights/Work on Roofs
    - ❑ Use of Explosive Powered Tools
    - ❑ The work may constitute a significant risk and there is no established and tested work instruction.
- Where work involves hot work, work in confined spaces, excavations or potentially concealed services, removing contaminated equipment from site or high voltage access, the other relevant permits must also be issued. ie hot work permit, confined space permit, dig cut permit, cleaning certificate or high voltage permit. Refer to the relevant Asset Management Standard Safety Procedure for further information.
- Prior to issuing a PTWC the AO shall:
  - Discuss with the person doing the work what the work will involve, what could go wrong and how the job can be made safer
  - Record the HIDRA score on the PTWC
  - Assess the potential impact on and from other work being performed in the area

- Personally inspect the plant
- Ensure correct isolation is in place and recorded
- Ensure relevant information is recorded on the PTWC (eg names of workers, scope of work, limitations)
- Ensure additional clearances have been granted (eg hot work, confined space, high voltage, dig/cut)
- Ensure conditions of the WMS (if required per table 1) have been met

▪ More than one AO may be involved in the PTWC issue – refer to local site procedures

▪ Prior to accepting the PTWC, the recipient shall read and agree to the permit conditions and record acceptance by signing and dating the PTWC

▪ A copy of the PTWC shall remain at the work site and at the point of permit issue for the duration of the job. If a job specific WMS is required, it shall be attached to the service providers copy of the PTWC

▪ A PTWC can be withdrawn at anytime by personnel with operational control of the area and work must cease.

▪ A PTWC is valid on the day of issue only unless it is extended. Where the job involves overnight work the PTWC must be extended or a new PTWC issued at the commencement of the following day shift.

▪ Up to 6 extensions of the PTWC can be given. Extensions must be over consecutive days. The AO must reinspect the work area prior to giving an extension and ensure that no changes have occurred

▪ If there is a change of AO eg at a shift change, the issuing AO shall discuss the PTWC and its conditions with the new AO and if satisfied, the new AO shall countersign the PTWC

▪ If there is a change of personnel performing the work:
  - The original recipients of the PTWC shall sign off the PTWC
  - The new personnel shall discuss the requirement of the PTWC with the AO
  - The new personnel shall sign onto the PTWC

▪ On completion of the work or leaving the work incomplete:
  - The recipient shall discuss the job status with the AO and record job status, date and time on all copies of the PTWC
  - The AO shall check the status of the work, record whether equipment is ready to be returned to service and sign date and record time of acceptance of closure of the PTWC

▪ Books of PTWCs can be ordered through stationery. An example PTWC is available on ConnectNet.

Work authorised to proceed without a PTWC

▪ Routine work carried out by local operations personnel under the control of an SOP may proceed without formal authorisation.

▪ Routine tasks with an approved Procedure that identifies hazards, assesses the risk due to the hazards and specifies controls may be carried out provided that conditions outlined in the procedure have not changed and no isolations or further permits are required.

▪ Work that is undertaken with a HIDRA score of 6 shall be permitted to proceed without a PTWC providing the following conditions are met:
  - The work appears on the site register of tasks with HIDRA score of 6

- There have been no changes to the work environment which may effect the risks associated with the work

- If the work meets these conditions the AO shall verbally permit the work to proceed and document the job, location, service provider and date approved in a site workbook or log. The AO shall initial alongside that approval has been given to proceed. The service provider shall sign on at the beginning of the job and sign off when work is completed for the day. This process must occur every day for jobs that are longer than one day/shift.
- At the conclusion of the work, the service provider must notify the AO of the status of the work.

Site register of tasks with HIDRA score of 6

- Where sites choose not to issue a PTWC for jobs with a HIDRA score of 6, the site should document these jobs on a site register (examples of work with that may fall into this category are specific repair of office equipment by service technicians, office work, inspections by maintenance service providers providing they are familiar with the site and that a site check has been performed, accompanied site visits)
- An example register is available on ConnectNet as AM Standard Form – Site Register for HIDRA Scores of 6
- The register must be filed with the site / business area's management system records.
- The register must be reviewed at least annually or when a request is made to the production area for an addition to the list

5. UNMANNED SITES – JOB AUTHORISATION

- An assessment of the risk of the work to be undertaken will be carried out by the work team, recorded on the job card and signed by an authorising officer
- The result of the risk assessment shall determine the level of documentation required for the job to proceed in accordance with Table 1 of this procedure. The authorising officer must ensure that this documentation is available prior to allowing the job to proceed.
- Prior to authorising work to commence the AO shall:
  - Discuss with the work team doing the work what the work will involve, what could go wrong and how the job can be made safer
  - Record the identified hazards and controls on the job card
  - Record the risk assessment score on the job card or Maximo docket
  - Assess the potential impact on and from other work being performed in the area
  - Ensure correct isolation is in place and recorded
  - Ensure relevant information is recorded on the Job Card (eg names of workers, scope of work, limitations)
  - Ensure additional clearances have been granted (eg hot work, confined space, high voltage, dig/cut)
  - Ensure conditions of the WMS (if required per Table 1) have been met
  - Ensure that the identified controls are in place and are effective

6. CAPITAL WORKS

- For one off Major Projects (eg Capital Works) a Project Safety Plan must be provided by the Service Provider/Contractor and approved by the appropriate SWC Representative.
- If the project task is to be carried out on a Greenfield Site with no potential to affect Asset Management's area of operation the task may proceed without a PTWC but must abide by the controls detailed in the Project Safety Plan.
- If the project task is directly involved with or has the potential to affect Asset Management area of operation (for example with cut-ins to systems) the work must be done under the control of a PTWC.

7. TRAINING AND RECORDS

- Prior to appointment and at least every two years (through safety training days), AOs shall be assessed to ensure:
  - they have sufficient knowledge of the site (facility) and PTWC/job card procedures;
  - they have demonstrated a responsible attitude towards safe work practices; and
  - they understand the legal requirements for the work they can authorise.
- The requirement to work under a PTWC or Job Card must be included in the induction given to service providers.
- The following records shall be maintained for defined periods:
  - register of jobs / tasks exempted from PTWC requirements (5 years)
  - records of Authorised Person training and test results (term of employment plus 3 years)
  - copies of all PTWCs / job cards (5 years)
  - copies of additional certificates/permits to perform work - eg. Hot Work Permits, Confined Space Entry Permits, etc (5 years)

8. ADDITIONAL INFORMATION

NSW OH&S Regulation 2001
Chapter 2 Places of work - risk management and other matters - Clauses 9-14 and 17

Codes of Practice
Not applicable

Australian Standards
Not applicable

Corporate and Asset Management Procedures
Contractor Safety Management System Manual
CP-KP-014 – Hazard identification and risk assessment
GP 001 – Safe entry and working in confined spaces
AMD SSP – Hot work
AMD SSP – High Voltage Awareness
AMD SSP – Dig / Cut
AMD SSP – Decontamination of Process Equipment

APPENDIX 1 – HIDRA RISK MATRIX

CONSEQUENCE OR IMPACT What type of impact do you expect could result from exposure to this hazard?	**LIKELIHOOD** – How often are people exposed to the hazard being assessed and how likely is it that these circumstances can and will lead to an accident?			
	Very likely The event could happen at any time	**Likely** The event could happen sometime	**Unlikely** The event could happen but very rarely	**Very unlikely** The event could happen but probably never will
Catastrophic (eg death)	1	1	2	3
Major (eg extensive injuries)	1	2	3	4
Moderate (eg medical treatment)	2	3	4	5
Minor (eg first aid treatment)	3	4	5	6
Insignificant (eg no injuries)	4	5	6	6

Sydney WATER	HEALTH AND SAFETY PROCEDURE
HSP 070	ASSET ISOLATION

1 SCOPE

This Sydney Water procedure specifies minimum requirements to ensure the safety of Sydney Water personnel and / or contractors who require safe isolation and / or flow management to prevent risk of flooding and injury to personnel, where a project or activity involves working in, on or around a live hydraulic asset and/or associated fittings. WorkCover impose specific requirements on some isolations.

Contractors/ Service Providers to Sydney Water are required to meet the requirements of this procedure and the relevant Flow management / Asset Isolation procedures manuals through their own systems of work.

2 KEY REQUIREMENTS

- The key requirements of the procedure must be met prior to any entry to a confined space.
- All planned isolations and flow management of live hydraulic assets, whether for water wastewater or stormwater operations or treatment, must follow the SWC procedure appropriate for the class of asset.
- Any planned or reactive work involving entry into a live hydraulic asset MUST follow the safety related processes of the relevant procedure. Safety takes precedence over minimizing water loss, reducing environmental impact and maintaining customer service.
- Urgent reactive work required to minimize customer impact, water loss or environmental damage, which does NOT involve entry into a live hydraulic asset, should be conducted according to the appropriate safe work method statements.
- Isolations for all assets which are also classified as confined spaces must follow the requirements of the *OHS Regulation 2001, Cl 69* and SWC corporate procedure "*Safe Entry and Working in Confined Spaces*".
- Flow management must consider potential peak flow rates.
- The rescue plan must take account of potential failure of isolation.
- Risk assessments must include consideration of all potential impacts to the environment, OH&S, and business (e.g. customers- ability to provide service).
- Trial isolations will be necessary where there is a risk that difficulties experienced executing the isolation/flow management plan may cause delays that will result in significant impact to safety, environmental impact, customer service or the business.
- All mechanical and electrical equipment associated with the asset to be isolated **MUST** be disabled from operation. All locking and tagging must be undertaken in accordance with SWC *Lock Out / Tag Out Procedure*.
- Where double barrier isolation is not feasible for an asset, an Isolation / Flow Management Plan must be approved by the appropriate manager
- Valve anchored by soil friction must be reviewed for adequacy. Where the work requires tomming or bracing of valves or pipes, a Civil Engineer must certify the method proposed and/or actual installation before work proceeds

3 PROCEDURES

FLOW MANAGEMENT / ASSET ISOLATION - PROCEDURES APPLICABLE FOR ALL ASSETS

Water delivery systems, wastewater delivery systems and water/ wastewater treatment systems have different risks and different management structures. Different procedures have been developed to manage the risks of flow management and asset isolation within these systems.

This document supports three stand-alone procedure manuals within a common framework of key requirements, definitions, forms etc.

1. For detailed procedures to be used when conducting an isolation of a water asset, refer to TG-506 HS Procedure Manual for Isolation And Flow Management of WATER assets.

2. For detailed procedures to be used when conducting an isolation of or managing flow in a wastewater asset, refer to TG-507 HS Procedure Manual for Isolation And Flow Management of WASTEWATER assets.

3. For detailed procedures to be used when conducting an isolation of or managing flow in a water or wastewater treatment asset, refer to TG-508 HS Procedure Manual for Isolation And Flow Management of TREATMENT assets.

Note 1: A Pochodyla plug may be used as one barrier for gravity flows with less than 10 metres head. The unit must meet the requirements of SWC Critical Safety Tools and Safety Equipment Standard, and be installed by trained persons.

Note 2: Confined space entry to insert a Pochadyla Plug, stop board or other flow management device must be managed under an appropriate live flow management plan. The remainder of the work then continues under the flow management/ isolation provided by the device.

4 COMPETENCIES

- All persons working in an isolated or flow managed live hydraulic asset should be conversant with the principles of effective isolation/ flow management and the isolation / flow management process used in this particular occasion.
- Asset isolations must be planned, implemented and proved by appropriate competent person(s).
- Competency assessments for people who plan, manage & conduct these tasks must be conducted annually by a competent person.

5 DEFINITIONS

Only definitions relevant to this procedure are given. Refer individual procedure manuals for their relevant definitions.

Asset	An asset for the purpose of this manual shall imply a 'live hydraulic asset' as defined below, including associated electrical mechanical equipment
Competent person	Competent person for any task means a person who has acquired through training, qualification or experience, or a combination of these, the knowledge and skills to carry out that task
Double Barrier Isolation	Any isolation by means of two physical, mechanical and/or electrical barriers as close as practicable to the asset to be isolated. Examples include: • The closing, locking and tagging of two valves in the piping leading to the work site with (where possible) a scour valve between the two closed valves locked and tagged open. • The insertion of two suitable full pressure spades (blanks) in piping between flanges, the insertion of two specifically designed and pressure rated stop boards, etc as close as practicable to the work site Notes: • *Double barrier isolation may be achieved through a combination of mechanical and physical barriers (eg a stop board and a valve)* • *Double barrier isolation may be achieved by both mechanical isolation of a valve and electrical isolation of an upstream pumping station (provided gravity feeds are also isolated).* • *The equivalent of double isolation is also achieved by the removal of a valve, spool piece, an expansion joint in piping leading to, and as close as practicable to the work site and blanking or capping the open end of the piping leading to the confined space.* • *Double barrier isolation must be applied both upstream and downstream on pressurised systems*
Excavation work	Excavation includes the excavation or filling of trenches, ditches, shafts, wells, tunnels and pier holes, and the use of caissons and cofferdams
Flow Management	Flow management is a process of assessing and controlling flow in order to prevent engulfment. Flow management includes the estimation of flooding time and emergency exit time giving consideration to system integrity, pressure head, mechanical strength / safe working limits of isolation mechanisms involved to withstand the worst case potential loads placed on them when closed and ongoing monitoring flow rate
Flow Management & Asset Isolation Procedures (FMAIP)	A documented process setting out the procedure to establish and maintain safe isolation, flow management, de-watering / re-charging & re-commissioning of live hydraulic assets.
Isolation Plan / Flow Management Plan	A set of documents outlining the scope of work, risks and controls, schedules and roles and forms as required to manage the safe working in, on or around a live hydraulic asset.
Isolation Schedule **Flow Management Schedule**	A schedule of activities to control the flow of fluid into a potential work site to provide a safe working environment.
Live hydraulic asset	Any part of a water, wastewater or stormwater network that is normally conveying or storing fluid.
Lock-Out and Tag-Out (LOTO)	A procedure used to disable an asset from operation. The activities must follow corporate procedure HS 049 lockout/ tagout.
Responsible Person for Isolation / Flow Management & Recommissioning	The person who has the necessary training and has been nominated by the Service Provider to perform those functions, as defined on the isolation / flow management and re-commissioning plans

6 REFERENCES

OHS Regulation 2001"
WorkCover NSW Safety guide – *Preventing death by drowning* To download Workcover documents, visit www.workcover.nsw.gov.au/ then follow the links.
Sydney Water Corporate Procedures: *Safe entry and working in confined spaces* *Lock Out / Tag Out* *Contractor Safety Management System (CSMS)* Flow Management & Asset Isolation Procedures Manual – Live Hydraulic Assets Within Water Networks. Flow Management & Asset Isolation Procedures Manual – Live Hydraulic Assets Within Wastewater Networks. Flow Management & Asset Isolation Procedures Manual – Live Hydraulic Assets Within Treatment Assets. Available on ConnectNet > Health & Safety > Health & Safety Instructions/Procedures
Sydney Water documents: Diving policy & procedures manual Available from Asset Management Division.

7 DOCUMENT CONTROL

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8 HISTORY

New document, incorporating existing AMD procedures into a HS corporate structure.

Sydney WATER	HEALTH AND SAFETY PROCEDURE
HSP 049	LOCKOUT/ TAGOUT

1. SCOPE

This procedure covers the requirements associated with the isolation and lockout and tagout (LOTO) of plant or equipment from all sources of motive power, stored energy, process or substances prior to any work being carried out. It includes the means for effective isolation, padlocking, tagging, testing and reconnection. This procedure applies to all sites under the control of Sydney Water.

This procedure does not apply to the isolation of high voltage electricity. For the isolation of high voltage electricity, refer to the Sydney Water High Voltage Operating Procedure (Green Book).

Sites working under "green field" arrangements may have their own LOTO procedures. However, any isolations at the interface between "green field" and "brown field" sites must be managed in accordance with this procedure.

