Equipment Technical Specification

Installation of conduits using trenchless techniques

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MAINS DESIGN INSTRUCTION

ET 0081

INSTALLATION OF CONDUI TS USING TRENCHLESS TECHNIQUES

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1.0 PURPOSE
To set out the technical requirements for the installation of conduits by trenchless techniques, and to confirm that the works are carried out in a safe and consistent manner.

2.0 SCOPE
This Specification is to be used for the installation of conduits by trenchless techniques on the transmission and distribution networks, where such techniques are either specified by Endeavour Energy or have been requested by a third party and approved by Endeavour Energy for a specific project.

Trenchless techniques include, but are not limited to, micro-tunnelling, horizontal directional drilling, auger boring, guided boring, impact moling, rotary moling, rod pushing, pipe ramming, and thrust boring and jacking.

Tunnelling using road headers or tunnel boring machines falls outside the scope of this document.

Endeavour Energy Standards must take precedence over all other guides and standards for construction projects on the Endeavour Energy network.

Attention is drawn to the Streets Opening Conference Publication Guide to Codes and Practices for Streets Opening, though site or project specific arrangements will also need to be considered.

Any proposed deviation from this Specification must be submitted to the Asset Standards and Design Manager for approval.

This Specification must be read in conjunction with the reference documents listed below.

3.0 REFERENCES

Internal
Group Board Policy 4.0 – Environment
Company Policy 9.9.1 – Network Asset Maintenance
Company Procedure GAM 0089 – Authorisations Governance and Management
Company Procedure GSY 0026 – Health Safety & Environment Risk Management
Company Procedure GSY 0067 – Personal Protective Clothing
Company Procedure GSY 1066 – Worksite Hazard and Risk Assessment
Company Form FSY 0081 – Work Health and Safety Management Plan
Electrical Safety Rules
Environmental Management Standard EMS 0008 – Environmental Incident Response and Management
Environmental Management Standard EMS 0013 – Spoil management
Environmental Management Standard EMS 0014 – Dewatering worksites
Mains Construction Instruction MCI 0006 – Underground distribution construction standards manual
Mains Design Instruction MDI 0028 – Underground distribution network design

External
Electricity Supply Act 1995 (as amended)
Energy Legislation Amendment (Infrastructure Protection) Act 2009
Protection of the Environment Operations Act (POEO Act) 1997
Waste Avoidance and Resource Recovery Act 2001
Protection of the Environment Operations (Waste) Regulation 2014
ENA National Electricity Network Safety Code (Doc 01-2008)
INSTALLATION OF CONDUITS USING TRENCHLESS TECHNIQUES

AS 2053:1984 - Non-metallic conduits and fittings
AS 4058:1992 - Precast concrete pipes (pressure and non-pressure)
AS/NZS 1743:2001 - Road Signs Specifications
AS/NZS 4799:2000 - Installation of underground utility services and pipelines within railway boundaries
AS/NZS 4130 - Polyethylene (PE) pipes for pressure applications
AUS-SPEC 1152 Road openings and restoration (Utilities)
ESC 540: Service Installations Within the Rail Corridor
HB.81 (set) – Field Guides for traffic control at works on roads
ISO 13953:2001 - Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint
Master Access Deed and Safety Interface Agreement for crossing within the Railway Corridor.
RailCorp Engineering Manual EP 20 00 04 02 SP - Underground installation configurations for high voltage and 1500 V dc cables
RailCorp Engineering Specification SPC 207 – Track monitoring requirements for under track excavation
Transport for NSW document T HR EL 10002 ST HV Aerial Lines – Standard Conductors and Current Ratings
WorkCover Excavation work code of practice; July 2015
WorkCover Code of Practice for Work Near Overhead Power Lines 2006

4.0 DEFINITIONS AND ABBREVIATIONS

**Allocation**
Standard set in the Streets Opening Conference from the property alignment in built-up areas, a survey pegged route, lateral position of installation or position of proposed installation as set out in the scope of works.

**Auger boring**
Positioned in a launch or entry pit, the system is fitted with cutting head and helical wound auger flights to remove the spoil back into the entry pit.

**Bore logs**
An accurate written recording of each drill rod’s position, distance, depth, angle and allocation taken as the pilot bore is being completed.

**Bore plan**
Detailed explanation of the proposed bore route, depth and allocation, sealing additives, duct installation, spacing and grouting materials and procedures and any possible deviations from the design drawing.

**Bore profile**
A drawing and calculation of the proposed bore path.

**Casing**
System of lining bores using Hobas steel or concrete pipe sections to provide support to the surrounding soils.

**Cavities**
Any unfilled voids between the ducts or areas of the annuals or substrata.
DBYD
Dial-Before-You-Dig service.

**Distribution cables**
Refers to electrical cables up to, but not including 33Kv.

**Drill slurry**
Material produced during the entire drilling process through the mixing of spoil and drill fluids.

**Drilling additives**
Bentonite or polymers added to water in specified ratios to produce a drilling fluid.

**Drilling fluid**
A mixture of water and drilling additives used to help stabilise the bore hole, suspend the cuttings, and assist in achieving flow to either the entry or exit pit.

**EPA**
NSW Environment Protection Authority.

**Frac-out**
A release of drill slurry at a fracture zone which has occurred on the surface through the building up of pressure in the bole hole.

**Grout**
A mixture of water, cement, sand and additives mixed together to form a suitable grout medium which is pumped into the borehole to fill any voids between the conduit and the outside wall of the bore or to fill in a failed borehole.

**High voltage**
A voltage normally exceeding 1,000 volts alternating (a.c.) or 1,500 volts direct current (d.c.).

**Hold point**
A defined position in the construction stages of the project beyond which work must not proceed without mandatory verification and acceptance by Endeavour Energy’s Project Manager.

**HDD**
Horizontal directional drilling - a guided boring system that is launched from the surface, with the drilling head located and guided using a transmitter and receiver system.

**Isolate or isolated**
Disconnected from all possible sources of electrical energy by opening switches, withdrawing circuit breakers, removing fuses, links, connections and the like and rendering incapable of being made live unintentionally by the application of danger tags (and locks where possible).

**Mandrel**
A device pulled through a conduit to clear blockages and test for a consistent internal diameter.

**SDS**
Safety Data Sheet – product information and instructions on the safe use of any material, (for example, drilling additives).

**Mixing system**
Equipment used for mixing drilling additives with water to produce a drill fluid.
Pilot bore
The initial penetration which will guide the HDD borehole. The drill head is steered to the desired depth and allocation.