2. KEY REQUIREMENTS

- All energy sources into or within a device must be isolated prior to work commencing.
- ALL isolations must be tested for effectiveness prior to the commencement of any work – ie the equipment must be proved de-energised and shown to have no stored energy.
- All isolations must have the appropriate tag applied at each isolation point
- Wherever possible each isolation point must be locked out as well as tagged
- All tags and locks are only to be removed by authorised people.
- Danger tags, red and blue locks are used for personal protection and can only be removed by the person whose name appears on the tag.
- Out-of-service & redundant tags, silver & black locks are not used for personal protection but to convey the status of the equipment.
- Danger Tags, Out of Service Tags and Redundant Equipment Tag are single use items only and must not be reused or recycled.
- No work must be undertaken on "live" equipment except under exceptional circumstances detailed in this procedure
- Under no circumstances are emergency stops to be used for equipment isolations for persons to work on that equipment.
- This procedure does not apply to the isolation of energy associated with high voltage electricity (ie greater than 1000 volts)
- When low voltage isolation is to be performed as part of a high voltage isolation, the high voltage procedure (Green Book) shall prevail
- Live hydraulic systems are to be isolated in accordance with Sydney Water's *Asset Isolation Procedure.*

3. PROCEDURE

LOTO Procedure for Manned Sites

- The relevant operations personnel shall identify the need for isolation and lock out/tag out.
- Operations personnel shall contact the relevant service providers to assist with the isolation. This includes identifying the equipment that needs to be isolated and all sources of energy to the equipment.
- When operations personnel and service providers are satisfied that the equipment is isolated, operations personnel shall:
  - Attach a black lock to the isolation point
  - Attach a yellow “out of service” tag to the isolation point/s ensuring that all information is completed – the “operations” box should be ticked indicating that only operations can remove the tag
  - Test and prove the isolation
  - Inform service providers that work can commence by completing a PTWC (Permit to Work Certificate)
  - Ensure that service providers working on the isolated equipment attach the relevant locks and tags and record this information on the PTWC.
- When service providers commence work on isolated equipment they shall
  - Attach a red lock or a blue lock to the isolation point/s
  - Attach a completed “danger tag” which includes selecting either the personal or group application and referencing the PTWC number on the tag.
- Where a job is **not complete** the service provider or responsible person shall:
  - Remove the personal lock
  - Remove the personal danger tag, destroy it or strike a line through it and dispose of it
  - Attach a new “out of service tag” to the isolation point (Note – this “out of service tag” is in addition to the operations “out of service” tag)
  - Update all sections of the new “out of service” tag, which shall include a detailed description of the status of the equipment and ticking the correct “to be removed by” box on the front of the tag (this will usually be by the trade that the service provider represents)
  - Return the lock with key to the operations personnel and inform operations personnel that the job is not complete
  - Sydney water electrical personnel may place a silver electrical lock on the isolation point to maintain the electrical isolation.
- On returning to the job the service provider shall:
  - Obtain a PTWC from operations personnel who shall retest / confirm the isolation
  - Obtain a red or blue lock and a danger tag from operations personnel who shall record this information on the PTWC
  - Remove the relevant “out of service” tag from the isolation point and destroy it or strike a line through it and dispose of it
  - Where a silver lock is in place get this lock removed by an electrical tradesperson
  - Attach a red or blue lock and a danger tag to the isolation point.
- When the service provider has **completed** the job, the service provider or responsible person representing a group of service providers shall:
  - Remove the personal lock
  - Remove the personal danger tag and destroy it or strike a line through it and dispose of it
  - Return the lock with key to the operations personnel
  - Complete the relevant sections of the PTWC.

- When the job is completed operations personnel shall:
  - Complete the relevant sections of the PTWC
  - Go to the isolation point and check there are no red or blue locks, danger tags or out of service tags that can not be removed by operations (if there are, obtain further information from the persons documented on the tags)
  - When satisfied that it is safe to start equipment, where necessary, organise with relevant service providers to remove equipment isolations
  - Remove the black lock and the operations out of service tag and destroy it
  - Recommission equipment as necessary

Proving Equipment Isolated

- Isolated equipment must be proved isolated from all sources of energy. This includes ensuring that there are no alternate sources of energy (eg dual feeds, hydraulic, mechanical etc) to the equipment and that there is no stored energy.
- When proving equipment isolated consideration should be given to the vicinity of other equipment (eg could there be crossed wires?).
- It should be noted that attempting to start equipment does not always prove equipment is isolated as there may be additional sources of power to the equipment.
- In most cases an electrician should prove electrical isolations. Exceptions to this are where it is positively known that there are no other sources of power nearby

Combined Fuse Isolating Switches

- Many sites have lockable fuse switches that can be used to electrically isolate equipment**.**
- Fuse switches can be an effective and efficient way of isolating equipment however they do not provide a visible break for verification of isolation.
- Fuse switches may be used for isolating electrical equipment provided that the risks associated with the work are assessed. Some examples are provided below
  - Isolating using lockable fuse switches is acceptable for work that involves simple inspection and testing
  - For higher risk work such as pump impeller repairs (where an accidental start up could cause a significant injury) the fuse should be removed by an electrician.

Group Isolation

- Group isolation can be used for 2 or more people working on the same isolated equipment. Group isolation means that only one danger tag and personal lock needs to be attached for the group.
- If group isolation is undertaken, a responsible person must be nominated. The responsible person is typically the most senior person in the group or the person who has received the PTWC.
- If group isolation is undertaken, the responsible person must select the “group” box on the danger tag and put his / her name on the danger tag.
- Operations personnel must include that Group Isolation is being undertaken on the PTWC.
- When removing the personal lock and danger tag and returning the PTWC, the responsible person is indicating that all personnel working under the personal lock and danger tag have been alerted that no further work on the equipment is to take place until another permit has been issued.
- Individuals always have the choice to use their own personal lock and danger tag instead of participating in group isolation.

Isolation boards

- Isolation boards may be utilised when there are multiple isolation points or when a job requires isolation over an extended period of time.
- The use of isolation boards must be approved by the PO E or most senior person (eg CIM) responsible for the site.
- As a guide, isolation boards can be utilised for jobs with greater than 5 points of isolation and / or for jobs that will last for greater than 3 days or for jobs that have standard operating procedures (eg decommissioning digesters).
- The detailed procedure for using isolation boards is attached as Appendix A

LOTO Procedure for Unmanned Sites

- The relevant personnel shall identify the need for isolation and lock out/tag out.
- The effect of the isolation on the Water / Wastewater system shall be identified. If necessary the SOC and/or the relevant asset owner should be notified.
- When service providers are satisfied that the equipment is isolated, they shall:
  - Attach a yellow “out of service” tag to the isolation point/s ensuring that all information is completed
  - Prove the equipment isolated
  - Record details of the isolation eg by completing a Job Card, Work Order or Proforma.
- When service providers commence work on isolated equipment they shall
  - Attach a red lock or a blue lock to the isolation point/s if possible
  - Attach a completed “danger tag” which includes selecting either the personal or group application and referencing the Job /Work Order number on the tag.
- Where a job is **not complete** the service provider or responsible person shall:
  - Remove the personal lock
  - Remove the personal danger tag, destroy it or strike a line through it and dispose of it
  - Attach a new “out of service tag” to the isolation point
  - Update all sections of the new “out of service” tag, which shall include a detailed description of the status of the equipment and ticking the correct “to be removed by” box on the front of the tag (this will usually be by the trade that the service provider represents).
  - Sydney water electrical personnel may place a silver electrical lock on the isolation point to maintain the electrical isolation.
  - Inform SOC and/or the relevant asset owner that the job is not complete.
- On returning to the job the service provider shall:
  - Obtain a red or blue lock and a danger tag and record this information on the Job Card, Work Order or Proforma.
  - Remove the relevant “out of service” tag from the isolation point and destroy it or strike a line through it and dispose of it
  - Retest / confirm the isolation by proving the equipment
  - Attach a red or blue lock (if possible) and a danger tag to the isolation point.
  - Where a silver lock is in place get this lock removed by an electrical tradesperson
- When the service provider has **completed** the job, the service provider or responsible person representing a group of service providers shall:
  - Remove their personal lock
  - Remove their personal danger tag and destroy or strike a line through it and dispose of it
  - Complete the relevant sections of the Job Card/Work Order/Proforma.
  - Ensure there are no other red or blue locks, danger tags or out of service tags that have not be removed (if there are, obtain further information from the persons documented on the tags)
  - When satisfied that it is safe to start equipment, where necessary, organise with relevant service providers to remove equipment isolations

– Recommission equipment as necessary

Working Live

- In general working on energised equipment (working live) is not permitted.
- It is recognised that for certain activities working on live equipment is necessary (eg electrical and mechanical fault finding, clearing chokes, inching equipment etc).
- Working live in these situations is permitted providing the conditions outlined in Appendix B are adhered to.
- All work on live systems must be have a risk assessment completed and a documented work method statement / JSA available for the task. The work method statement shall include provisions to prevent equipment being tested from inadvertently being started from the SCADA systems where present (eg applying the “maintenance mode” tag on SCADA (where available) to such equipment.

Removal of Another Person’s Locks and Tags

- The removal of another person’s (or trades) locks and tags is prohibited ie – locks and tags should only be removed by the person who applied them or, in the case of out of service tags, by the group indicated on the tag. Additionally silver locks can only be removed by Sydney Water electrical personnel.
- If the individual who applied the tag is not available, and the personal protection locks and tags need to be removed the special lock / tag removal work sheet available on ConnectNet is to be completed in conjunction with the following conditions being met:
  – Verify the individual who applied the LOTO is no longer on site
  – Verify that it is safe to remove the LOTO by contacting the individuals immediate supervisor for approval
  – Notify all personnel associated with the operation
  – Make all reasonable efforts to notify the individual and inform them the LOTO has been removed.
- The site should complete a non-conformance request and investigate why the tags / lock was left in place. Corrective actions should be developed to prevent it from happening again.
- A copy of the lock / tag removal form should be sent to the most senior person responsible for the site so they are aware of the breach in procedure.

Training and Records

- Personnel who are expected to administer or implement the requirements of this procedure are required to undergo refresher training and prove their competency every 2 years. This will usually be through safety training days.
- Records of training shall be kept for the term of an individual’s employment plus 3 years.
- PTWCs and all paperwork associated with LOTO shall be kept in a secure location for 5 years.

4. ADDITIONAL INFORMATION

Lock Out Tag Out Equipment

- Danger Tags, Out of Service Tags and Redundant Equipment Tags are available through Boise Cascade as stationery items.
- Danger Tags, Out of Service Tags and Redundant Equipment Tag are single use items only and must not be reused or recycled.
- On manned sites the site owner will provide all locks, tags and other isolation equipment required for the site except by prior, documented agreement.
- On unmanned sites, service providers will be responsible for providing required locks and isolation equipment. Asset Management will arrange for appropriate tags to be available.

- Maintenance providers and site operational staff must jointly inspect all manned sites to ensure that the appropriate isolation points / devices are available for the site. Where appropriate (ie lockable) isolation points are not available the site owner will consult with its providers to install appropriate lockable devices.

- **Out of service tags**
  - Are used to convey the **status** of the equipment
  - Are to be attached to the isolation point or an isolation board (when used)
  - Should only be removed by the person or position indicated on the tag

- **Danger tags**
  - Are to be used to provide **personal protection** to an individual or group of individuals working on isolated equipment – the relevant box (group or personal) on the tag should be selected to indicate the application
  - Are to be used in conjunction with red or blue locks
  - PTWC / Job Card / Work Order / Proforma number must be referenced on the tag
  - Must only be removed by the person whose name appears on the tag

- **Redundant equipment tag**
  - A redundant equipment tag is to be applied to sources of energy or equipment that is no longer used on site and has been permanently isolated.
  - All information on the redundant equipment tag should be completed
  - Redundant equipment tags should be reviewed and replaced every 2 years
  - Sites must ensure that they develop a process to keep a consolidated list of redundant equipment on their site. The list maybe in any format (eg in a book, on a whiteboard, hardcopy list etc).

- **Black locks**
  - Are used as operational control locks and are under the control of the site's operations personnel
  - Black locks are **NOT** to be used for personal protection by any person. Operations personnel should use a blue lock and a personal danger tag. Service providers should use the relevant coloured lock outlined below and a personal danger tag.

- **Red and blue locks**
  - Red and blue locks are to be used for personal protection whilst a service technician or other person is working on isolated equipment.
  - Red and blue locks **MUST** be individually keyed
  - Spare keys for Red and Blue locks are not to be available.
  - Red locks are for use by electricians
  - Blue locks are to be used by any other trade or person (including Asset Management personnel) working on isolated equipment for personal protection

- **Silver locks**
  - Are used to convey the electrical status of the equipment.
  - Are used by Sydney Water electrical personnel to maintain an electrical isolation overnight.
  - Silver locks are commonly keyed and can be removed by an electrical supervisor after confirming that the isolation is still safe.

5. DEFINITIONS

Lock Out	The process of physically locking a piece of plant or equipment with stored power or energy so that it can not be operated
Tag Out	The official written warning to others not operate or tamper with equipment
Manned site	A site, which in normal operations, usually has Sydney Water employees at that site during normal working hours
Control lock	The lock placed on isolation points that prevent equipment being operated. Control locks are to be black or silver in colour and are not to be used for personal protection.
Personal lock	An individually keyed padlock that is attached to an isolation point. It provides protection to a person or group of persons working on isolated equipment by preventing the equipment from being inadvertently de-isolated. Personal locks are red (for electricians) or blue (for other service providers and Asset Management personnel).
Danger Tag	A tag to be used by an individual or by a group of individuals to provide personal protection and associated information whilst working on isolated equipment.
Out of Service Tag	A tag used to provide safety advice, status of work in progress and to protect equipment. They are not to be used for personal protection.
Redundant equipment tag	A tag placed at a point of isolation that indicates that equipment is no longer in service.
Isolation	Putting an effective barrier in place between the energy source and the work and also removing any residual energy that may affect the work.
Isolation Board	A board where keys to isolation locks are kept and locked down to prevent access. Isolation boards are only for certain isolations. Isolation locks used in conjunction with isolation boards are to be yellow in colour.
Energy	Electricity, gas hydraulic, pneumatic, mechanical, gravitational or any other energy source that presents a hazard
Operations personnel	Any person who has direct operating control at any Sydney Water site eg production officers at sewage treatment plants
Safety observer	A person who is competent to carry out the procedure being observed, is competent and has been trained in cardio pulmonary resuscitation and electrical rescue and has an electrical rescue kit available.

6. REFERENCES

NSW OH&S Regulation 2001
Chapter 2 Places of work - risk management and other matters - Clauses 9-14 and 17
Chapter 4 – Part 4.2 Work Premises – *Division 3 Electricity*
Chapter 4 – Part 4.3 Use of places of work– *Division 8 Electricity*
Chapter 7 – Part 7.7 Electrical work

Codes of Practice
NSW WorkCover *code of practice for low voltage electrical work – 2001*

Australian Standards
Not applicable

Corporate and Asset Management Procedures
Hazard Identification and Risk Assessment (HIDRA)
SWC High Voltage Operating Procedure (Maroon Book)

7. DOCUMENT CONTROL

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8. APPENDICES

- Appendix A Isolation Board Procedure
- Appendix B Work on Live Systems

APPENDIX A ISOLATION BOARDS

When a decision is made by a senior person on site to use an isolation board the following shall be undertaken

Isolation

- The site shall develop a documented isolation procedure if one does not already exist. The isolation procedure shall indicate all isolation points
- The relevant operations personnel shall organise the isolation to be undertaken in accordance with the procedure by a suitably qualified person (eg electrical service provider where necessary)
- The person performing the isolation shall attach individually keyed yellow locks and out of service tags to the isolation points as indicated in the isolation procedure.
- The person performing the isolation shall initial the isolation procedure alongside each isolation to indicate that the isolation has been performed in accordance with the procedure
- The relevant operations personnel shall check that the isolation has been performed in accordance with the procedure and prove the equipment isolated
- Once the equipment has been proved isolated, operations personnel shall hang the keys to the yellow isolation locks on the isolation board. The lockable panel shall be brought over the keys and a completed out of service tag applied together with a black lock preventing access to the keys to the yellow locks.
- The initialled isolation procedure shall be posted on the isolation board

Working under an isolation board

- When work is to commence on equipment that has been isolated using an isolation board, service providers shall obtain a PTWC
- Prior to PTWC issue, the person issuing the PTWC shall:
    - Check that the yellow locks are still in place as per the procedure
    - Check that the keys to the yellow locks are still on the isolation board
    - Confirm / recheck the isolation by proving the equipment isolated
- The service provider shall attach a blue or red lock to the isolation board locking the panel to prevent access to the keys to the yellow isolation locks
- The service provider shall also attach a completed danger tag to the isolation board
- When work is complete, the service provider shall remove the personal lock and tag and if the work is not finished, shall attach an appropriately completed out of service tag to the panel
- When the work is complete, the relevant operations personnel shall remove their out of service tag and lock from the isolation board and gain access to the keys to the yellow isolation locks. They shall then organise an appropriate person to remove the locks and re-energise the equipment.
- Operations personnel shall then recommission the equipment as necessary.

APPENDIX B WORK ON LIVE SYSTEMS

Electrical fault finding

- The location of electrical faults should first be attempted with the supply isolated
- If the fault can not be found with the supply isolated, measures must be implemented to control the hazards associated with working on live equipment. These include:
  - Identifying exposed conductive parts that could become live whilst using test instruments
  - Using only approved insulated tools and testing probes
  - Checking to ensure all test instruments are functioning correctly
  - Posting barriers and signs to prevent other persons from entering the vicinity of exposed live parts
  - Developing documented safe work procedures (eg a work method statement or job safety analysis) relevant to the task
  - Ensure that an electrical rescue kit is available
  - Conducting periodic reviews of the situation to ensure that no new hazards are created during the process
  - Utilising a safety observer where risk requires it
- After the fault has been found and repair work commences, the full LOTO process must be applied and documented on the PTWC/Work Order/Proforma

Mechanical working live – eg commissioning, "inching" equipment, clearing chokes etc

- It is recognised that for some mechanical jobs, the application of the black control lock may make maintenance work such as clearing chokes, inching and commissioning impractical
- For these jobs, it is acceptable for the isolation shall be under the control of the service provider provided a documented work method statement is developed
- The work method statement shall indicate the use of a red or blue lock personal lock and the isolation points to ensure personal safety
- The PTWC/Work Order/Proforma shall indicate that the isolation is under the control of the service provider

Electrical working live – emergency situations

Working live on electrical equipment is permitted in emergencies only when:

- The risks of de-energising are greater
- A documented risk assessment has been completed which includes the development of a work method statement or job safety analysis which outlines how the job will be undertaken safely
- For manned sites approval is given by the site in the form of a PTWC

The risk assessment must include all control factors as outlined in the *2001 WorkCover Code or Practice for Low Voltage Electrical Work* and documented below (can be used as a checklist if necessary).

Requirements for working live in electrical emergencies

- Electrical worker must be competent and confident to apply the safe work procedures
- Worker must be authorised by the employer and the person in control of the premises to work on or near a live conductor
- Work area must be clear of obstructions to allow quick and safe entry and exit
- Test equipment must be appropriate
- Tools and accessories, correct for the job, must be well maintained
- Tools and equipment must be up to date and have been inspected to ensure they are serviceable
- People performing the task must be provided with appropriate clothing and PPE for the task
- There must be a safety observer present competent in electrical rescue and cardio pulmonary resuscitation and competent to carry out the procedure being observed
- First aid facilities must be available at the site and readily accessible
- Emergency services contact numbers must be available at the site
- Evacuation lighting should be provided and should be operating correctly
- Fire fighting suitable for electrical fires should be accessible
- Key people (eg person in control of premises and the supervisor) must be informed that the worker is about to work live
- The isolation point of the relevant electricity supplies must be established and labelled
- Live conductors should be insulated where necessary to prevent inadvertent contact or flashovers
- Unauthorised persons must be prevented from entering the work area by signage and/or a barrier

Sydney WATER	HEALTH AND SAFETY PROCEDURE
HSP 058	RISK ASSESSMENT IN DESIGN

1 SCOPE

This procedure applies to all SWC capital projects involving the creation and modification of fixed assets including structures, plant and equipment.

Its purpose is to assist key stakeholders to collectively identify and reduce construction, installation, commissioning, operation, maintenance, repair and demolition health and safety risks associated with the design of fixed assets.

Contractors, subcontractors, developers and their employees who perform work on behalf of Sydney Water will meet the Key Requirements of this procedure. An alternative procedure which delivers the same desired outcomes may be followed.

2 KEY REQUIREMENTS

- Risk assessment shall be carried out for all capital projects involving the design of new or modification of existing fixed assets.
- The risk assessment process shall adopt a life cycle approach.
- Depending on the complexity and nature of the work, risk assessment shall be carried out at various stages of the project as follows:
  - Risk Assessment 1 – at Conceptual Design stage
  - Risk Assessment 2 – at Detailed Design stage
  - HAZOPS – at Detailed Design stage (if required)
  - Post Completion Design Review.
- The risk assessment process shall adopt a consultative approach with relevant stakeholders including designers, constructors, end users, maintainers and OH&S personnel.
- Risk assessment workshops shall be led by an appropriately qualified facilitator.
- Risk assessment workshops shall utilise appropriate risk assessment techniques.
- OH&S risk control measures shall be incorporated into the design. These measures should reflect the hierarchy of controls.
- Completed works shall be checked at commissioning to ensure all agreed design modifications have been implemented.
- Risk assessment records documenting actions and recommendations shall be kept and will be available for regular review
- SWC design standards shall be reviewed to reflect the learnings of the risk assessment process.
- During the life cycle of the asset, any health and safety issues arising from the design shall be communicated by the asset owner to the Asset Solutions Design Services Group.
- Risk assessment requirements shall be addressed in contract specifications and tender evaluations.

3 PROCEDURE

3.1 RISK ASSESSMENT GENERAL

For all projects involving construction of new assets and the modification of existing assets an essential consideration is the safe and proper functioning of the asset throughout its entire life.

In developing the design outputs the designer should highlight the standards and regulations used in the design and should ensure that design reviews (including specialist reviews), verifications and approvals are carried out as outlined in the SWC *Capital Project Delivery Management System* .

Risk assessments to identify health and safety risks associated with the design shall be carried out for all projects involving the construction of new assets or modification of existing assets. Risk assessments shall identify all significant OH&S risks in the project, assess the risks and detail actions to eliminate or minimise each risk.

The risk assessment process shall consider the OH&S risks to persons through the entire life cycle of the asset eg acquisition, transport, construction, installation, commissioning, operation, maintenance, repair, modification, decommissioning, dismantling, demolition and disposal.

The risk assessment process provides a framework for a facilitated discussion that is stimulated by guideword prompts and checklists. These prompts assist key stakeholders to collectively identify and reduce construction, operation, maintenance and demolition health and safety risks associated with a design or modification. These risks are then assessed as per the SWC *HIDRA Procedure* and formally listed for action by appropriate stakeholders.

The process for running a risk assessment workshop is outlined below:

a) Select a facilitator and assemble a study team (include all stakeholders).

b) Define the objectives and the scope of the study.

c) Agree on a set of guidewords/prompts to assist the brainstorming process.

d) Partition the design process into logical blocks of appropriate size.

e) For each logical block, use various guidewords to assist with the identification of health and safety hazards/risks.

f) Discuss associated risks and determine if the health and safety risk can be eliminated.

g) If the risk cannot be eliminated, determine how it might be reduced.

h) Assess whether the proposed risk controls are appropriate (is the risk as low as reasonably practicable).

i) Document comments, actions and recommendations – determine an appropriate method for design issues to be resolved.

If it is not reasonably practicable to eliminate a risk then it must be controlled. Controls will be determined by reference to the hierarchy of controls below:

a) Substitution of the hazard with less hazardous plant, process or substance.

b) Reduction of the risk through isolation (separate the hazard from the person)

c) Reduction of the risk through engineering controls (eg/ automation, guarding, design and ventilation)

d) Reduction of the risk through administrative controls (eg/ training, instruction, supervision and systems of work)

e) Reduction of the risk through personal protective equipment (PPE). The use of PPE is a last resort.

Costing reflecting the health and safety risk control measures considered shall be developed taking into account the life cycle of the asset.

On completion of all risk assessment workshops any proposed/agreed design changes will be communicated to all relevant stakeholders to ensure the impact is fully assessed.

Proposed design changes arising from risk assessment workshops shall be subject to standard design review and verification processes in line with the SWC *Capital Project Delivery Management System* .

The risk assessment process shall be applied to all projects. If the project for which the design is being developed is repetitive, standard and of low inherent hazard, then the Risk Assessment 1 Study Team may recommend to the Project Manager that Risk Assessment 2 is not required. Reasons for the decision shall be documented.

There may be small low risk projects where the Project Manager decides in consultation with the Design Coordinator that a full Risk Assessment 1 workshop is not warranted. Reasons for this decision shall be documented and an effective alternative risk assessment process should be followed eg design plan and documentation review based on the relevant checklists attached to this procedure.

A HAZOPS study is required for all projects involving the creation or modification of complex operational or chemical processes eg water and sewage treatment plants, chemical injection processes etc

3.2 RISK ASSESSMENT 1

Risk Assessment 1 is conducted at the Concept Design stage.

The purpose of Risk Assessment 1 is to review the concept design and identify the significant construction, installation, operation, maintenance, repair and demolition safety risks associated with the project. By identifying and understanding these risks very early in the project they can be more easily eliminated or controlled.

Any OH&S issues identified during the Project Risk Assessment conducted as part of the 'Define' stage of a project shall be re-considered at the Risk Assessment 1 workshop.

Those involved in the Risk Assessment I workshop should have an informed and constructive view on the overall 'constructability' 'operability' and 'maintainability' of the asset.

3.2.1 Study Team

A Study Team will be formed (See Appendix F for guidance) and led by a facilitator who is a "third party" to the design. The Team will carry out a systematic and formalised "brainstorming" process which involves the appropriate stakeholders (designers, constructors, operators, maintainers, safety representatives, etc.). By using a diverse group of people and a systematic methodology the chance of overlooking a major problem is significantly reduced.

3.2.2 Process

Risk Assessment 1 is based on the risk assessment methodology outlined in the *CHAIR* (Construction Hazard, Assessment Implication Review) document published by NSW WorkCover and contains supplementary information applicable to Sydney Water's assets. The methodology ensures that:

- the design is divided into logical components for assessment;
- for each component of the design, sources of risks or other factors related to risks are identified;
- an assessment is carried out as to the level of the risk and its controls.

3.2.3 Guide words

One of the main elements of the study is the use of guidewords, applied to various sections of the design to stimulate discussion and risk identification. A list of guidewords is provided in Appendix A. The Risk Assessment 1 facilitator should review the applicability of the guidewords (including additional words that may be required) as part of the workshop. This review should be based on the experience of SWC in operations and works similar to those being constructed in the project at hand.

3.2.4 Documentation

Attendees, methodology, guidewords and findings shall be documented. Meeting minutes should accurately specify those identified risks that require action or follow up, or to justify a decision to retain an existing design element.

A sample Risk Assessment 1 – Minute Recording Sheet is provided in Appendix A.

3.3 RISK ASSESSMENT 2

Risk Assessment 2 is conducted at the Detailed Design stage.

The primary focus of Risk Assessment 2 is to review the detailed design and identify modifications necessary to reduce:

a) construction and/or demolition hazards, and

b) operational and maintenance hazards.

This study may be performed as a single workshop that covers both a) and b). Alternatively, separate workshops may be held. .

Risk Assessment 2 is performed as the detailed design is approaching completion but well before construction commences. For those projects that also require a HAZOPS study (see Section 5.4) Risk Assessment 2 may be conducted before or after the HAZOPS process. HAZOPS is not a substitute for Risk Assessment 2.

For large or complex projects multiple Risk Assessment 2 workshops may be needed to address different project deliverables or portions of the work.

3.3.1 Study Team

Risk Assessment 2 is performed by a group of people who are involved in the design, construction. operation and maintenance of the asset and sufficiently experienced to consider ways in which a design can be modified to eliminate or reduce constructability, demolition, operational and maintenance hazards.

3.3.2 Process

The purpose of Risk Assessment 2 is to focus on risks that would not be expected in the context of normal demolition/construction/operation/maintenance and have not been identified in Risk Assessment 1.

The methodology ensures that:

- the construction, demolition operation and maintenance sequence is divided into defined logical steps for assessment;
- for each construction, demolition, operation and maintenance step, sources of risks or other factors related to the risks identified;
- an assessment is carried out as to the acceptability of the risk, possible controls to improve the design, and clarification of a preferred construction, operational and maintenance methods and sequences.

3.3.3 Guidewords

At the detail design stage, there is less opportunity to fundamentally change the design. However, there would exist the possibility to modify the design with regard to the intended construction, demolition, operation or maintenance methods.

The guidewords provided in Risk Assessment 1 are also applicable for Risk Assessment 2. Additional guidewords related to project constructability, demolition, operability and maintainability are provided in Appendices B and C.

The guidewords will reflect the task-oriented approach of the construction, operation and maintenance sequence. The aim is to acknowledge that the basic design will be built, but also to identify design modifications that would result in safer construction, demolition, operation and maintenance techniques.

3.3.4 Documentation

It is important to adequately document the methodology, attendees, guidewords and findings of the Risk Assessment 2 study. A layout for recording the minutes of a Risk Assessment 2 meeting is provided in Appendices B and C.

3.4 HAZOPS STUDY

In addition to Risk Assessment 1 and Risk Assessment 2, a HAZOPS study is required for projects involving the creation or modification of complex operational or chemical processes eg water and sewage treatment plants, chemical injection processes, etc.

HAZOPS requirements will be assessed either by the Project Manager at the Project Define Stage or as part of Risk Assessment 1.

The purpose of HAZOPS is to review the detailed design and operating procedures to identify any hazards or obstacles to operability that could arise, particularly through deviations from the design intent. HAZOPS will be based on firm engineering line diagrams/Process and Instrumentation Drawings (P&IDs) that have already been subject to design review and on outline operating procedures. The consequences of deviations are identified and where necessary appropriate corrective actions initiated. The study also provides an opportunity to review potential maintenance risks at a more detailed level than Risk Assessment 2.

<u>Key process aspects include</u>:

- Systematic study of the design and outline operating and maintenance procedures using guide words lists to identify the consequences of deviation from the design intent;
- Consideration of transient operating conditions during start up, shutdown, plant upsets and emergencies and the required reliability of services and power sources;
- Consideration of potential exposure of employees to harmful affects of chemicals during routine operations and any controls that may be necessary;
- Consideration of containment of discharges, emissions and noise;
- Consideration of ergonomics and manual handling
- Consideration of land protection issues.

<u>Key control/protection aspects include</u>:

- A detailed systematic study of the specialised functional requirements of the control and protection systems to establish that the process requirements will be met in detail and that hazard and operability problems will be minimised;
- Consideration of manual and automatic controls;
- Consideration of steady state and transient conditions;
- Consideration of control and protection system reliability
- Consideration of common mode and system related failure modes; and
- Consideration of operator/control system and operator /protection interfaces and the control of any override facilities.

Commonly the control protection aspects of HAZOPs consist of system studies for each major equipment item followed by a detailed review of the documented functional requirements of the planned control and protection systems.

3.5 POST COMPLETION DESIGN REVIEW

A Post Completion Design Review is performed to ensure that the completed asset is safe to operate and maintain from a design perspective.

3.5.1 Study Team

Depending on the size and complexity of the design, a Post Completion Design Review could be performed by a small team chosen from the teams of Risk Assessment 1 and/or 2, provided they have:

- knowledge of the final design and the operating and maintenance requirements of the project;
- a thorough understanding of the function of the completed asset

The review is performed 12 weeks after the "practical completion" of the project.

3.5.2 Process

The purpose of the review is to enable operators and maintainers to identify any safety concerns with the completed asset. The process allows future design improvements to be identified, and put in place operational and other controls necessary for the safe operation and maintenance of the completed asset.

3.5.3 Guide words

Guidewords that relate to project completion are provided in Appendix D.

3.5.4 Documentation

Attendees, methodology, guidewords and findings shall be adequately documented.

A layout of recording the minutes is provided in Appendix D.