Recycled system
Equipment used to recycle drill slurry by separating the solids from the liquid.

Reamer
A cutting tool attached to the drill string to enlarge the borehole.

Roads authority
A person or body that is, by or under the Roads Act 1993, declared to be a roads authority, such as Roads and Maritime Services (RMS) and local councils, and in relation to a particular public road means the roads authority for that road.

Service
Conduits, pipes or conductors within the road reserve for transferring products (such as water, electricity, telecommunications and gas). Conduits or conductors may consist of pipes, ducts or cables with associated accessories, support, protection and location indication devices. Services comprise public utility and commercially provided services, and property services.

SMP
Site safety management plan implemented by the Principal Contractor or the sub-contractor acting in the role of Principal Contractor.

SWMS
Safe Work Method Statement.

Thrust boring/micro tunnelling
A pit launched system that produces a borehole using a cutting head and installs a casing at the same time.

Transmission cables
Refers to electrical cables including 33kV and all voltages greater.

Tremy grouting
A method of grouting that requires an additional conduit or pipe to be installed with the main bank of conduits. Grout is inserted into the ring as the conduit or pipe is removed.

Trenchless technology
The use of an array of different methods to install new, or to rehabilitate or replace existing underground assets by causing minimal to no disruption to all surface activities.

Utility/service provider
Provider of services such as electricity, gas, water and telecommunications.

Vacuum tanker or truck
Used to remove the drill slurry from a pit or containment area and safely transport the contents to an OEH approved waste depot.

WAE
Works as executed clearly details any deviations from the design on a marked-up project design so accurate information is transferred to the Network maps and records.
5.0 ACTIONS

5.1 Trenchless technologies

Endeavour Energy’s preferred method of conduit installation is by open trench excavation, installation and back-filling.

Boring will be nominated only when the impact upon and benefits to Endeavour Energy and the wider community have been considered, including safety, inconvenience, community engagement (at sensitive sites) and cost savings.

The undertaking of a project using trenchless technology can be achieved using various trenchless techniques including, but not limited to horizontal directional drilling, thrust boring or micro tunnelling.

Trenchless technology is noted throughout this document as boring. Other boring methods may also be used if approved by Asset Standards and Design Manager.

The undertaking of these methods may or may not include the requirement of an additional outer sleeve lining or casing to be installed along with the conduit. The type of boring method required will generally be nominated on the project drawing after discussion with boring contractors and/or consultants during the design stage of the project and in the detailed bore plan.

5.1.1 Compliance with codes and standards

The contractor/equipment must comply with the requirements of the relevant Australian Standards and Endeavour Energy’s current Standards.

5.1.2 Certification and authorisation

All works carried out within the Endeavour Energy network will require all horizontal directional drilling operators and their assistants to hold certification.

Certification will comprise the completion and assessment of a combination of the mandatory units of competency and elective units relevant to the tasks to be performed.

The Certificate levels and minimum authorisation requirements for the following occupational classifications are set out below.

<table>
<thead>
<tr>
<th>Occupational classification</th>
<th>Certification required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drillers assistant/offsider, conduit or product installer</td>
<td>Certificate II in Drilling Operations</td>
</tr>
<tr>
<td>Drill operators</td>
<td>Certificate III in Drilling Operations</td>
</tr>
<tr>
<td>Senior drill operators or driller supervisor</td>
<td>Certificate IV in Drilling Operations</td>
</tr>
<tr>
<td>Work crews involved in trenchless activities near underground assets</td>
<td>must be authorised in accordance with Company Procedure GAM 0089.</td>
</tr>
</tbody>
</table>
6.0 ENVIRONMENTAL REQUIREMENTS

6.1 General

All works must be performed in an environmentally satisfactory manner and in accordance with EMS 0001, and the findings/recommendations of the Environmental Impact Assessment for the proposed works.

Precautions must be taken to minimise dust generated by wind, in accordance with accepted dust suppression techniques.

Approved sedimentation control/management methods must be employed to manage any potential sedimentation migration from the work site to protect all drainage systems and adjacent properties. The positioning of these devices must not impede pedestrian/vehicular traffic. Any property, damaged as a result of the carrying out of these works must be restored to its original condition at the completion of the works or to a state that has been agreed to with the property owner, prior to the commencement of works.

Environmental incidents must be managed in accordance with EMS 0008 Environmental Incident Response and Management.

6.2 Boring near existing trees, constructions or assets

The decision as to whether any proposed conduits will be laid at a depth and allocation to avoid existing trees, constructions or assets, or cause disturbance during future road or footpath construction, will be made by the Endeavour Energy Project Manager in consultation the local council, the RMS, or any other relevant agency or authority. It is anticipated that in instances where such consultation may be necessary, it will be undertaken as part of the environmental assessment process and any agreements or mitigation measure reached must be documented within the environmental assessment in accordance with EMS 0001 Environmental impact assessment and environmental management plans.

After consultation with a qualified Arborist it is unavoidable that a tree needs to be removed as part of any works, the Endeavour Energy Project Manager must also consult with the property owner and the local council or any other relevant authority (such as the Heritage Office), document the results of such consultation/negotiation, and set out the mitigation measures within the environmental assessment.

If it has been determined as part of the environmental impact assessment process to remove any tree, it is generally accepted that at least one-for-one replacement ratio apply for removed trees. Costs associated with supplying and planting of replacement trees will be borne by Endeavour Energy.

The contractor is responsible for the inadvertent loss of or damage of any tree as a result of employing inadequate measures to protect the tree or its roots system. Where the works affect trees and/or large tree roots, approval of the Endeavour Energy Project Manager is required before proceeding.

6.3 Spoil handling

All spoil excavated on site must be managed in accordance with EMS 0013 – spoil management.

When the excavated material is to be used for backfilling the trench, it may only be deposited beside the open trench as long as it does not present an environmental hazard or create safety concern to people working in the trench, cause disturbance to public, traffic or access to properties.
Where excavated material is considered unsuitable for backfilling, or is excess to backfilling requirements, disposal of the material must be carried out in accordance with EMS 0007 Water management and EMS 0013 Spoil management, which render that a waste management plan be prepared that particular project.

Where any spoil is identified as potentially contaminated, work must cease until an assessment of the spoil is carried out. Should the spoil prove contaminated, the results of the testing will determine the suitable disposal method for the spoil. Spoil requiring disposal must be done so to an EPA licensed facility.