Any shortcomings related to safety in design which are identified at the Risk Assessment 3 workshop shall be communicated back to:

– the SWC Asset Solutions Design Group;

– the asset owner;

– operators and maintainers of assets across SWC.

3.6 THE FACILITATOR

The success of risk assessment studies is dependent on the ability of a facilitator to select and use the experience and expertise of the study team to critically evaluate the design. Therefore, the selection of an accredited facilitator is critical. Assistance on the selection of a suitable facilitator can be obtained through Health & Safety Operations.

The role of the facilitator is to encourage workshop participants to constructively challenge the design and explore whether issues have been overlooked or sufficiently thought through.

It is recommended that the facilitator should have the following attributes:

- competent in risk assessment methodology;
- an understanding of the principles of safety in construction, operation and maintenance;
- the respect, or potential to quickly gain the respect, of workshop participants;
- as a minimum, a broad understanding of the project;
- the ability to bring out the views of a diverse range of people participating in the workshop to constructively challenge the design concept;

- the ability to put forward their own views and thus provoke thought, but without dominating the workshop;
- the ability to keep the workshop on track and moving along (issues that can't be resolved relatively quickly should be listed for action outside the workshop).

3.7 WORK CARRIED OUT BY EXTERNAL DESIGNERS

All designs carried out by external parties shall comply with the requirements of this procedure and consultant briefs and contracts to engage external designers shall include these requirements.

The capacity of external designers to meet the requirements of this procedure shall be assessed and taken into account during the tender evaluation process. .

The Notice of Requirements to Developers shall also include the requirements of this procedure, as applicable.

Where external designers are involved and required to attend Risk Assessment 3 workshops after practical completion this requirement shall be clearly specified in contract documents and consultant briefs.

3.8 RECORDS

Records of risk analyses shall be kept by the Project Manager to document the methodology, justification, findings, recommendations, etc. Minutes of meetings recording attendees identified OH&S risks and follow-up actions shall be kept in the project file.

Design documentation, including documentation of design change/modification addressing the feedbacks from the risk analyses, shall be maintained according to the relevant Quality Management System (QMS).

Records must be retained for a period not less than ten (10) years.

3.9 CONTINUOUS IMPROVEMENT

Design improvements identified in Risk Assessment 1, Risk Assessment 2, HAZOPS and Risk Assessment 3 shall be formally communicated to:

- planning groups of SWC's Asset Management Division for incorporating in new project need specifications and updating standard drawings;
- the SWC Asset Solutions Design Group Manager for incorporation into the design of new projects and technical specifications.

Any design shortcomings identified during the life of an asset which affect the safe operation or maintenance of that asset shall be recorded on the form provided at Appendix E and communicated to:

- the SWC Asset Solutions Design Group Manager;
- the asset owner;
- operators and maintainers of similar assets across SWC.

The Asset Solutions Design Group will maintain a centralised Design Risk Register incorporating Risk Assessment worksheets and design shortcomings from all projects covered by this procedure.

Project Managers shall consult the SWC Asset Solutions Design Group's Design Risk Register to ensure that design improvements identified therein are taken into account in the ongoing design or modification of assets as appropriate.

4 COMPETENCIES

All persons involved in the design process should be trained in the requirements of this procedure and the skills necessary to implement their role.

5 DEFINITIONS

Concept Design	Preliminary design that incorporates the critical elements of the asset being designed
Design Coordinator	An appropriately qualified person who has the responsibility for coordinating the design tasks of the project.
Detailed Design	Development of the Concept Design into distinct parcels of work that contain the necessary detail to allow construction, modification or installation.
Facilitator	A person with recognised training and competency in the leadership of Risk Assessment and where possible independent from the team working on the project under review.
Fixed assets	Structures, facilities, plant, operating systems / equipment
Guidewords	Prompt to assist brainstorming processes / stimulate discussion.
Hazard	A source of potential harm or a situation with a potential to cause loss.
Project	Any engineering development work (including creation, expansion or substantial modification to fixed assets) for which an Expenditure Proposal is required.
Project Manager	An appropriately qualified person who has been given the responsibility to manage a fixed asset design or modification capital project on behalf of the client.
Risk	For purposes of this procedure risk is defined as the chance that either, an expected outcome will not be achieved, or, that an unforeseen event will occur. It is measured in terms of consequences and likelihood
Risk Assessment	The process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels and other criteria.

6 RESPONSIBILITIES

Business Area Managers	Ensure that the requirements of this procedure are met as appropriate in their area of responsibility.
Project Managers	Ensure that all elements of the design process are carried out as outlined in SWC Capital Delivery QMS procedures.
	Ensure the SWC Design Risk Register is consulted appropriately during the asset design process
	Ensure risk assessments are conducted in line with this procedure;
	Ensure design improvements are translated into the final design;
	Check completed works at commissioning to ensure agreed design modifications have been implemented.
	Ensure that personnel engaged during the design process are suitably qualified, trained and experienced
	Communicate risk assessment outcomes Maintain documented risk assessment records
	Ensure risk assessment requirements are included in contract specifications and tender evaluations.
Health & Safety Operations Managers	Monitor the consistency of implementation of the risk assessment in design process;. Provide assistance and advice to business areas and Project Managers in identifying risks arising during the design and modification process and ensuring these risks are assessed and controlled.
Manager, Design Services	Maintain a SWC Design Risk Register
Employees	Participate in risk assessments as appropriate Report design related safety issues

7 REFERENCES

WorkCover	*NSW Occupational Health and Safety Act 2000*
WorkCover	*NSW Occupational Health and Safety Regulation 2001*
WorkCover	*Safety in Design, Construction Hazard Assessment and Implementation Review (CHAIR)*
Sydney Water	*Hazard Identification and Risk Assessment Procedure*
Sydney Water	*Contractor Safety Management System*
Sydney Water	*SWC Capital Project Delivery Management System*

8 DOCUMENT CONTROL

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9 HISTORY

New document

10 APPENDICES

Appendix A **Risk Assessment 1**
1. Study Guidewords
2. Sample Minute Recording Sheet

Appendix B **Risk Assessment 2 - Constructability/Demolition**
1. Study Guidewords
2. Sample Minute Recording Sheet

Appendix C **Risk Assessment 2 - Operability/ Maintainability**
1. Study Guidewords
2. Sample Minute Recording Sheet

Appendix D **Post Completion Design Review**
1. Study Guidewords
2. Sample Minute Recording Sheet

Appendix E **Reporting Form**: Design Related Safety Risks During the Life of an Asset

Appendix F **Composition of Risk Assessment Teams For A Capital Project**

Appendix G **Procedure Flowchart**

11 ATTACHMENTS

Nil

APPENDIX A

RISK ASSESSMENT 1

1. **Study Guidewords**
2. **Sample Minute Recording Sheet**

RISK ASSESSMENT 1 –
STUDY GUIDEWORDS

GUIDEWORD	SUB-PROMPTS
SIZE	Too large Too small Too long Too short Too wide Too narrow
HEIGHTS / DEPTHS	Working at heights Falls / struck by falling objects Scaffolding (shape, space to fit) Confined space Access / egress
POSITION / LOCATION	Too high Too low Too far Misaligned Wrong position
POOR ERGONOMICS	Posture / manual handling RSI / discomfort / fatigue / stress Effect on PPE Visibility (lighting sightlines) Slips, trips, falls
MOVEMENT / DIRECTION	Stability Compression Physical damage Vibration Friction / slip Rotation Upwards / Downwards Reverse Expansion / Tension Rollover
LOAD / FORCE	High / Excess Low insufficient Additional loads (construction) Dynamics Temporary Weakness
ENERGY	Low / high energy Tension / compression Potential / kinetic Inertia / moment
TIMING	Too late, too early Too short, too long Incorrect sequence Extended delays
EGRESS / ACCESS	No. of exit points Emergency egress, size Obstructions, lighting Entry / exit points External impacts Maintenance People and equipment Movements
MAINTENANCE / REPAIR	Posture / Manual handling Size / Width Access / egress Heights / dropped Objects weight Discomfort / stress / PPE Visibility / slips / trips Rotating equipment Other

GUIDEWORD	SUB-PROMPTS
ENVIRONMENTAL CONDITIONS	Extreme weather Temperature Ground Noise Water Hazardous areas
EXTERNAL SAFETY INTERFACES	Members of the Public Traffic Adjacent property Power / services External fire / plans Day / night / weekend
TOXICITY	Lead / asbestos Handling Precautions Ventilation
FIRE / EXPLOSION	Prevention / detection Fire protection Emergency procedures
ENVIRONMENTAL IMPACT	Vapour / dust Effluent / noise Seepage / waste Hazardous chemical
UTILITIES & SERVICES	Lighting Air / water Fuel / electricity Oxygen / water
COMMISSION / STARTUP / SHOWDOWN	Requirements Sequence
SAFETY EQUIPMENT	Personnel protection Safety showers Barriers / guards
NATURAL HAZARDS	Earthquake Flooding Thunderstorm (lightning protection) High winds
INSPECTION / TESTING	Eliminating Isolation Access
DEMOLITION	Ease Issues Documentation
DOCUMENTATION	Operations Maintenance Inspection / testing Sequence Emergency Records / Reports
QUALITY CONTROL	Inspection / testing Quality assurance
CONSTRUCTION EQUIPMENT	Sequence Timing / access

RISK ASSESSMENT 1 –
SAMPLE MINUTE RECORDING SHEET

Project: **Design Element:** **Date:**

Drawing(s) / Reference(s): **Revision:**

No.	Guideword	Risk Issue(s)	Causes	Consequence	Likelihood	Risk	Action(s)	Res. Person & Date Due	Date Completed

APPENDIX B

RISK ASSESSMENT 2
Constructability/Demolition

1. **Study Guidewords**
2. **Sample Minute Recording Sheet**

RISK ASSESSMENT 2 – CONSTRUCTABILITY/DEMOLITION STUDY GUIDEWORDS

Construction/Demolition Based Guidewords

GUIDEWORD	SUB-PROMPTS
ELIMINATE	Falls (of people) Falling material / objects Stepping on or striking against objects Caught or trapped Lifting and carrying – over exertion Asphyxiation / drowning Machinery Electricity Transport / mobile plant Toxicity, fires and explosions
SUBSTITUTE	Falls (of people) Falling material / objects Stepping on or striking against objects Caught or trapped Lifting and carrying – over exertion Asphyxiation / drowning Machinery Electricity Transport / mobile plant Toxicity, fires and explosions
COMBINE	Construction / lifting Sequence Timing Locations
AVOID	Construction / lifting Sequence Timing / locations Temporary instability Access / egress Delays / confined spaces Erection / dismantling Heat / cold / noise
OTHER ISSUES?	Modification Isolation / engineering controls Personnel protective Equipment Alter / rearrange Increase / reduce Simplify / improve Confined spaces

RISK ASSESSMENT 2–CONSTRUCTABILITY/DEMOLITION
SAMPLE MINUTE RECORDING SHEET

Project: **Construction Step:** **Date:**

Drawing(s) / Reference(s): **Revision:**

No.	Guideword	Risk Issue(s)	Causes	Consequence	Likelihood	Risk	Action(s)	Res. Person & Date Due	Date Completed

APPENDIX C

RISK ASSESSMENT 2
Operability/Maintainability

1. **Study Guidewords**
2. **Sample Minute Recording Sheet**

RISK ASSESSMENT 2

OPERABILITY/MAINTAINABILITY

GUIDEWORD	SUB-PROMPTS
CONDITION	Degradation Corrosion Toxic Remedial Mechanical Electrical Confined spaces
BLOCKAGE	Overflow Diversion Flooding Relief Environment Contamination / breach of licence Remedial Access Egress
HANDLING	Manual Automatic Too heavy Protection equipment Visibility
INJURY	Electric shock Trip hazard Vehicle collision Sunburn Confined space Puncture Fire Crushing Noise Toxic Compressed Air Slips / trips / falls Posture Manual handling
ISOLATION	Electricity Valves Pumps Bypass Stopboards Remote Local
ODOUR	Excessive Confined Space Ventilation Toxic chemicals
FAILURE	Catastrophic Contain fluid Incident Information Safety

RISK ASSESSMENT 2: OPERABILITY/MAINTAINABILITY

SAMPLE MINUTE RECORDING SHEET

Project: **Design Element:** **Date:**

Revision:

No.	Guideword	Risk Issue(s)	Causes	Consequence	Likelihood	Risk	Action(s)	Res. Person & Date Due	Date Completed

APPENDIX D

POST COMPLETION DESIGN REVIEW

1. **Study Guidewords**
2. **Sample Minute Recording Sheet**

POST COMPLETION DESIGN REVIEW

GUIDEWORD	SUB-PROMPTS
OPERATION	Access Manuals Equipment Plant Isolation Safety Feedback Specification
MAINTENANCE	Manuals Repair Approval Visibility Objects Plant safety Access Documentation
CONDITION	Degradation Corrosion Toxic Remedial Mechanical Electrical Confined spaces
BLOCKAGE	Overflow Diversion Flooding Relief Environment Contamination / breach of licence Remedial Access Egress
HANDLING	Manual Automatic Too heavy Protection equipment Visibility
INJURY	Electric shock Trip hazard Vehicle collision Sunburn Confined space Puncture Fire Crushing Noise Toxic Compressed Air Slips / trips / falls Posture Manual handling
ISOLATION	Electricity Valves Pumps Bypass Stopboards Remote Local

GUIDEWORD	SUB-PROMPTS
ODOUR	Excessive Confined Space Ventilation Toxic chemicals
FAILURE	Catastrophic Contain fluid Incident Information Safety

POST COMPLETION DESIGN REVIEW
SAMPLE MINUTE RECORDING SHEET

Project: **Date:**

Revision:

No.	Guideword	Risk Issue(s)	Causes	Consequence	Likelihood	Risk	Action(s)	Res. Person & Date Due	Date Completed

APPENDIX E

REPORTING FORM:
DESIGN RELATED SAFETY RISKS DURING THE LIFE OF AN ASSET

Business Area	
Division	
Operating Facility	
Plant or equipment or process affected	
What is the nature of the design issue?	
How was the design issue identified?	
Assessed risk of the design issue **(based on HIDRA 1-6)**	
Recommended Action	
Name of person reporting the design issue	
Contact details	

This Form is to be sent to the Asset Solutions Design Group General Manager

APPENDIX F

COMPOSITION OF RISK ASSESSMENT TEAMS FOR A CAPITAL PROJECT

Risk Assessment Stage	RA 1	RA 2	HAZOP	POST
Project Manager	Y #	Y #	Y #	Y #
Client Representative or Manager	Y #			Y #
Facilitator	Y	Y	Y	Y
Concept Designer	Y	@	@	
Detail Designer	Y	Y	Y	Y
Operations Representative	Y	Y	Y	@
Maintenance Representative	Y	Y	Y	Y
Construction Representative	@	Y #	Y	@
OH&S Advisor	Y	Y	Y	Y
Environmental Advisor	Y	@	Y	@
Commissioning Manager	@	Y	Y	Y #

RA 1 Risk Assessment 1

RA 2 Risk Assessment 2

HAZOP HAZOPs Study

POST Post Completion Design Review

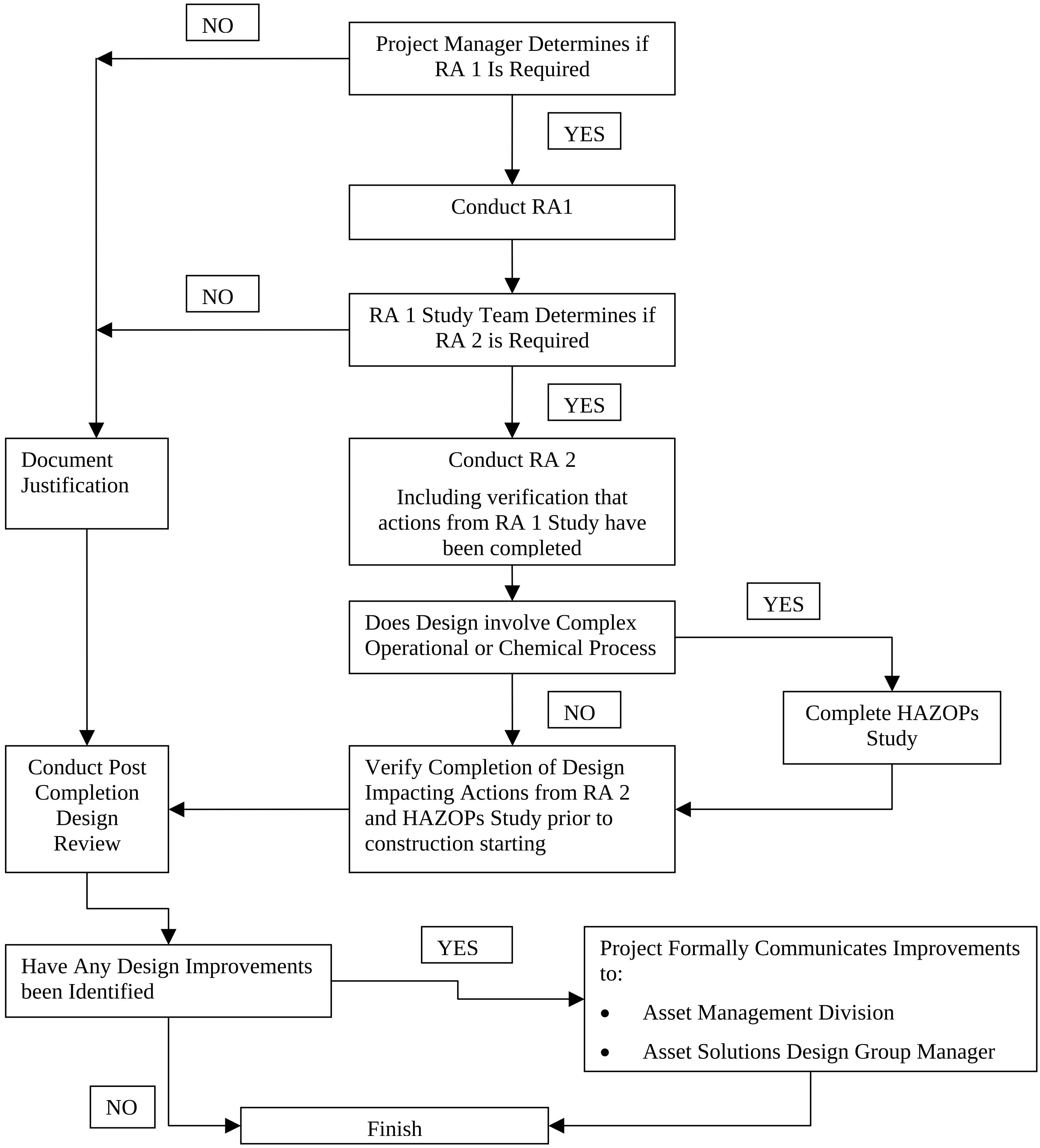
- "Composed by" Designates that the team composition is determined by the person indicated in consultation with the client representative.

@ - "As Required"

Y – Member of team

APPENDIX G

PROCEDURE FLOWCHART



APPENDIX N – EMERGENCY STOPS POLICY

EMERGENCY STOPS POLICY

1. General

NSW OH&S Regulations (2001) require that emergency stop circuits must be incapable of malfunction.

AS4024.1 defines the requirements for Safeguarding Machinery, including categories of safety circuits and a risk assessment methodology for establishing the required safety circuit.

2. Scope

This policy shall apply to the design of all new emergency stop circuits for Sydney Water and shall remain in force until amended or withdrawn.

3. Purpose

The purpose of this policy is to alert all designers to the legislative and regulatory requirements relating to emergency stops and to specify SWCs particular requirements.

4. POLICY:

- Emergency stops shall, as a minimum, comply with AS4124.1 and current NSW OH&S regulations, in addition to any other regulatory or legislative requirement.
- Risk assessments shall be conducted and documented for all Sydney Water machines. Assessment templates and a detailed assessment procedure shall be produced by the designer.
- Maintenance considerations shall be taken into account in the risk assessments. Danger from machinery shall be eliminated if possible, by guarding or otherwise. Safe working procedures will be introduced where necessary (e.g. isolation, barriers, etc).
- Emergency stops shall not be used for maintenance purposes.
- Emergency stops used for personnel safety shall be designed to be incapable of malfunction.
  - They shall include red pushbuttons on a yellow background, pull to reset, non locking, with a large emergency stop label comprising black letters on a red background.
  - For Treatment Plant SCADA the circuits shall be based on SWC template circuit TE100E and the requirements of the latest issue of SWC Automation and SCADA Standards.
  - For all other assets the circuit shall be in accordance with the latest issue of the SWC I&C Manual and shall be approved by Telemetry Operations Group.
- Emergency stops that are not used for personnel safety shall be referred to as latch stops to aid distinction as to their function and avoid any confusion as to purpose with regard to OH&S 2001.
- – They shall include a red mushroom head button against a grey background, pull to reset, non locking, with no label.
- – For Treatment Plant SCADA the circuits shall be based on SWC template circuit TE100 and the requirements of the latest issue of SWC Automation and SCADA Standards.
- – For all other assets the circuit shall be in accordance with the latest issue of the SWC I&C Manual and shall be approved by Telemetry Operations Group.
- Where there is a conflict between this policy and relevant regulations or legislation, it is the responsibility of the designer to immediately notify the Principle upon becoming aware of such a conflict.
- For existing machines the policy stated in the addendum shall apply.

John Myliotis Project Director, Design Services, ASD	**Glyn Williams** OHS Manager, Support, AMD
Jim Pruss A/Process Leader WWT, AMD	**Greg Kane** Process Leader, Maintenance, AMD
Paul Freeman General Manager, Asset Management Division	**Date: 6/8/03**

Addendum to SWC Emergency Stops Policy for existing Machines.

1. Background

Sydney Water has approximately 7000 emergency stop circuits, only a small proportion of which are used to provide personnel safety, but all of which are capable of malfunction. A specific query to the OH&S State Coordinator, Electrical, has confirmed that these emergency stops do not meet the new legislative requirement.

OH&S 2001 reinforces the requirement that where there is danger from machinery, there is need for risk assessment, elimination of the danger if possible, by guarding or otherwise, and introduction of safe working systems. These include correct design, written procedures for work and maintenance, and training in the observance of the procedures.

With necessary guarding in place, it is anticipated that less than 5% of the total number of existing emergency stops will be found to provide a personnel safety function and will need to be retained and upgraded to eliminate the possibility of malfunction.

2. Scope

This addendum applies to all existing emergency stops within SWC at the time of signature and shall remain in place until modified or withdrawn.

3. Purpose

The purpose of this addendum is to alert all responsible Asset Management Staff to the legislative and regulatory requirements relating to emergency stops and to identify SWCs particular requirements.

4. POLICY

- In complying with OH&S 2001, priority shall be given to current and future work.
- Risk assessments need performing and documentation made readily available for all Sydney Water machines.
- Although maintenance considerations will be taken into account in the risk assessments, safe working procedures will be introduced where necessary (e.g. isolation, barriers, etc).
- Emergency stops shall not be used for maintenance purposes.
- Existing emergency stops that fulfil a personnel safety function shall be upgraded to be incapable of malfunction in order of priority with other safety work on a site by site basis.
- As international standards allow emergency stops to be used other than for personnel safety, and existing emergency stops used for purposes other than personnel safety do not present an OH&S risk, it is proposed such emergency stops remain as is.
- At SPSs, existing labels on red mushroom head buttons referring to “isolator” shall be removed. Existing drawings need not be modified. UPGs and SOPs shall remove any reference to the “isolator” button. Documentation for new installations shall refer to such buttons as latch stops but the button themselves shall not be labelled.
- Design Services will be responsible for identifying areas of need for Sydney Water compliance with OH&S 2001 requirements for guarding and emergency stops at existing installations. This shall include the development of Assessment templates and a detailed assessment procedure.
- All modified emergency stop circuits shall be in accordance with SWC Emergency Stop policy.
- Plant Managers and Asset Owners will be responsible for obtaining funds if necessary and implementing changes, including adequate risk assessment documentation, procedures, maintenance and training.

HEALTH AND SAFETY PROCEDURE
HSP-026 CONTROL OF HOTWORK

1 SCOPE

This Procedure specifies precautions to be taken prior to and during hot work (including welding, grinding and allied processes) to prevent the possibility of injury, fire or explosions.

This procedure applies to all employees of Sydney Water Corporation. It applies for all Sydney Water sites and assets.

Contractors to Sydney Water are expected to meet the key requirements of this procedure through their own systems of work.

2 KEY REQUIREMENTS

- The workteam will assess if the task can be performed by alternative methods that do not require hotwork..
- If the task requires hot work, the work team will complete a hazard identification and risk assessment prior to work commencing.
- Where a valid risk assessment identifies a need for a hotwork permit, that permit will be obtained from the relevant Authorising Hot Work Officer prior to commencing any Hot Work.

  Note: A Hotwork permit must be obtained for any hot work in a bushland area.
- Where a Permit to Work Clearance system is in place the Permit to Work Certificate procedure and Hot Work Permits shall be cross-referenced.
- Prior to issuing a Hot Work Permit, the Authorising Officer shall:
  - assess the potential impact on and from other work being performed or facilities in the area;
  - personally inspect the proposed work area;
  - ensure all reasonably practicable controls and precautions to reduce the risk of fire or explosion have been identified and implemented; and
  - ensure the scope of the Hot Work authorised, including any limitations, the specific types of equipment authorised to be used and the name(s) of the people authorised to do the Hot Work are recorded on the Hot Work Permit.
- Prior to accepting a Hot Work Permit, the recipient shall read and agree to the identified hazards, controls and precautions and shall register acceptance by signing the Hot Work Permit.
- If identified in the risk assessment, that an observer is required, they shall be in attendance for the entire duration of the Hot Work.
- Suitable fire extinguishing equipment must be provided for all types of hot work.
- The Hot Work Permit shall be kept on the job at all times while work is proceeding.
- Any person has the responsibility to stop the hot work if it is deemed to be unsafe or surrounding conditions change.
- During a total fire ban, Hot Work Permits in the open air shall only be issued for essential work covered by the exemption under section 5 of the *Rural Fires Act* or other work for which an exemption has been obtained under section 18 of the *Rural Fires Act.*
- During a total fire ban and high fire danger period, any hot work as a minimum, **must** be carried out in accordance with the requirements of clause 3.2 of this procedure.

ADDITIONAL REQUIREMENTS FOR HOTWORK IN A CONFINED SPACE

When hot work is to be performed in or on a confined space, this procedure should be read in conjunction with Sydney Water's *Safe Entry and Working in Confined Space* Procedure.

ADDITIONAL REQUIREMENTS FOR HOTWORK IN A FLAMMABLE GAS HAZARDOUS AREA

When hot work is to be performed in or near a flammable gas hazardous area, this procedure should be read in conjunction with Sydney Water's documents - *Classification and Management of Flammable Gas Hazardous Areas* and *Flammable Gas Guidelines*

3 PROCEDURE

Prior to any work a risk assessment is to be completed. Where hot work is identified as creating a fire risk, a Hot Work Permit is required.

3.1 HOT WORK WITH RISK OF FIRE

When planning hot work, the workteam must give particular attention to:

- Environmental conditions, eg fire danger period, total fire ban, high winds and/ or high temperatures.
- Adequacy of ventilation including weather conditions, and whether forced ventilation is required if working in an enclosed area.
- Ensuring that the work area is free of all combustible materials or wet down work area.
- Check for the presence of underground gas services or power lines – especially adjacent to house service lines.
- Presence of nearby gas distribution mains, gas service lines etc.
- Preventing the creation of flammable or hazardous atmospheres by leakage of welding gases.
- Containment of sparks, welding splatters, etc by use of shields, watering area down
- An agreed emergency plan in the event of fire or explosion.
- Availability of suitable fire extinguishing systems, and the training of employees in their use.
- Control of fumes generated by the hot work.
- Inspecting the area on the other side of a wall or partition where work is being carried out to ensure there is no combustible material directly or indirectly in danger of ignition.
- Ensuring that flame producing equipment is used strictly in accordance with manufacturers instructions and not left unattended while alight.
- Ensuring that combustible floors and fixtures in the work area are protected with overlapping sheets of non-combustible materials or are covered with sand.
- For gas or electric welding and cutting apparatus ensuring that:
  - ➢ The stub-ends of welding rods do not come into contact with combustible materials.
  - ➢ Gas cylinders not being used for the work in hand are kept outside of the building in or on which the work is carried out and away from any obvious fire hazard.

3.2 HOTWORK DURING A TOTAL FIRE BAN OR HIGH FIRE DANGER PERIOD

A total fire ban prohibits the lighting, maintenance, or use of any fire in the open air. Fire includes all Hot Work or any other heat or spark producing operations. Sydney Water has a general exemption granted by the Rural Fire Service during TOBAN periods only for the essential repairs or maintenance required for continuance or restoration of water and sewage services.

For other work required during a TOBAN period, an exemption must be obtained from the Rural Fire Service if Sydney Water deems the Hot Work activity to be necessary. A template for an exemption is attached at appendix C.

The following additional precautions must be implemented during the High Fire Danger period, and during any work permitted under an exemption during a TOBAN:

- Place a shield or guard of fire resistant material in such a way as to prevent emission of sparks and hot pieces of metal from the area where work is been done.
- Keep an area at least 3 metres around the work completely clear of combustible material or wet down sufficiently to prevent the spread of fire. This is particularly important where waste wood, sawdust, bark or dry grass is in the vicinity. Where the risk assessment identifies further precautions these are to be implemented.
- Have close at hand a reticulated water supply with charged hose or an effective water spray pump, such as a backpack, fully charged with 16 litres of water;
- Have a fire extinguisher (liquid type) of 9 litres minimum capacity on site
- Have a fireproof receptacle for waste cut-offs and electrode stubs
- Where the Risk Assessment requires it, nominate an observer for the duration of the work and document this on the Hot Work permit
- Carry out a site inspection after the Hot Work has been completed, to ensure that no smouldering material remains.

3.3 ADDITIONAL PROCEDURES FOR HOTWORK IN OR ON A CONFINED SPACE

GENERAL

A hotwork permit is required for all Hot work in, or on the exterior surfaces of, a confined space.

If a person enters the confined space, a confined space entry permit is required in addition to the hot work permit. Refer Sydney Water's *Safe entry and working in a Confined space Procedure*

If the confined space risk assessment indicates that the entry permit gas testing may be conducted by a workteam gas tester, this person may also perform the hotwork flammable gas testing.

SAFE WORK PRACTICES

- All surfaces covered with coatings that would decompose or volatilise under hot work into toxic and/ or flammable, corrosive or irritant components, should be stripped from the area of heat application. Coatings should also be removed for a sufficient distance from the area to be heated.
  - *NOTE: Typical coatings which may pose a hazard include zinc, cadmium, lead paints, oil residues, certain other paints and plastics.*
- All combustibles, including any dry residues, in the vicinity of the hot work should be removed to a safe place. If they cannot be moved, such items should be covered by a non-combustible cover or other means to prevent ignition from heat, sparks and slag.
- When welding or cutting is to be performed on a tank shell or a conductive boundary of a confined space, the same precautions should be exercised inside and outside the space where the hot work is being performed.
- When a confined space or an adjacent space has contained a flammable liquid, vapour or gas, the permit should be issued only after inspection and testing have ensured that the following factors have been considered:

  (i) The concentration of flammable vapours or gases in the atmosphere.

  (ii) The liquid and solid residues have been removed as necessary to prevent the release of flammable substances that will raise the concentration of flammable substances in the atmosphere.

  (iii) The concentration of flammable vapour or gas within any piping within the confined space or connected to it.
- In a confined space having last contained dry material that creates a flammable or explosive atmosphere when dispersed in air, the permit should be issued only after inspection has ensured that loose dust has been removed from the confined space and all appropriate surfaces have been cleaned or the material has been rendered safe (for example, by wetting grain dust).
- Flammable metal anti-corrosion anodes should be removed from the work site and replaced when the work is completed.
- Remember that most gas detection instruments are unable to measure welding fumes or to predict the release of flammable gas/vapour on heating of oily residues.