Excavated material cannot be used as backfill material in paved road or footpath areas.

All spoil stockpiles must be approved by council, the relevant authority or landowner and must be protected by the use of appropriate sedimentation controls/devices to prevent the spoil or silted run-off entering any local drains, waterways or adjacent properties. Such approvals must be sought during the environmental assessment process in accordance with EMS 0001 Environmental impact assessment and environmental management plans.

The spoil mounds must not exceed a height that poses a risk to people in the work area or to the general public.

6.4 Disposal of slurry

Excess drilling slurry is to be contained in the entry and exit pits and will be removed by a vacuum tanker. The vacuum tanker will deliver and dispose of the recycled drill slurry to an EPA licensed waste management disposal facility.

The approximate amount of disposable drill slurry produced during the drilling process must be submitted to Endeavour Energy before the bore is undertaken. This may take into account the use of a recycling unit.

Testing results and disposal receipts must be retained and are required to be shown to an Endeavour Energy Project Manager when requested.

When disposing of drill slurry/liquids, the contractor must comply with the requirements of the:

- Endeavour Energy’s Environmental Management Plan for the project (in accordance with EMS 0001);
- Protection of the Environment Operations Act (POEO Act) 1997;
- Waste Avoidance and Resource Recovery Act 2001; and
- Protection of the Environment Operations (Waste) Regulation 2014

The contractor must also agree to comply with any future changing requirements determined by the NSW EPA in relation to the containment, transport, testing or disposal of drill slurry.

6.5 De-watering and removal of seepage and sludge

Work sites requiring dewatering will be done so in accordance with EMS 0014 Dewatering work sites.

All necessary measures must be taken to keep the excavation free of water, seepage and sludge at all times.

De-watering and removal of seepage and sludge from the site must be carried out with due recognition of potential pollution from any spillage event, the environmental assessment and environmental management plan, and the NSW EPA requirements.
7.0  PREPARATION OF TRENCHLESS CONDUIT INSTALLATION

The following issues are to be considered during preparation:

- Whether the bore is straight or changes of direction are required.
- Number and size of cables and conduits to be installed.
- The installation, encasement and backfilling of cable conduits, including conduit spacers (if applicable), draw lines and flowable thermal materials.
- Service congestion - may determine the techniques suitable for a project, and lead times for negotiations with other utilities, such as rail and gas.
- Geotechnical surveys to assess ground conditions will determine achievable ratings, and, for example, need for lining, grouting, or ability to adjust the bore route.
- Locations of entry and exit pits, joint bays, open points, pedestrian and residential pathways and driveways.

7.1  Access and control

7.1.1  Traffic control

All works must be carried out in a safe manner with the minimal obstruction to vehicular and pedestrian traffic.

The contractor must not obstruct traffic and will be held responsible for the safe traffic management while in control of the site and must provide all watchmen, lights, barriers, signs and fences necessary to prevent any accident, public or private damage/loss and to regulate traffic during the progress of the works.

All personnel undertaking traffic control must have the appropriate Roads and Traffic Authority certification for the work being performed.

An approved traffic control plan must be provided to the Project Manager prior to commencement of works that allows for traffic diversion to an alternative route, approved by the appropriate authority or by the formation of side tracks alongside the work, or, in the case of works within a residential subdivision, town or village, by the excavation work on one-half of the road at a time, leaving the other half available for traffic.

7.1.2  Protection of assets and access

The works must not, by its operations, obstruct any side road or branch track, or break down any fences, utility lines, or obstruct any drain or watercourse.

When such obstructions or breakages cannot be entirely avoided, adequate provision must be made to remove obstructions when they occur, repair breakages, or immediately make alternative arrangements for traffic.

7.1.3  Adjoining lands or property

The works must not involve any act of trespass, and must protect all adjoining properties and property owners against any loss, damage, or injury that may occur through the carrying out of the works, whether to buildings, goods, property of any kind, livestock, or to persons.
7.2 Site inspection and evaluation

The site inspection will assess likely routes for a bore and options for alternative solutions, such as installation in existing or planned bridges over waterways, or use of existing road or services tunnels. The presence of obstacles or hazards, including existing assets, trees, constructions, infrastructure, water crossings and significant changes in ground levels or ground conditions, must be considered and noted.

7.3 Service searches

As a minimum for all projects, preliminary enquiries must be undertaken into the location of services and availability of geotechnical information for the proposed route. If the proposed route involves close approach to high value assets such as high pressure gas mains or major telecommunications links.

A formal risk control plan must be developed and implemented regarding how the drilling process will incorporate the asset owner's requirements to ensure assets are protected from damage.

7.4 Planning and site preparation

7.4.1 Location of services

Prior to the commencement of any excavation or boring works it is compulsory to notify the Dial Before You Dig (DBYD) service (phone 1100, fax 1300 652 077, Internet www.dialbeforeyoudig.com.au), of the time and place of work before the work starts and determine whether there are any underground services that utilities may have at the work site.

Up to date service plans (Dial Before You Dig, local government, utility providers or similar) must be at hand and in use on the site. These plans must be available on site at all times. All existing services must be correctly located and identified before any excavation takes place.

All services within a designated clearance area of the trench or bore path must be pot holed by non-destructive methods and sighted before any excavation or boring can proceed.

Where potholing is not practical (such as under waterways, railways or major roadways), the asset location and depth must be confirmed by the relevant utility and/or asset owner prior to any excavation or boring.

Note: DBYD plans are valid for between 14 and 28 days from the date of issue.

Confirmation must be noted and documented showing the time and dates on which all existing utilities were properly located. This form is to be held by Endeavour Energy's Project Manager.

The undertaking of any works must strictly adhere to all existing utility clearances stated by all relevant asset owners.

All projects must comply with the current specifications and codes within the requirements of the work:

a) Clearances stated by existing service providers for their existing network/s.
c) NSW WorkCover - Work near Underground Assets.
d) Endeavour Energy's procedures when working near electrical and other services, including the requirements of the sections 7.7 and 7.8.
e) Standards and specifications of all other underground asset owners also located within the Endeavour Energy Network area that may be affected by the works.
7.4.2 Potholing, core bores and test pits

The undertaking of non-destructive potholing or test pits must be used to locate other services, obstructions, and to determine the proposed or final cable route. Such undertakings must be carried out and backfilled prior to the excavation work commencing.