- Means should be provided to exhaust contaminated air from the confined space. The exhaust suction point should be located as close as possible to the source of contamination within the confined space (for example, welding). Such exhaust should be directed to a location where it presents no hazard and will not accidentally be recirculated into the confined space. This exhaust ventilation is additional to any dilution ventilation necessary to prepare the confined space for entry.

WELDING SAFETY

Welding in a confined space should be conducted in accordance with the requirements of *Part 7.3 of the OHS Regulation 2001*, the recommendations of AS 2865 Appendix F, the relevant provisions of AS1674.1 and the Welding Technology Institute of Australia's Technical Note 7. make the following dot points

Containing of sparks, welding splatters, etc especially when working above or near a Flammable Gas Hazardous Area.

Arrangements to rapidly disconnect power supply, turn off gas lines, etc, which service the work inside the Confined Space.

When arc welding is suspended for a substantial period of time, such as during lunch periods or overnight, the power source to the equipment should be de-energized, all electrodes removed from holders and the holders placed so that accidental contact or arcing cannot occur.

When gas welding or cutting is suspended for a substantial period of time, such as during lunch periods or overnight, the torch and cylinder valves should be closed. The torch and hose should be removed from and depressurised outside the confined space.

No compressed gas cylinders or associated manifolds, other than those used for self-contained breathing apparatus, should be located inside the confined space.

FIRE SAFETY

A pressurized fire hose and a suitable nozzle or other suitable extinguishing equipment, or both, should be available

Suitable fire extinguishers should be available and the workteam trained in their use. Be aware that some types of fire extinguisher may release hazardous amounts of toxic gas and/or displace oxygen when operated in an unventilated Confined Space.

When combustible materials are present, consideration should be given to the assignment of a fire watch while the hot work is being performed and for a period of not less than 30 minutes after completion of such hot work.

AIR QUALITY STANDARDS

For Confined Spaces which are NOT Flammable Gas Hazardous Areas, apply the confined space air quality standards of 5% of the Lower Explosive Level (LEL) of any flammable gas identified in the risk assessment.

3.4 ADDITIONAL PROCEDURES FOR HOTWORK IN OR ADJACENT TO A FLAMMABLE GAS HAZARDOUS AREA

A hotwork permit is required for all Hot work in, or adjacent to, any flammable gas hazardous zone.

If the flammable gas hazardous zone is also a confined space, these requirements are additional to those required for hotwork in a confined space.

HOTWORK IN ZONE 0 FGH AREAS

Strictly NO ENTRY OR WORK is permitted in Zone 0.

If work is required in Zone 0 FGH areas, **before commencing**, special precautions and physical modifications must be made to enable the temporary re-classification to a Zone 1 or Zone 2 FGH area for the duration of the work.

Examples of the precautions which can be used to help downgrade a Zone 0 FGH area are specified in the "SWC Guide: *Classification and Management of Flammable Gas Hazardous Areas*.

After completion of the work and removal of the physical modifications that were made, the area resumes its original Zone 0 FGH area classification.

HOTWORK IN ZONE 1 FGH AREAS

Explosion-protection techniques for electrical apparatus used must be approved for use in Zone 1 areas (e.g. intrinsically safe, flameproof etc.)

A Specialist Gas Tester must monitor all Hotwork in Zone 1 areas.

Entry to Zone 1 FGH areas: is permitted when precautions have been put in place to reduce and maintain flammable gas levels below 5 % LEL (as per Confined Space regulations).

Working in Zone 1 FGH areas: only non-sparking tools (generally made of beryllium-copper, aluminium-bronze and brass) and pneumatic tools (air powered) should be used. Examples of these include: brass hammers; brass picks; brass spanners; brass screw drivers; air powered drills (note: take special care to prevent sparks from drill bits on metal).

Notes:

The use of non-sparking and pneumatic tools does not guarantee that sparks will not be produced under normal operating conditions.

Non-sparking tools that become impregnated with grit, rock etc. can become a source of ignition. Non-sparking tools must be correctly maintained.)

The use of a non-sparking tool is not a substitute for removing a flammable atmosphere before the work is carried out.

All equipment brought into a FGH area should be of antistatic properties

Alloys of aluminium/ magnesium / titanium are known to create sparks on contact with rusted iron (incendive sparking). Articles constructed of these alloys are not to be brought into a flammable gas hazardous area.

Hot work in Zone 1 FGH areas: should be avoided or minimised unless the area can be physically downgraded to a Zone 2 FGH area for the duration of the Hotwork. If Hotwork is unavoidable within a Zone 1 FGH area, strict safety precautions must be put in place. These include but are not limited to:

- Lock-out/Tag-out procedure
- A Hotwork Permit is required (**mandatory)**
- A Specialist Gas Tester is required to monitor the atmosphere for the duration of Hotwork.
- Flammable gas levels must be maintained below 5 % LEL
- Identify and rectify/ isolate any source of gas release. (use 1 % LEL (500 ppm) as an indicator of gas release.)
- Contain all sparks produced by the Hotwork
- Cover all exposed drains and open pipe work
- Physically isolate the Hotwork from flammable gas hazard sources
- Removal of all flammable material
- Charged water hose and other fire fighting equipment must be on site

HOTWORK IN ZONE 2 FGH AREAS

Regular tools and equipment are permitted within Zone 2 FGH areas, but must be correctly maintained (e.g. inspection and tagging of power tools and leads).

Continuous gas monitoring is required for all Hotwork in Zone 2 areas.

Entry and working in a Zone 2 FGH area: is permitted where the area is monitored by installed gas detection equipment set to alarm at 5% LEL, or only after a gas check using a hand held monitor confirms that flammable gas concentrations are maintained below 5 % LEL.

Hotwork in a Zone 2 FGH area:

- A Hotwork Permit is required.
- Constant gas monitoring by a trained gas tester
- Flammable gas concentration to be maintained below 5% LEL
- Contain all sparks produced by the Hotwork
- Cover all exposed drains and open pipe work
- Physical isolation of the Hotwork from flammable gas hazard sources
- Identify and rectify/ isolate any source of gas release
- Remove of all flammable material
- Running water hose and other fire fighting equipment on site

4 COMPETENCIES

- Employees performing hot work must be trained and able to demonstrate competence in this procedure, hot work skills, fire awareness (including fire prevention techniques) and emergency plans as well as use of equipment to be utilised during hot work.
- Authorising officers require competence in this procedure, contractor obligations and requirements, and fire awareness.
- Contractors performing hot work should be aware of Sydney Water's requirements for hot work during periods of high fire danger periods and total fire bans.

5 DEFINITIONS

Hot Work	Welding, thermal or oxygen cutting, heating and other fire-producing or spark-producing operations.
Hot Work Permit: (HWP)	A document that identifies the Hot work to be done, the hazards involved and the controls or precautions to be taken.
Total Fire Ban (TOBAN)	On days of extreme fire danger caused by a combination of certain weather conditions and dry vegetation the Commissioner, NSW Rural Fire Service may declare a total fire ban. Total fire bans usually are only for 24 hours, midnight to midnight.
Flammable Gas Hazardous Areas	An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources.
High Fire Danger Period	During the bush fire danger season fires in the open are restricted. The high fire danger period is from October to May of each year, this may be extended depending on conditions.
Open Area	Any area outside of a building or fixed structure (anything without four walls and a roof).

Authorising Officer: (A.O.) — An employee or contractor who has been trained, assessed as competent and authorised to issue Hot Work Permits.

Observer — A person responsible for monitoring the work site and work operation for fire risk associated with performing Hot Work. .

Specialist Gas Tester — A person authorised by management to carry out atmospheric testing in confined spaces and also to verify whether hot work is permitted in a flammable gas hazardous areas.

Essential Repairs and Maintenance

(In relation to Hot work activities on Total Fire Ban days under the exemption provided by schedule 5 NSW Rural Fires Act 1997.)

Means work that will rectify or prevent:

- A disruption to the water supply of multiple customers
- A disruption to sewage services of multiple customers
- A disruption to water or waste water treatment facilities which is affecting or likely to affect Compliance with Operating Licence or with EPA Licences
- Significant and immediate threats to the health and safety of employees, contractors or others associated with Sydney Water's operations
- A sewage overflow or bypass affecting or likely to affect receiving waters or resulting in a noncompliance with Sewage Treatment System Licenses issued by the EPA
- A disruption to water supply likely to affect firefighting capabilities;

and for which no practicable alternative measure can be effected in the short term to avoid "Hot Work" during periods of a Total Fire Ban. 'Essential work' criteria will normally not apply to planned activities as appropriate contingencies will have been implemented as part of the work planning.

Exemption — An exemption is applied for in writing to the NSW Rural Fire Services for planned work (see example in appendix C). A hot work permit is still required to be completed.

6 RESPONSIBILITIES

Business Area /Site / Asset Managers

Responsible for:

Ensuring that the HWP procedure is implemented and enforced for Sydney Water sites / assets under their control. This includes the obligations and requirements for contractors that are performing hot work.

Ensuring that all people performing hot work or authorised to issue HWP's are competent in the HWP procedure.

Monitoring the administration and application of the HWP system to ensure the requirements of this procedure are followed.

Maintaining the HWP records.

Authorising Officers

Responsible for:

Carrying out a Hazard Identification and determining the necessary controls / precautions with the work team or contractor at the job site prior to issuing the HWP.

Reviewing and approving the method of work.

Ensuring that the agreed controls and precautions are in place and utilised.

Observer

Responsible for:

Carrying out duties as detailed in Appendix B.

Employees /

Responsible for:

Complying with the requirements of this procedure

7 REFERENCES

LEGISLATION AND RESOURCES

OHS Regulation, 2001, Chapter 4 –part 4.2 Division1 General duties of controllers of premises, part 4.3, division 5 Atmosphere, Division 9 Working in confined spaces Chapter 7 Part 7.3 Welding
Rural Fires Act 1997 schedule 5 and Schedule 18
Sydney Water Corporate Procedures: *Hazard Identification and Risk Assessment Process* *Safe Entry and Working in Confined Space* *Emergency Preparedness* *LockOut/TagOut* Available on ConnectNet > Health & Safety > Health & Safety Instructions/Procedures
Sydney Water Health and Safety guide: *Classification and Management of Flammable Gas Hazardous Areas* *Flammable Gas Guidelines* Available on ConnectNet > Health & Safety > Guides and checklists
Sydney Water Emergency Risk management guide and policy manual *ERM Bushfire Emergency Plan* Available on ConnectNet > Home **>** About Us **>** Plans **>** Emergency Risk Management Plans
Australian standards AS 1674.1 Safety in Welding and Allied Processes Part 1: Fire Precautions AS 2865 Safe Working in a confined space

8 DOCUMENT CONTROL

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9 HISTORY

Revised May 2006 to include confined space hotwork & flammable gas hazardous areas requirements. Replaces CP-KP-026 issued 11 Nov 2003.

10 APPENDICES

Appendix A	Hot Work Permit Checklist for Authorising Officers
Appendix B	Guidelines for Hot Work Observer
Appendix C	Example of exemption letter to the Rural Fire Services

11 ATTACHMENTS

Attachment 1	Hot Work Permit

Appendix A

HOT WORK PERMIT CHECKLIST FOR AUTHORISING OFFICERS

Prompts (X if in place)

- ❑ Have all employees doing the work been appropriately trained?
- ❑ Has a risk assessment been performed?
- ❑ Does the recipient understand the nature and scope of the work?
- ❑ Do you understand the nature and scope of the work?
- ❑ Does the task require isolations to be shared with other work? If so, should a Master Control Sheet be used?
- ❑ Is there a total fire ban?
- ❑ Should work proceed?
- ❑ Is there an emergency procedure in place?

Contractor Recipients

- ❑ Induction to site or plant.
- ❑ Inspection of equipment.
- ❑ Personal protective equipment.
- ❑ Supervision arrangements.

Hazards Associated with Hot Work

- ❑ Spills or leakage of flammable or combustible liquids
- ❑ Leakage of flammable gases
- ❑ Leakage of oxygen
- ❑ Sampling or draining of flammable materials
- ❑ Flammable materials soaked into lagging or ground
- ❑ Flammable materials floating on water in drains or trenches
- ❑ Presence of combustible solids or dusts
- ❑ Combustible materials on the other side of walls or partitions.
- ❑ Combustible floors and fixtures.
- ❑ Rubbish or packaging
- ❑ Building materials
- ❑ Cooling tower packing
- ❑ Possibility of hot work releasing fumes
- ❑ Possibility of hot work initiating a chemical reaction
- ❑ Possibility of hot work igniting residual process material in equipment
- ❑ Lack of containment of sparks from welding or cutting.
- ❑ Possibility of stub-ends of welding rods coming into contact with combustible materials.
- ❑ Uncontrolled sparking from failure to attach welding set earth return leads close to the work
- ❑ Latent and radiant heat after welding or cutting (cool down period).

Appendix B

REQUIREMENTS FOR HOT WORK OBSERVER

The Observer assigned to Hot Work duties has a responsibility towards their fellow workers with regard to minimising the risks associated with performing Hot Work.

a) Before the Hot Work Starts

1. Discuss the job with the person assigning you to observer duties. Ensure that you are clear about:
   - ❑ What work has to be done;
   - ❑ What likely hazards exist; and
   - ❑ What precautions have to be observed.
2. Personally read and understand emergency procedures and Hot Work Permits, and any other permits associated with the job.
3. Ensure team are aware that you are the observer.
4. Check communications (if appropriate) with the Control Room and Site Office
5. Consider what PPE is required.
6. Position your fire extinguisher and/or other fire prevention equipment in a location that is accessible to you and the person(s) doing the Hot Work job.
7. For electrical welding, ensure that you know:
   - ❑ Where electrical isolator is;
   - ❑ How to quickly stop the generator;
   - ❑ Where the earth lead is connected (this should be connected to the metal being welded or as close as possible to it. The earth should not be insulated from the welding spot by gaskets or a broken flange);
   - ❑ Where the cable has been run and that it is out of the way of traffic and cannot be damaged.

b) During the Hot Work:

Be aware that:

- You are authorised to stop the hot work at any time, if in doubt, stop the hot work and seek advice.
- You, or a relief assigned by the Authorising Officer responsible for the Permit MUST be in attendance for the duration of the hot work. If this is not possible, hot work must cease.
- If you do stop the hot work, you cannot allow it to be restarted without the agreement of the Authorising Officer responsible for the Permit. This is because conditions may have changed during the time that the work was stopped. This applies to smoko and meal breaks.
- Wind direction changes may bring new hazards.

Ensure that:

- You patrol the area so that you can keep an eye on both the hot work source and the general area where any hazardous gas may emanate, also watch for any "unexpected" ignition source.
- Other people keep well clear of the hot work area.
- Flammables are not released nearby by sampling, venting or breaking of a line.
- During oxy cutting, heating or use of blowtorches, that the flame is alight only when actually being used and that the "live" torch is kept in the hand.
- In an enclosed area, gas cylinders not being used for the work at hand are kept outside.
- Use appropriate fire extinguisher for all hot work.

c) After the Hot Work

Ensure that:

- You report to the person who assigned you to observer duties, or relief.
- You advise that person if you had cause to use your fire extinguisher. If not used, return it to its original location.

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Appendix C

REQUEST FOR EXEMPTION FOR HOTWORK IN TOTAL FIRE BAN

Applicant: Sydney Water (or Contractor to SW (eg/ Lend Lease))

Project(s): ***(Insert specific addresses)***
Eg/ Reticulation Projects:

- 86-240 Kirribilli Avenue, Kirribilli
- 1-50 Smith Street, Guildford

Date/Time(s) that exemption is requested: ***(Insert specific date/s and times applied for)***

Eg/ Date: 22/06/03 Times: 7am to 5pm

If applying for a general exemption copies may need to be sent for each day applied for.

[Eg/ xx/xx/200x to xx/xx/200x as required *. Working hours generally 7am to 5pm weekdays, sometimes night work 8pm-6am, sometimes weekend work.

* Exemption is only required for Total Fire Ban days that are declared in this period or on these dates. This is not known at this time.]

Description of Works & Reason for Request for Exemption:

- Eg/ Involves the supply of water in a number of localities both for domestic & fire purposes.

Proposed hotwork tasks & location for time of exemption application:

Eg/ Hotwork Tasks	Locations/Projects	Frequency
Pipe cutting and grinding	At connection points to existing mains on all projects;	Connections: Several cuts on one or more days per project.
Grinding & welding on steel pipe	Welded steel concrete encased pipe	Daily on steel pipe sections

Site characteristics:

☐ Bushland ☐ Grassland ☐ Forest

Ground inclination = _____ Slope

Area cleared around site for ___ meters

General topography:

Precautions to be implemented:

- The Sydney Water Corporation Hot Work Procedure will be implemented and followed.

Contact person for application for exemption:

Insert name & phone number

Date of application for exemption:

Insert date

Contact person for siteworks on date of exemption:

Insert name & phone number

HOT WORK PERMIT

HWP No. ___________

This permit must be completed prior to any hot work (eg welding, oxy cutting or grinding) or any work in a flammable gas hazardous area

Job Card / PTWC No.	Confined Space Permit No.
Location of Work:	Description of Work to be Undertaken:
Service Provider: Company Name: Contact Name: Mobile:	**Personnel Assigned:**

FIRE PRECAUTIONS (Review each item and indicate YES or NOT APPLICABLE by ticking)

Precaution	Yes	N/A	Precaution	Yes	N/A
Environmental conditions are suitable for hot work (wind, temperature etc)	☐	☐	Observer required. Name: …………………………	☐	☐
Area clean / free of all readily combustible materials	☐	☐	Appropriate fire extinguishers onsite	☐	☐
A water hose run to job site and tested / left charged	☐	☐	Work area has been isolated and barricaded	☐	☐
All drains within 15 metres sealed or covered with wet fireproof blanket	☐	☐	Tanks, valves, pipelines, vents checked, blanked or isolated	☐	☐
Flammable substance containers / pipelines identified	☐	☐	Electrical trace on pipes isolated	☐	☐
Probable leakage points identified and tested	☐	☐	Flashback arrestors fitted to oxy/acetylene equipment	☐	☐
Power leads not draped across pipelines or access ways	☐	☐	Welding machine/gas cylinders located away from any drain	☐	☐
Welding machine earthed directly to equipment being welded	☐	☐	Non-ferrous tools	☐	☐
Welding / Flash screens in place	☐	☐	Fireproof receptacle available for waste cut-offs and electrode stubs	☐	☐
All sparks from work above ground contained by use of a suitable enclosure	☐	☐	Additional Precautions: …………………………………	☐	☐

FLAMMABLE GAS CLEARANCE (Strike out this section if work is not carried out in Flammable Gas Hazard Area)

Flammable Gas Hazardous Area: Zone ……. or Not Applicable ☐

Flammable Gas: (<5% of LEL) ……………….% Potential leakage points checked: ☐ Yes ☐ No

Gas Tester: ....…………………….. Time: …….......... am / pm Date…../…../…..

Continuous Monitoring Required: ☐ Yes or ☐ Routine monitoring every ……. hour (s)

Additional requirements to be used for Zone 1 Must be completed by a specialist gas tester

Flammable Gas (<500ppm): ……………… ppm Ventilation Functions Correctly: ☐ Yes ☐ No

Potential Gas Leakage Points Checked (Identify): ………………………………………………………………………

Monitoring Delegated to Gas Tester: ☐ Yes ☐ No Conditions: ……………………………………………..

Continuous Monitoring Required: ☐ Yes ☐ No ……………………………………………

Specialist Gas Tester: ………………………………..… Time: .... am / pm Date:...../...../......

FUME PROTECTION **(Review each item and indicate YES by ticking)**

☐ Exhaust Ventilation for fumes generated by work ☐ Supplied-Air Respiration Protection required
☐ Dilution Ventilation of Workplace ☐ Filter Respirator: Type..............……………

AUTHORISATION TO PROCEED This permit must be attached to the Job Card / PTWC raised for this job.

Authorising Officer Name …………….……. Signature …………………… Date ……/……/…….	**Service Provider (Responsible Person)** Name ……………………. Signature …………………… Date ……/……/…….

Original to Service Provider, copy retained by Authorising Officer

Sydney WATER	HEALTH AND SAFETY PROCEDURE
HSP 030	INCIDENT INVESTIGATION

1 SCOPE

This Procedure defines Sydney Water's processes to ensure that all accidents, incidents and near misses are investigated in a timely manner. The purpose of an investigation is not to apportion blame, but to identify the root causes and establish appropriate Action Request(s).

This procedure applies to all Sydney Water employees and is to be applied to health and safety events (that is, events that have caused or have the potential to cause physical or psychological harm) involving employees and members of the public. The process also applies to contractor health and safety incidents as listed in Appendix 4

2 KEY REQUIREMENTS

- Local emergency procedures should address actions to be taken immediately following an incident. The first priority is removing persons from actual, or potential harm.
- Subject to legislative constraints, the incident scene shall be controlled to preserve evidence and managed in order to prevent further injury and damage. This may require process isolation, shutdown or other measures.
- All incidents shall be reported in accordance with Sydney Water's *Incident Notification and Recording Procedure*.
- Incidents shall be investigated in a manner that is thorough, objective, structured and technically sound.
- Investigation of near miss incidents & incidents that result in lost time injury or medical treatment must commence as soon as possible, preferably with 12 hours, to a maximum of 1 week.
- All near miss incidents & incidents that result in lost time injury or medical treatment must have an investigation recorded in the Incident Recoding System
- The rigour of the investigation shall be determined by the actual or probable likelihood and/or severity, as appropriate. This applies to both events and near-miss events.
- The investigation shall be conducted at the location of the incident and where the majority of interviewees are found.
- The investigation team shall determine the root causes for each incident.
- The investigation team shall recommend action request(s) for all incidents with a risk rating of recurrences (when calculated without controls) of 1,2 or 3
- All action request(s) shall:
  - Aim to eliminate or minimise the opportunity for recurrence of the root cause(s).
  - Be allocated a person within the affected business/Division who is then responsible for completing the agreed action;
  - Have an agreed due date for completion

- Be monitored via the IRS database and the ongoing OHS audit program.
- Not be allocated to Health & Safety Consultants unless it relates to the SWC Health & Safety Management System.

- Management teams shall review incident investigations and action requests as a monthly agenda item.
- Where necessary, investigations shall be conducted under the protection of legal professional privilege. The necessity for such a measure shall be determined in consultation with the SWC Legal and Health and Safety departments. The dominant purpose of the investigation must be to assist the procurement of legal advice against the prospect of prosecution; otherwise it will be hard to sustain a claim of legal professional privilege.
- Contractors are required to have an investigation process in place. The application of this procedure to contractor health and safety events is discussed in Appendix 4. All contractor health and safety incidents or accidents are to be included in the review process.

3 PROCEDURE

The procedure for investigation is:

1. Review and classify Level of Incident
2. Appoint Investigation Sponsor
3. Allocate Investigation Leader
4. Investigate using appropriate techniques
5. Write and submit report
6. Implement corrective actions.

For each Level of Incident (3, 2 or 1), an increasing level of formality and skill is required for the investigation. This is summarised in Figure 1.

3.1 LEGAL PROFESSIONAL PRIVILEGE

At the start of an investigation, consider whether WorkCover, the EPA or other regulatory authority has or is likely to investigate the incident.

For these investigations, consult with the Sydney Water Legal department who will advise whether they wish to commission the investigation under Legal Professional privilege.

These investigations should be intended to assist the procurement of legal advice against the prospect of prosecution; otherwise it will be hard to sustain a claim of legal professional privilege.

If, during any investigation, sensitive material is discovered, stop the investigation and consult Legal for advice.

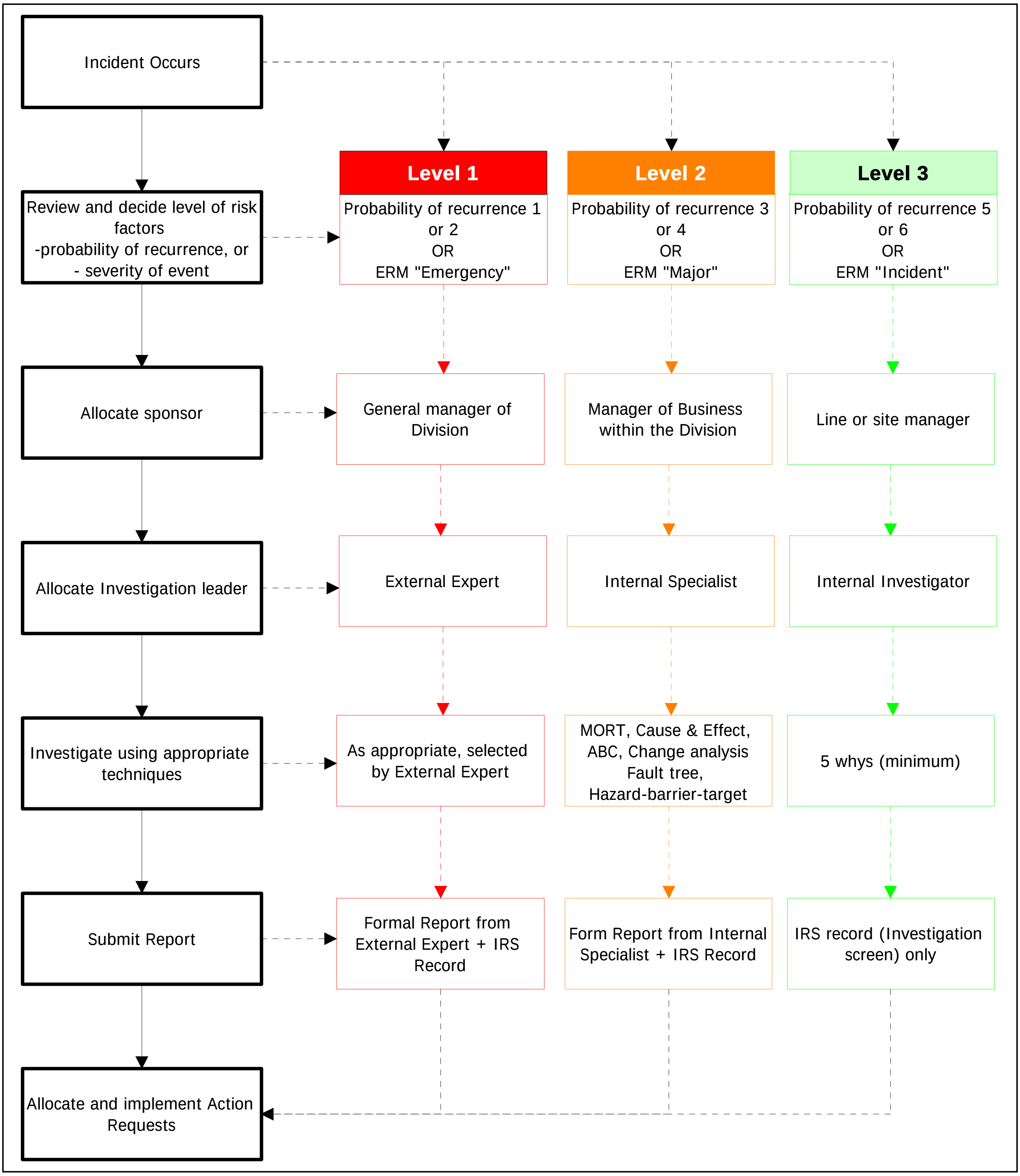
It is usually too late to claim legal professional privilege on a completed investigation

3.2 GENERAL INFORMATION

1. Incident investigation should involve the injured (or nearly injured) person, his/her manager and a site visit to review the conditions at the time of the incident.
2. Additional information or people may be called in, as required. For example:
   - interpreter (if required)
   - union representative (if requested)
   - witness(es)
   - person(s) with knowledge of the process and/or equipment involved
   - scheduler (eg if root cause involved allocation of work)
   - *H&S Consultant*

3. Incident investigation may take as little as ten minutes, preferably conducted at the site of the incident, provided the root cause is identified & appropriate actions are agreed.
4. Once incident has been investigated, arrange to have information recorded in IRS by yourself (if you have access), or IRS *data-entry nominee*,
5. Ensure you advise *H&S Ops* & your line manager of outcomes of the investigation.

Figure 1: Incident Investigation Procedure



3.3 CLASSIFICATION OF INCIDENTS

Incidents are required to be classified in order to appropriately allocate resources. These levels are described in Table 1.

Table 1

	EVENT EXAMPLES
Level 1	ERM “emergency” involving health and safety, eg WorkCover Serious Incident More than one Lost Time injury exceeding 7 days duration. Permanent serious disability Risk of Recurrence (calculated in IRS Investigation screen) of 1 or 2
Level 2	ERM “Major” incident involving health and safety, for example WorkCover notifiable event Victim admitted to hospital Risk of Recurrence (calculated in IRS Investigation screen) of 3 or 4
Level 3	ERM “incident” involving health and safety, for example - LTI less than or equal to 7 continuous days absence - Medical treatment injury - First aid treatment Near miss of first aid or medical treatment Risk of Recurrence (calculated in IRS Investigation screen) of 5 or 6

3.3.1 Near Miss Events

Referring to the potential outcomes above. For example, consider a near miss where the most likely outcome is a first aid treatment, the near miss should be classed as a minor event and investigated as a Level 3 event. If, however, a likely outcome is a permanent disability, then it should be classed as a “catastrophic” event and investigated as Level 1. Appendix 5 provides information on determining the investigation level.

3.3.2 No Investigation required

All incidents should be reviewed. When no investigation is needed, the reason should be recorded on the IRS report. In general, a formal SWC investigation is required for all workplace accidents which have a potential to cause a lost time injury.

3.4 SPONSOR AGREEMENT

The Investigation Sponsor is responsible for the agreement of scope, timing and resources to investigate the process and the allocation of costs (including external resources).

In general terms, the sponsors of incidents are appointed, based on the Level of Incident (see Table 1). However, there is nothing that precludes an incident investigation being sponsored by a more senior officer than indicated above.

3.5 INVESTIGATION LEADER AND TEAM MAKE-UP

Investigations Leaders are classified into three levels (or stages) of skill. These are:

- Investigator
- Specialist, and
- Expert.

The Investigation Leader shall be appointed, based on the classification of the Incident (Level 1, 2, or 3), (See Appendix 1).

Due to the technical expertise required in investigation of some incidents, it may be necessary to enlist the services of external (or internal) consultants to assist in the investigation.

3.5.1 Team Make up

3.5.1.1 Level 1 Incident

For a Level 1 Incident, the team must meet the following criteria:

- At least one person must be at Expert skill level.
- The Expert should be independent of the business, possibly independent of Sydney Water.
- At least one person should be knowledgeable of the site and processes involved in the incident
- From time-to time, technical experts may need to be involved (See Appendix 3).

3.5.1.2 Level 2 Incident

For a Level 2 Incident, the team must meet the following criteria:

- At least one person must have completed Specialist training.
- At least one person should be knowledgeable of the site and processes involved in the incident
- From time-to time, technical experts may need to be involved (See Appendix 3).

3.5.1.3 Level 3 Incident

Level 3 Incidents shall be investigated by one or more personnel who have at least Investigator skills.

3.6 INVESTIGATION PROCESS

3.6.1 Investigation Technique

The investigation technique applied to the Incident is dependant on the Level of the Incident. As a minimum, “Investigative interviewing” or the “5 Why’s” technique shall be allied to all Level 3 Incidents. The application of other investigation methods remains the decision of the Investigation Leader, who will direct the team in the use of specific investigation technique(s), based on the type of incident. The application of investigation techniques are outlined in Appendices 1 and 2.

3.6.2 Investigation Outcome

The investigation team shall determine the **root cause(s)** for each incident as the outcome of the investigation. The identified causes should be subject to the following analysis:

- the problem could be duplicated based on the suggested causes;
- the event would not have occurred had the causes not been present;
- correction or elimination of the causes will restore failed barriers and reduce the likelihood of future barrier failures.
- correction or elimination of the causes will break the sequence of events illustrated by an Events and Causal Factors chart.