If, at the direction of the Endeavour Energy’s Project Manager, the potholing or test pits are to be left open, all necessary precautions to protect pedestrians and traffic until backfilling takes place must be undertaken.

Potholing, core bores or test pits require geotechnical tests be performed to verify existing ground conditions. The test must be by core boring a 50-100mm diameter hole and examining the core to determine the make-up of the ground strata.

The location and spacing between the bores will be determined by the Endeavour Energy Project Designer before the commencement of the works. The core bore, will generally be to a depth of 1-2 metres, but must be a minimum of 30cm below the depth of any proposed directional bore.

7.4.3 Bore plan

The following information must be provided as part of the bore plan:

- A bore profile.
- Planned commencement date of the work.
- Objectives of the work.
- Details of any preliminary potholing or test pits.
- Brief description of the methodology.
- Depth of drilling.
- Number, size and approximate relative position of the planned drill holes.
- The grouting mixture and thermal resistivity of the mixture (refer to clause 7.11.10).
- Method of dealing with unsuccessful bore holes.
- Expected duration of the work.
- Method of removal and disposal of spoil, drill slurry and sludge.
- Name and contact details of the trenchless technology contractor.
- Name and contact details of Endeavour Energy’s Project Manager.

The information provided in the bore plan is over and above any requirements for traffic management plans, and the information provided as part of the notification does not replace any of the requirements of AS1742.3 for traffic management.

7.4.4 Construction site layout

A site specific layout plan must be compiled and included in the bore plan before any work is undertaken. This must be compiled on an overview map of the area or on a site drawing. The site layout will include but not be limited to:

- Emergency evacuation points.
- First aid locations.
- Bore profile showing proposed route including depths under all relevant structures.
- Location of all underground services within the works area and clearances to the proposed bore.
- All entry and exit pit locations, including dimensions and entry and exit angles, and distances to, for example, relevant structures or drains.
• Positioning of all machines and equipment (such as HDD, recycler/mixing, vacuum truck).
• Location of fencing and/or barriers.
• Location and description of environmental measures required.
• String out requirements and location of product installation

7.5 General requirements

7.5.1 Electricity allocation

7.5.1.1 Distribution

All bore holes for electrical cables must be contained within the agreed electricity allocation as detailed in MCI 0006 Underground distribution construction standards manual.

Where it is intended to use the footway allocation of other service utilities (such as gas, water or telecommunications) for the installation of new electrical cables and conduits, the agreement of both the service utilities concerned and the Endeavour Energy Mains Assets Manager must be obtained in writing before the commencement of any such work.

7.5.1.2 Transmission

All bore holes for electrical transmission cables must be located within the allocation as detailed in the approved transmission design drawing.

Transmission cables are typically located within road carriage ways and/or acquired easements. Where other service utilities come within the vicinity of a proposed transmission cable route, (refer to clause 7.4.1 for further details) approval must be obtained from the Asset Standards and Design Manager and the asset owner prior to the commencement of any construction works.

7.5.2 Easements - private and public properties

Any cables or conduits installed by trenchless techniques in easements must comply with the same requirements as any other cable or conduit installed elsewhere by the same techniques. In addition, any underground electrical services installed in easements must be visibly and permanently marked using appropriately labelled marker tiles or other options approved by the Asset Standards and Design Manager.

7.5.3 Roadway underbores

There will be locations where road crossing conduits are installed only by horizontal directional drilling, micro tunnelling or auger boring. Details of the type of bore required will be included on the project drawing.

It is required that a drawing be prepared indicating the position of all underground services and the profile of the proposed bore. This drawing must be made available to the Endeavour Energy Project Manager as part of the bore plan as well as to all crews located onsite. The bore profile must include clearances from utilities, entry and exit angles, allocations and depths proposed. All distribution roadway crossings must be perpendicular to the carriageway, in accordance with MDI 0028 Underground distribution network design, unless specifically approved by the Mains Assets Manager.

All road crossings must conform to and be designed in accordance with all relevant Standards and requirements indicated by the relevant road and traffic authority, asset owners and local authorities.
7.5.4 **Driveway underbores**

Smooth walled HD conduits may be installed under driveways without the need of a steel casing sleeve.

All boring conducted under driveways is to be undertaken at a depth that the contractor and Endeavour Energy’s Project Manager deem to be safe and stable for the area concerned.

The size of the bore hole must be sufficient to allow the installation of the conduits. Appropriate depths must be achieved under driveways and sufficient compaction during restoration to minimise the potential risk of destabilisation (trench collapse or subsidence) occurring.

Appropriate pipe (in accordance with section 7.11) and bore hole void grouting must be utilised when boring under a driveway or similar hard surface using an auger boring method.

7.5.5 **Railway under track crossings**

Railway property crossings require review/endorsement by the Manager Network Connections, prior to the final route selection and will be accepted only as a last resort.

The crossing of railway property must be carried out using a trenchless method, including horizontal directional drilling, auger boring or micro tunnelling. All installed conduit crossings must start and finish outside the rail corridor. The final method chosen must be according to the rail authority’s requirements and specifications. Where an underground extension or augmentation project crosses a railway line, or land owned by the railways, the designer must prepare a separate crossing design drawing and profile.

All projects undertaken within or under a rail corridor must comply with the required Australian and Rail Infrastructure Corporation’s Electrical Engineering Standards, which may include, but not be limited to:

- **AS 4799-2000**: Installation of Underground Utility Services and Pipelines Within Railway Boundaries
- **ESC 540**: Service Installations Within the Rail Corridor
- **EP 20 00 04 02 SP**: Underground Installation Configurations for High Voltage and 1500Vdc Cables
- **SPC 207**: Track Monitoring Requirements for Under-track Excavation

All designs/drawings which form part of a submission must be approved by a certified Civil Engineer.

All installations under rail crossings using trenchless methods are also subject to approval from the appropriate rail authority. This approval process must be undertaken by Endeavour Energy’s Project Manager.

The boring contractor will be required to supply all relevant certified design documentation and bore plans outlined in the scope of works and provide them to the Endeavour Energy Project Manager prior to commencing the project. Such projects must be supervised by a certified Civil Engineer.

Endeavour Energy will make all necessary arrangements with the rail authority for the proposed crossing.
Drawing and documentation noting the following the requirements must be developed for each project:

1. Location of all relative underground services within and outside the rail corridor.
2. Bore profile showing proposed route and allocation including depths under all relevant structure and tracks.
3. Clearances between proposed bore (outer diameter) and existing utilities.
4. Distances from entry and exits pits to relevant structures, tracks and drains.
5. Proposed exit and entry angles at each pit.

The above information must be made available to the Endeavour Energy Project Manager prior to commencing the trenchless project in a format specified by Endeavour Energy.

The contractor must also be responsible for supplying a detailed site-specific methodology to the Endeavour Energy Project Manager prior to commencing the project.

All proposed rail under track crossings must be completed in accordance with the Master Access Deed for Railway Crossings. This deed governs all work undertaken by Endeavour Energy and its subcontractors on or near rail infrastructure.

Details of all proposed rail under track crossing designs and work methodologies must be approved by the relevant rail authority and Endeavour Energy’s Project Manager before commencement of the work, (for distribution projects refer to MDI 0028 Underground distribution network design, clause Underground Network Distribution Design, and RailCorp document EP 10 01 00 05 SP).

7.5.6 Crossings under waterways

When installing conduits under a waterway, the preferred method will be horizontal directional drilling. Details of such projects, including any analysis of options and recommended solutions, must be referred to Asset Standards & Design and/or through Endeavour Energy’s Network Investment Options (NIO) process, for determination on a project by project basis.

For crossings under waterways, the following requirements must be developed and implemented, but not be limited to:

1. An approved environmental management plan following the preparation of environmental assessment in accordance with EMS 0001 environmental impact assessment and environmental management plans capturing approvals required from external agencies.
2. Project supervision and signing by a Civil Engineer.
3. The installation of indicator signage or plates, which identify the entry and exit points of the bore on either side of the waterway where a bore has been installed under a navigable waterway.

Bores under navigable waterway crossings are not subject to the requirements of NSW Maritime’s Crossings of NSW Navigable Waterways: Electricity Industry Code - 2010.

Problems have been encountered with bores under creeks fracing out, which could have significant environmental implications if it were to happen beneath the creek rather than on the approach. Such environmental implications, although avoidable, should be reported as an environmental incident and managed in accordance with EMS 0008 Environmental Incident Response and Management.
Technical advice should be sought during the environmental assessment stage of the project to determine the most suitable route of the bore in order to minimise environmental harm. The design of drilling fluid is significant in minimising the risk of frac out.

7.6  Marking of cable route

The actual cable route must be pegged out, using temporary markers as the pilot hole is opened. The markers must be left in place until the installation has been inspected and approved by Endeavour Energy’s Project Manager.

On completion of the works a detailed survey of the cable route, including depth profile and conduit orientations must be provided to Endeavour Energy as part of the WAE documentation.

7.7  Minimum clearances from existing electrical cables

The following minimum clearances (measured from all directions) must be maintained between new bore holes and existing underground services unless specifically approved by the Endeavour Energy Mains Assets Manager:

- Communication, supervisory and control cables  600mm
- Distribution cables and conduits  600mm
- Transmission cables and conduits  2000mm
- Other utility services  600mm

The precise location of all existing underground services (other than transmission cables and conduits) falling within one (1) metre of a proposed bore hole, and all transmission cables and conduits falling within three (3) metres of a proposed bore hole, must be established by potholing before commencement of the works.

The number of potholes required will be site specific and vary depending on each situation; however, sufficient holes must be excavated along the entire route length to allow identification of exact location of existing services.

Where a bore hole is intended to cross existing underground services, these services must be exposed at the proposed crossing points by hand digging. A two (2) metre long trench must also be dug starting at the crossing point on the approach side of the existing underground services. The purpose of this trench is to expose the auger or drill head before it gets too close to the existing services. Progress of the auger must be monitored as it approaches existing services to confirm that minimum clearance requirements are achieved.

Where minimum clearances cannot be maintained, the Endeavour Energy Project Manager must be advised and approval for alternative arrangements obtained from the relevant Transmission/Distribution Manager before work can proceed. This constitutes a hold point.

For further information on working near high voltage cables, see Endeavour Energy’s Electrical Safety Rules, section 8.6.

7.8  Isolation of electrical cables

Where it is proposed to undertake works involving trenchless techniques within one (1) metre of existing distribution cables, or within three (3) metres of existing transmission cables (measured from any direction), the cables must be de-energised, isolated and earthed before commencement of the intended works.
7.9 **Bore hole requirements**

7.9.1 *Machine requirements*

A suitable horizontal directional drilling machine must be used that has the capacity to efficiently undertake the designated bore, along with the correct tooling and appropriate mixing system for the ground conditions identified in the bore plan as likely to be encountered.

A bore path profile must be selected to avoid *frac-out* or discharge of drilling fluids along the bore path outside of any pits. Any changes in bore direction must be noted as amendments on the bore plan and be sufficiently gradual to allow easy insertion of the conduit.

All entry and exit angles must be at a minimum to reduce any undue stresses being placed on the drill rods and conduit and to minimise the bending radius in the transition from underbore conduit to open trench conduits.

The drilling system must incorporate a survey system that will allow tracking of the drill head for the entire bore path. The system used, must be capable of measuring lateral position, depth and gradient of the bore path. An appropriate mixing system or recycling system must be used to mix correct drilling additives with water. A vacuum truck must be on site or within the project area at all times during drilling to collect the drill slurry and in case of any potential environmental problems.

All machinery and equipment used on site must be maintained to confirm minimal noise or vibration is produced, minimise the likelihood of oil/fuel/fluid leaks, and that all safety and operational equipment is in working order to minimise the effect on the local community, environment and work schedule. All machinery and equipment used over the construction period of the project must have up to date service history available upon request.

7.9.2 *Depth of cover*

The required depth of the bore must be in accordance with the Endeavour Energy design drawing and must be calculated from the outside of the final borehole diameter. The depth of cover may vary due to various factors including but not limited to existing underground services, large drainage pipes and similar structures, geological conditions, entry and exit angles and surface features.

The maximum depth of cover required is designed to limit the extent of cable de-rating.

The required depth of the bore must be in accordance with the Endeavour Energy design drawing and must be calculated from the outside of the final borehole diameter.

All bores must be undertaken at a safe and appropriate depth as specified in the design drawing.

If it is deemed that the borehole depth is inappropriate, unsafe or impractical, the approved Endeavour Energy Project Manager must be notified immediately and before boring commences.

At no time must the contractor construct the bore at an alternative depth unless written approval has been given by Asset Standards and Design Manager.