3.6.3 Investigation Recommendations

The investigation team shall recommend action request(s) aimed at eliminating or minimising the opportunity for recurrence of the root causes. Action request(s) may also be recommended for factors contributing to the incident.

In making recommendations, the investigation team should not be limited to working within current constraints eg organisational policy, budget, timing etc. Recommendations should focus on the long-term objective of risk/hazard elimination.

In developing action request(s) the following should be considered:

- Action requests should directly address all root causes;
- Action requests should consider the hierarchy of control;
- Action requests must be achievable, acceptable and realistic;
- Action request shall address generic implications whenever possible.

The development & Implementation of action request(s) shall comply with *SWC Health & Safety Management System requirements.* The implementation of action request(s) shall be subject to audit.

3.7 INVESTIGATION REPORT

Level 1 and Level 2 investigations shall conclude with a formal report. This report shall be submitted to the sponsor and Health and Safety Operations. A (electronic) copy of the report shall be attached to the IRS record of the incident.

For Level 3 incidents, a separate report is not required. As a minimum the investigation shall be recorded in the IRS by adding content to the relevant fields.

The Investigation report (Level 1 and Level 2 Investigations) report will be factual and concise and will directly address the issues raised by the incident.

The report should include the following sections:

- executive summary
- investigation team details
- scope of investigation
- summary of events and causal factors
- event chronology
- significant items of interest and implications for the corporation
- facts, conclusions and recommendations for each investigation finding.
- appendices
  - investigation analysis methods
  - supporting documents (diagrams, plans, sketches, etc.)

4 COMPETENCIES

Required investigator competencies are outlined in Appendix 2

5 DEFINITIONS

Emergency	An event which: (a) endangers, or threatens to endanger, the safety or health of persons or animals in the State; or (b) destroys or damages or threatens to destroy or damage, any property in the State, being an emergency which requires significant and coordinated response" where: (c) threats or danger to property includes a reference to threats or dangers to the environment, and (d) the protection of property includes a reference to the protection of the environment"
ERM	Emergency Risk Management, and processes to minimise harm and assist recovery from an incident.
Investigation	A formal process to identify the root causes of an incident or accident. Three levels of Investigation are provided based on actual or potential harm.
Investigator	The person conducting an investigation. Investigators are classified into three skill levels, expert, specialist and investigator.
IRS	Incident Recording System… the SWC intranet based system used to record all health & safety incidents.
Legal professional privilege	A process to safeguard the information and process documents from being obtained by an opponent in legal proceedings.
LTI	Lost Time Injury, A work related occurrence that results in a fatality, permanent disability or time lost from work of one day / shift or more, not including the day of the accident.
Action request	Generic term encompassing corrective and preventative action. It is the goal of any investigation to identify actions that will prevent recurrence.
Root cause	The principal contributing factor that lead to the incident or the severity of the event or condition under analysis.
Sponsor	The person accepting management responsibility for the investigation. Depending on the incident, this may be one of the Corporation's senior managers… eg General Manager, Department Manager, H&S Operations Manager, Divisional H&S Manager, Line Manager or Site Manager.
WorkCover Serious Incident	The OHS Regulation 2001, clause 344, requires an employer to notify WorkCover and not disturb an accident scene for 36 hours except for helping trapped or injured persons or actions agreed by WorkCover, where an incident results in: • Fatal injury. • an injury to a person that results in the amputation of a limb, • the placing of a person on a life support system, *(cont'd over page)*

	• any event or circumstance listed below that presents an immediate threat to life: ➢ the loss of consciousness of a person caused by impact of physical force, exposure to hazardous substances, electric shock or lack of oxygen, ➢ major damage to any plant, equipment, building or structure, ➢ an uncontrolled explosion or fire, escape of gas, dangerous goods or steam, ➢ imminent risk of explosion or fire, or escape of gas, dangerous goods or steam, ➢ a spill or incident resulting in exposure or potential exposure of a person to a notifiable or prohibited carcinogenic substance ➢ entrapment of a person in a confined space, entrapment of a person in machinery or collapse of an excavation, ➢ serious burns to a person.
WorkCover notifiable event	The OHS Regulation 2001, clause 341, requires an employer to notify WorkCover of certain accidents and incidents. • an injury, illness or incidence of violence to a person that results in the person being unfit, for a continuous period of at least 7 days, to attend the person's usual place of work, to perform his or her usual duties at his or her place of work or, in the case of a non-employee, to carry out his or her usual activities, • damage to any plant, equipment, building or structure or other thing that impedes safe operation, • an uncontrolled explosion or fire, or an uncontrolled escape of gas, dangerous goods or steam, • a spill or incident resulting in exposure or potential exposure of a person to a notifiable or prohibited carcinogenic substance • removal of workers from lead risk work due to excessive blood lead levels, • exposure to bodily fluids that presents a risk of transmission of blood-borne diseases, • any occurrence that involves a risk of explosion or fire, or escape of gas, dangerous goods or steam, or serious injury to, or illness of, a person, or substantial property damage.

6 RESPONSIBILITIES

6.1 HEALTH AND SAFETY OPERATIONS

Health & Safety Operations shall maintain a register of qualified investigators, nominated by Divisional management, and shall, as far as practicable, ensure that investigators are given opportunities to develop and maintain their skills.

The Manager, Health And Safety Operations, shall maintain a register of suitable recognised experts who may be available to assist in investigations.

Health and Safety Operations shall monitor the implementation of recommendations from all incident investigations.

Level 1 and Level 2 investigation reports shall be formally reviewed quarterly by the Health and Safety management team for adequacy and appropriateness, and to extract learnings and trends for the wider corporation

The Health and Safety Operational Manager allocated to the Division area shall be responsible for monitoring that all incidents/ accidents in their business area are investigated appropriately.

6.2 DIVISIONAL MANAGEMENT

Business processes are required to ensure incidents are rapidly reported up to the appropriate sponsor level and investigations initiated.

Where an OHS incident is notified as per Sydney Water's *Incident Notification and Recording Procedure*, the manager receiving that report should assess the level of investigation required.

Level 1 and Level 2 investigation reports shall be formally reviewed monthly by the divisional management team for adequacy and appropriateness, and to extract learnings and trends for the business.

6.3 INVESTIGATION SPONSOR

All investigations will have a formal sponsor at the appropriate management level.

The sponsor shall allocate sufficient resources to conduct the investigation.

The investigation sponsor shall be responsible for implementation of recommendations from all incident investigations, or documenting reasons for alternative actions.

6.4 INVESTIGATION TEAM

The investigation team shall work to the completion date, as agreed with the investigation's sponsor.

7 REFERENCES

Sydney Water Corporate Procedures

(available on Connectnet Health & Safety site @ *Health & Safety > Policy, Systems. Standards & Procedures > Procedures*)

- *Incident Notification and Recording*

- *Hazard Identification and Risk Assessment Procedure*

Sydney Water's Asset Management Emergency Risk Management Manual

8 DOCUMENT CONTROL

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Approved by:	**Health & Safety Operations Manager**
Date of approval:	**31 Aug 2005**

9 HISTORY

This Procedure replaces CP-KP-030 Incident investigation issue A revision 0 issued 11 Nov 2003

10 APPENDICES

Appendix 1 Incident Level and Investigation Process

Appendix 2 Investigator Competencies

Appendix 3 Technical Specialists

Appendix 4 Contractor Incidents

Appendix 5 Risk Assessment

APPENDIX 1: INCIDENT LEVEL AND INVESTIGATION PROCESS

PROCESS ELEMENT	Level 1	Level 2	Level 3
Classification	ERM “emergency” involving health and safety OR Risk of recurrence 1 or 2	ERM “Major” incident involving health and safety OR Risk of recurrence 3 or 4	ERM “incident” involving health and safety OR Risk of recurrence 5 or 6
Sponsor	General Manager of the Division owning the incident.	Manager of the Business owning the incident	Line Manager or Site Manager of the Business owning the incident.
Team Leader	Expert	Specialist	Investigator
Team Make-up	The team must meet the following criteria: • At least one person must be at Expert skill level. • The Expert should be independent of the business, possibly independent of Sydney Water. • At least one person should be knowledgeable of the site and processes involved in the incident	The team must meet the following criteria: • At least one person must have completed Specialist training. • At least one person should be knowledgeable of the site and processes involved in the incident	Level 3 Incidents shall be investigated by one or more personnel who have at least Investigator skills.
Investigation Technique(s) to be applied	Appropriate recognised techniques as selected by the (Expert) lead investigator Detailed risk assessment - comparisons of SWC controls versus industry practice - effectiveness of control options for the management of risk (ie identify base & residual risk levels) - risk rank the range of activities/parameters/ elements which may be impacted by the incident to identify whether there is an increased risk in any particular activity/parameter/element	Events & causal factors analysis and other techniques as needed	“Investigative interviewing”, Five why’s” or other techniques as appropriate to the investigation needs and competency of the investigator.
Report Type	Formal Report + IRS record	Formal Report + IRS record	IRS record

APPENDIX 2: INVESTIGATOR COMPETENCIES

10.1.1 Investigator

Investigator, or basic skills assist investigators to identify all the factors that contributed to an incident.

Training and/or experience to develop competence in

- Evidence collection
- Interview techniques
- Basic investigation techniques eg “5 why’s”
- Investigation reporting

10.1.2 Specialist

Specialist, or intermediate skills training should enhance Investigator competencies and deliver knowledge of the range of formal investigation techniques. (See Table below).

10.1.3 Expert

Expert, or advanced skills are developed by experience in applying Specialist skills to a variety of investigations.

TECHNIQUE	DESCRIPTION	SKILL LEVEL
5 Whys	A simple tool that examines behaviours and observations (facts) and seeks to identify the root causes for those observations. Generally, a situation is probed by repeatedly asking “why”.	Investigator
Events & Causal Factors	A diagrammatic tool that charts the chronology of the events leading up to and beyond an incident. It also charts other factors, such as environmental conditions, external influences, etc. Its value is that it very clearly helps keep the investigation on track and manages the “loose” ends.	Investigator / Specialist
Behaviour-based investigation	A process used to identity motivators behind human behaviour, particularly when procedures or warning signs are not being followed. The procedure looks at ways in which to tailor the message to make the reason for the procedure / message immediate & of value (consequence)	Investigator / Specialist
Change Analysis	Change Analysis examines the effects of change in the context of unwanted events. Change Analysis examines factors in place when a set of circumstances did not and then did lead to an accident.	Specialist
Hazard-Barrier Target Analysis	HBT analysis explores the failure or absence of barriers that should have prevented the hazard impacting the target (employee).	Specialist
MORT	Management Oversight & Risk Tree (MORT) is a tool developed for the US Department of Energy. It is a rigorous examination of the management system and seeks to eliminate investigative bias by use of fixed questions and process.	Expert
Fault Tree Analysis	A particular variant of the generic tree diagram, this tool helps visualize and analyse complex systems and problem situations.	Expert
Human Error	Examines for the presence of task performance errors and the reasons behind them.	Expert

Note that a more thorough investigation is required if the outcome reasonably could have been more significant. As an example, if a cut finger event reasonably could have resulted in an amputation, then it should be investigated at that level

APPENDIX 3: TECHNICAL SPECIALISTS

Effective investigation of some incidents may require a technical specialist. They can assist in the determination of failure processes, causes, technical capability etc. Their opinion (testimony) may also be used in the preparation of defence of Sydney Water, in the event that a prosecution results from an incident.

Recognised sources include:

FACTOR	EXPERTISE
Chemicals, Dangerous goods etc Airborne contaminants eg Gases, dusts etc	Occupational Hygienist
Radioactivity Non-ionising radiation etc Heat or cold	Health Physicist
Structural or mechanical failure	Mechanical engineer, Structural engineer, Geotechnical engineer
Electricity	Electrical engineer
Operator error	Ergonomist, Psychologist

APPENDIX 4: CONTRACTOR INCIDENTS

Contractors are expected to have in place an investigation process of similar rigour to the SWC process. It is neither necessary nor desirable for Sydney Water to intervene in contractors' internal processes. However, in most cases SWC Project Managers will participate in the contractor's investigation process to ensure that learnings can be incorporated into Sydney Water processes. Completed contractor investigation reports are to be included in the project documentation and also forwarded to *Health & Safety Operations* for extraction of relevant information.

There are occasions when Sydney Water should to conduct its own investigation of a contractor incident. Examples include:

- Our employees or members of the public were injured or were put at risk of injury.
- Our assets were damaged or put at risk of damage.
- The incident is of interest to the regulatory authorities (and/or prosecution is considered likely).
- There is a possibility that our systems or personnel may have contributed to the nature or extent of the incident.

Such an investigation should be sponsored within the guidelines of section 6.3.

APPENDIX 5 - INCIDENT RISK ASSESSMENT

This represents an adaptation of the process given in Sydney Water's *Hazard Identification and Risk Assessment Procedure* to incident investigation.

1. Identifying the Hazards

The incident report should identify the direct cause of harm. If further causes are found during the investigation, they should be assessed for probable outcome and the level of investigation increased if necessary.

2. Assessing the Risks

1. Determining the Consequence

The actual outcome should be known from the incident report. This determines the minimum level of investigation.

Alternative, worse outcomes should be assessed to determine whether a higher-level investigation is required.

For example, consider a person climbing a vertical ladder to access an elevated reservoir slips on a wet ladder rung. They were not using a fall restraint system but their hands held them from falling. The person suffered shock and skin abrasions to the lower leg.

If the ladder were 10 m long and the fall near the top, the consequence of a fall could have been death or serious injury, a catastrophic event.

Consequence	Severity - what can happen
Catastrophic	• Death • Permanent disability or ill health • Workcover non-disturbance event
Major	• Extensive injuries • Prolonged ill health • Prolonged restricted duties • Workcover notifiable event
Moderate	• Medical treatment required • Lost time injury – less than 7 days • Emergency services response
Minor	• First Aid treatment • No lost time due to injury.
Insignificant	• No injuries

2. Identifying the Likelihood

For incident investigation, the frequency component of Sydney Water's *Hazard Identification and Risk Assessment Procedure* is omitted and we proceed direct to likelihood. For the example, the actual result, a slip resulting in skin damage is the likely outcome. The serious fall is an unlikely event.

Likelihood of Exposure: This is a measure of the possibility of a person being exposed to harmful effects from the event under review

Descriptor	**Description**
Very likely	The event is expected to occur in most circumstances The event could happen at any time
Likely	The event could happen at some time
Unlikely	The event could occur but very rarely
Very unlikely	The event may only occur in exceptional circumstances The event could happen but probably never will

1) Assigning a Risk Rating

Having decided the **consequence** and the **likelihood**, the **risk rating** is determined by reading the consequence/impact on the left-hand column of the table against the likelihood across the top of the table.

CONSEQUENCE OR IMPACT *What type of impact do you expect could result from exposure to this hazard?*	**LIKELIHOOD: H***ow likely is it that these circumstances can and will lead to an accident?*			
	Very Likely The event could happen at any time.	**Likely** The event could happen sometime.	**Unlikely** The event could occur but very rarely	**Very Unlikely** The event could happen but probably never will.
Catastrophic • Death • Permanent disability or ill health • Workcover non-disturbance event	**1**	**1**	**2**	**3**
Major • Extensive injuries • Extensive injuries • Prolonged ill health • Prolonged restricted duties • Workcover notifiable event	**1**	**2**	**3**	**4**
Moderate • Medical treatment required • Lost time injury – non reportable • Emergency services response	**2**	**3**	**4**	**5**
Minor • First Aid treatment	**3**	**4**	**5**	6
Insignificant • No injuries	**4**	**5**	6	6

Using this process, all of the hazards associated with the task, job, workgroup or workplace can be assessed and a risk rating assigned to each.

The following table provides a guideline on the actions to be taken.

RISK RATING	INCIDENT INVESTIGATION ACTION
1	Level 1 investigation.
2	Level 1 investigation.
3	Level 2 investigation.
4	Level 2 investigation.
5	Level 3 investigation.
6	Level 3 investigation.

Concluding the example, the fatal fall (catastrophic, unlikely) has a rating of 2 and a level 1 investigation is required,

If the ladder were short (less than 3 metres, the fatal fall would be very unlikely. Reducing the rating to 3 and allowing a level 2 investigation.