7.9.3 *Bore length*

The required bore length must be in accordance with the Endeavour Energy design drawing. If it is deemed that the bore length is inappropriate, unsafe or impractical, the approved Endeavour Energy Project Manager must be notified immediately, and before boring commences.
Inappropriate, unsafe or impractical bore length may be due to, but not limited to, required entry and exit locations, existing underground services, large drainage pipes and similar structures, geological conditions, entry and exit angles, and surface features. Any agreed changes to the project design must be noted as amendments on the bore plan.

7.9.4 Monitoring

During the pilot, reaming and installation process, constant observation of the bore path must be undertaken. This must include monitoring of any surface disturbances, constant flow of drill slurry into either the entry or exit pit and any introduction of drill slurry in drains or water ways through frac-outs and other below ground destabilisation.

If, at any time during the drilling process, a loss of drilling fluid occurs, the drilling process must be stopped immediately and the cause of the loss investigated. Drilling can only recommence when the cause has been identified and a procedure put in place to prevent it reoccurring.

Where required, the drilling process must be monitored through an excavation pit or pothole as either the drill head, reamer conduit or final conduit passes an existing service, to minimise the risk of damaging the service.

7.9.5 Bore logs

During the pilot boring process, a bore log must be maintained, noting the location of the bore path. Bore information must be recorded at a minimum distance of each drill rod. The information must contain start and finish date, machine(s) used, crew, supervisor, product installed, location of bore, total bore length, ground type encountered with all changes to the ground type noted as well as depth, pitch and allocation of the drill bit.

7.9.6 Unsuccessful or unused bore holes

Unused holes such as trial holes and unsuccessful bore holes must be filled with a sand/cement mix or approved slurry to eliminate the risk of subsidence and roadway paving failures.

7.9.7 Multiple conduits in a single bore hole

Where multiple conduits are to be installed in a single bore, how they are to be supported or positioned will depend on the diameter and length of the bore and the number of conduits.

The orientation of the conduits must be same all along the installation. Any twist in the orientation must be limited to 22.5º clockwise or anticlockwise (from a point at top centre of the bore). The conduits must not cross over each other at any point along the route length.

It will be necessary for the bore contractor and the project designer to work together to determine the bore design and cable selection to best meet the requirements of the project (including cable rating).

7.9.8 Multiple bore hole separation

Where it is necessary to bore more than one (1) hole along a cable route, a minimum separation of 500mm must be maintained between different bore holes. Every hole must be regarded as a new hole and independent of any other adjacent holes for the purpose of compliance with the requirements of this Specification. The minimum separation distance between transmission feeders must be determined by a ratings calculation and given in detail in the project design.
7.9.9 Drilling additives

During the entire boring and conduit installation process, Bentonite and/or suitable drill additives must be used to help stabilise the borehole, minimise any potential frac-outs, help in lubrication during conduit installation and aid in the flow of drill slurry. Additives must not be hazardous to humans, the environment and fauna. No carcinogenic or toxic material is to be used.

Data Safety Sheets and test reports - completed by the CSIRO or an equivalent testing facility (as deemed by Endeavour Energy) - on the drilling additives must be provided to and approved by the Hazardous Materials Manager before any work commences, to demonstrate compliance with this requirement. Biodegradable additives are preferred.

All drill slurry flushed from the borehole to the surface must be safely collected using appropriate methods, irrespective of the drilling system adopted and removed from site by the contractor.

7.10 Excavation and boring

7.10.1 General requirements

Unless specifically directed otherwise by Endeavour Energy’s Project Manager, excavations and trenches must be excavated and/or conduits installed in accordance with the project drawing and this Specification.

Deviations from this Specification may only be permitted with the approval of the Mains Assets Manager via a dispensation request prior to commencement of works.

7.10.2 Excavation requirements

Excavation and boring must be carried out strictly in accordance with the route indicated by the project drawing and/or the Endeavour Energy Project Manager, as surveyed, and all Endeavour Energy procedures.

7.10.3 Entry and exit access pits

Every trenchless undertaking will include a minimum of an entry and exit pit, which will be site specific. The size and depth of the pits will vary from site to site and must be constructed safely and in accordance with WorkCover Excavation work code of practice; July 2015 and all other relevant Australian standards.

The number and sizes of the pits and their locations must be in accordance with the project drawings. The entry and exit pits must be constructed to allow safe entry and exit of personnel and suit the required trenchless setup distance, allocation and approach angle, plus allowing sufficient room to safely and correctly install the conduit.

The pits will be sufficient in size to confirm correct finish depth of the conduits is achieved, as well as containing the drill slurry to confirm no contamination occurs to drains, waterways and gutters. The size of the pits to be excavated will be included in the site layout, showing depth, width, length and shoring requirements.

Where entry and exit access pits are to be excavated near footpaths, road crossings and vehicular driveways, the work must be carried out in such a manner that minimises interference to the public and traffic. In some areas, it will be necessary to restrict work to periods of low traffic volume, such as at night or at weekends.
7.10.4 **Open points**

*End capped or sealed* open points must be in accordance with the project design drawing and must be left in conduit lines as required. Open point *pits* are to be left clean and clear, de-watered and shored if required, with conduits level and accessible. The holes must be covered with *secure and sturdy* walk boards and securely fenced. Barricading or mesh is not acceptable.

7.10.5 **Shoring**

All pits must be shored where necessary for the safety and security of workers, the worksite, adjacent buildings and pavement, and must meet WorkCover and all relevant legislative requirements.

7.10.6 **Bulkheads or stop ends**

Bulkheads or stop ends are required at all open points, or at the end of a conduit line, or on steep inclines where collapse or scouring of the conduit backfill or bedding material may occur. Bulkheads must consist of bags made from a non-decaying material such as polypropylene or an equivalent filled with sand. They must be located at regular intervals or where directed by the Endeavour Energy Project Manager.

Each end of the main borehole must be sealed watertight prior to grouting. The stop-end must be constructed using a combination of timber plywood and fast setting mortar. The fast setting mortar must be placed to a depth of no less than 100mm thick or otherwise sufficient to resist the depth of grout pouring. The timber plywood must then be cut to shape to tightly fit the conduit configuration and secured using timber supports.

7.10.7 **Temporary crossings**

*Secure and sturdy* temporary crossings must be provided across excavations to give pedestrian and/or vehicular access to all properties affected by the works as stated in project drawings, or other locations as directed by the Endeavour Energy Project Manager.

All bridging provided is required to be treated with a non-skid material on the surface, to maintain the safety of both pedestrians and vehicles. The contractor is bound by the requirements of the RMS and local authorities. All bridging must be certified by an accredited engineer regarding acceptable loads they can carry.

7.10.8 **Site security**

All holes require temporary fencing for protection. The worksite and exposed assets must be protected for the period of construction and up to three (3) months after the drilling and conduit installation, until the official handover to Endeavour Energy Project Manager.

Temporary signs, warning notices, lights, fencing, barriers, pedestrian and vehicular crossings and the necessary patrolling of these temporary installations to confirm that they are maintained in good order must be deemed to be included in the contract of works.

If the official handover has not been completed after three (3) months, Endeavour Energy may have the option of taking over the hire of the fencing or have the contractor backfill the holes until they are ready for continuation of works.

All signs, lights, warning notices, barriers and the like must comply with the requirements of Australian Standards AS1742, 1743 and HB.81, as amended.
7.10.9 Breaking of surfaces

Within reserves, parks, grassed areas, on paved areas or footpaths, all care must be taken to prevent machines diverging from the excavation line and causing damage to adjacent ground surfaces. Endeavour Energy encourages the implementation of ground protection material such as wooden ply sheets or planks to be used to minimise damage to grass or other areas when moving machines.

Where the route passes through paved areas, lawn, gardens and well-kept grassed areas, excavated material must not be placed alongside the trench, but must be placed into a tipper or similar vehicle and stored offsite.

7.11 Cable conduit installation

All conduits, pipes, fittings and joints used, must comply to;

- ISO 13953:2001 - Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint.
- AS 2053:1984 - Non-metallic conduits and fittings.
- AS/NZS 4799:2009 - Installation of underground utility services and pipelines within railway boundaries.
- AS/NZS 4130 - Polyethylene (PE) pipes for pressure applications.

Cable conduits must be installed as shown in the design drawings.

The 140mm and 180mm HDPE pipe used in directional bores must be supplied by the contractor and must be PN 10 in 12m lengths or 100m coils or, in the case of a river crossing, is suitable to the underbore being undertaken. The HDPE pipe outside diameters must be de-beaded after being joined by butt fusion welding.

The installation of any conduits must not have any impact on future hauling of cables or connection to existing conduits or joining of cables. This must include acceptable entry and exit angles when installed using horizontal directional drilling to confirm a smooth transition to existing or additional works.

All conduits must be positioned at the required finished depth specified by the design drawings. If, for other reasons, the finished depth cannot be achieved, the Endeavour Energy Project Manager must be contacted to discuss any issues and possible solutions.

Also refer to 7.9.9 for additives used to lubricate conduits during installation.

7.11.1 Conduit handling and safety

The contractor must confirm that correct safe handling of conduits is always observed, including during transportation of materials, unloading, storing, welding, stringing out and installation into the borehole. Correct PPE must always be worn when working around conduits. Important areas of concern include cutting of bindings around coils, stringing out the conduit along residential areas and roads as well as installation into borehole.
Additional care is to be observed if conduits become stuck within the borehole. If removal of these conduits is to be undertaken, a SWMS and risk assessment are to be completed before any attempt at removal commences. The Endeavour Energy Project Manager is to be contacted if this procedure is being undertaken.

7.11.2 Conduit twisting

The use of suitable swivels, techniques or spacers must be used to limit the amount of conduit twisting to the acceptable level as stated in clause 7.9.7.

7.11.3 Conduit spacers

Spacing of conduits is not required unless specifically specified in the project design and approved by Endeavour Energy’s Mains Assets Manager.

7.11.4 Jetline

A draw line, Jetline, with a 163kg breaking strain or similar, must be installed in each conduit and secured outside the end cap at each end for use by Endeavour Energy.

7.11.5 Bell-mouths

All conduit ends in open points must be smooth, cleanly cut with the sharp edge removed, and bell-mouths installed.

7.11.6 Conduit caps

The end of the conduits must be plugged with tightly sealed plastic plugs or caps supplied by the contractor to prevent the entry of dirt, sand and other foreign matter.

7.11.7 Conduit welding

Conduit welding must be carried out by an accredited person(s). All internal welds must be de-beaded in a manner that does not weaken the pipe strength whilst ensuring a structurally strong and watertight weld.

Endeavour Energy reserves the right to test individual fusion welds joining two (2) polyethylene pipes together. These portions of conduits must be removed from site and taken to a certified testing facility to conduct tests under controlled conditions.

These tests will be undertaken to confirm the fusion welds are within the requirements of ISO 13953:2001: the results must be stored in the project file. Any defective welds must be replaced by the contractor at their expense.

7.11.8 Joining pressure bore pipe to existing LD or HD conduits

If a project involves joining of newly installed pressure bore pipe to existing LD or HD conduits, there must be a smooth transition in the internal diameter between the pressure pipe, coupling and conduit. Because of the difference between the wall thicknesses, the internal diameter of the bore pipe needs to be chamfered for at least 50mm from the end and into the pipe to eliminate the step between products.
All joins must be glued by wiping a suitable primer around the pipe/conduit and into the coupling. Allow the primer to dry before spreading an even layer of solvent cement onto the same surfaces. Align the coupling and pipe/conduit before pushing together. Hold the coupling and pipe/conduit together until the cement takes effect.

7.11.9 The integrity of the conduits

Conduits must be thoroughly cleaned after installation and backfilling to confirm they are clear of all debris, foreign matter and water. The integrity of the conduits must also be proved by a mandrel, camera and or other appropriate Endeavour Energy approved method.

The mandrel must be pulled through every conduit in both directions, prior to grouting, to prove continuity by the contractor in presence of the Endeavour Energy Project Manager. If the mandrel does not cleanly pull through the entire length, any affected locations/sections must be excavated and repaired or replaced. The integrity of the entire conduit length must be proved before acceptance.

The mandrel must have a diameter no less than 12mm less than the inside diameter of the conduits, and 500mm in length. Duct tape and rags are not acceptable.

7.11.10 Grouting of voids

Grout between the conduits within the bore hole is essential to keep conduits in position, provide a medium where heat generated by the cables is effectively transferred to the walls of the bore and to provide additional support to the surrounding ground. The grout mixture selection or design will require input from both the drilling contractor and the circuit designer to achieve an optimum design.

The nominated area requires the use of a low thermal resistivity, pumpable grout mixture (comprising sand, cement and suitable additives). The grout mixture must be suitable for backfilling around conduits carrying high voltage electrical cables and must therefore have the following properties:

- low exothermic temperature generation during curing;
- a thermal resistivity (TR) value of less than 1.2ºm/W;
- a maximum time through a standard flow cone test of 40 seconds; and,
- a maximum heat of hydration of 35ºC when tested in an insulated 300mm x 300mm cube.

Each end of the main bank of conduits must be sealed watertight with a suitable design stop end, prior to grouting. Grouting of bore holes is to be achieved by a method that sufficiently fills the voids through slow and steady injection under pressure, without causing deformation of the installed conduits.

Long HDD bores may require an additional small conduit or pipe to be installed within the conduit bundle to allow for grouting of the bore (the Tremy method). The contractor must submit the proposed grouting mixture and procedure as part of the bore plan, for approval, prior to any boring being undertaken. All grouting installation pressures and curing temperatures must not exceed the conduit or pipe suppliers recommended specifications as this may damage the installed product.

At the completion of the installation of the conduits, there must be no cavities between both the bore hole and the conduits or between the conduits themselves.
7.11.11 Filling of internal voids within conduits

As required by the rating calculations and design drawings, transmission conduits may be required to be filled with an approved thermally stabilised backfill after the installation of cables. The thermal backfill within in the conduits must be continuous in all sections it is required and must be injected in a way that eliminates the existence of any air voids.

8.0 BACKFILLING AND SITE RESTORATION

8.1 Backfilling

The backfilling of excavations, excluding designated open points, must be carried out as soon as possible after the installation of conduits is complete. Backfilling of any entry and exit holes is to conform to the requirements of the:

- AUS-SPEC 1152 Road openings and restoration (Utilities);
- RMS;
- EMS 0013 – Spoil Management;
- Local Council or;
- As shown on the project drawing for site specific requirements.

All timber and rubbish must be removed from the excavation before backfilling is commenced. Backfilling must not commence until the approval has been obtained from the Endeavour Energy Project Manager.

Where existing material is used as backfill in parks and/or non-paved easements, the material must be fine enough to pass through a 75mm sieve. All excavations must be well compacted with a hand held “Wacker Compactor” or plate vibrator.

Compaction must achieve as a minimum 98% compaction rate in layers of excavated material or clean fill not greater than 150mm at a time. When imported material such as road base or 14:1 sand/cement mix or fine crushed rock is used for backfilling, the material must also achieve a compaction rate of 98%. A general indication that the correct compaction has been achieved is that the heel of a boot will not indent into the compacted material.

Where a local council or the RMS stipulate special backfill requirements and/or compaction tests, the Endeavour Energy Project Manager will supply the information to the contractor prior to the work commencing.

During construction, the following conditions must be met:

- No damage is caused to other services during the backfilling process.
- Polymeric cable cover is installed across the full width of the trench 300mm above the conduit level in all open points.
- The site must be made available for any compaction tests as requested by the RMS, local council or other regulatory bodies.

8.2 Restoration

8.2.1 Grassed areas

When carrying out work in grassed areas, the restoration of the area must be carried in such a way that the finished surface is left in an as found condition. This may be achieved by the reusing existing turf, laying of new turf that matches the existing turf, or re-seeding as directed.
The contractor must be responsible in parks and grassed areas for the maintenance and watering of the turf after it has been replaced. The surface must be levelled and top dressed with good soil, so that it is restored to its original condition.

In wet locations, the Endeavour Energy Project Manager may ask that road base or similar material is placed on top of the excavation and compacted to a finished thickness of 25mm to allow access.

### 8.2.2 Concrete or bitumen surfaces

In sealed roadways, footways and other paved areas, a hot mix bituminous mixture is to be used for temporarily sealing the excavation surface unless specifically directed otherwise by the Endeavour Energy Project Manager. This is accomplished by using a bituminous substance compacted to a finished thickness of 25mm in footways and 100mm in RMS roadways.

The surface of the excavation is to be left smooth and level with the surrounding pavement.

### 8.2.3 Paved areas

In brick or tiled paved areas, the existing pavers are not to be reinstated by the Contractor. When pavers are lifted they are to be stacked on timber pallets and returned to the works depot of the local council or RMS, unless otherwise indicated by the Endeavour Energy Project Manager. The excavated areas will be topped with 50mm of compacted road-base. The surface is to be left level with the surrounding pavers.

### 8.3 Works completed

It is the responsibility of the Project Manager to organise the recording of the locations for all cable and conduit work throughout the project. The information must be recorded on the Works as Executed drawing supplied by the contractor at the completion of the project.

At completion of the works, the contractor must supply an as-built plan to Endeavour Energy showing all relevant information relating to the construction of the project. This may also include photographic/multimedia evidence. The works completed must be in accordance with this Standard and Endeavour Energy's requirements.

A testing procedure may be instigated at random to confirm satisfactory conduit installation within the correct alignment and at the agreed depth, as set out in the project design.

### 8.4 Compliance to design drawing and standards

A testing procedure may be instigated at random to confirm satisfactory conduit installation and complete grouting of the borehole has occurred, with the aim of removing all voids within the bore. This maybe a series of trial holes dug, (using a non-destructive method to minimise any additional disturbance to the area) over the newly installed product to confirm that the bore is free from voids.
9.0 AUTHORITY AND RESPONSIBILITIES

The General Manager Asset Management has the authority and the responsibility for:

- approving technical specifications including any variations;
- making all decisions concerning compliance in respect to this Specification;
- nominating Endeavour Energy's representative(s) for either the manufacturing facility inspection and/or witness testing; and
- delegating any of these authorities and responsibilities to the Manager Asset Standards and Design

Manager Asset Standards and Design is responsible for the content of this standard and must have the authority and responsibility for:

- reviewing technical specifications and making recommendations to the General Manager Asset Management; and
- making recommendations concerning compliance in respect to this Specification.

Mains Assets Manager has the authority and responsibility for the acceptance and approval of all test reports submitted, as specified within this document and making recommendations to the Manager Asset Standards and Design.

Manager Supply and Logistics is responsible that all conduits and fittings purchased by Endeavour Energy comply with the requirements of this instruction.

Contractor Operations Manager, Network Connections Branch, is responsible for confirming that all conduits and fittings installed by Level 1 Accredited Service Providers comply with the requirements of this instruction.

Regional Managers is responsible that all conduits and fittings installed by regional Asset Management staff comply with the requirements of this instruction.

10.0 DOCUMENT CONTROL

Documentation content coordinator: Mains Assets Manager

Documentation process coordinator: Branch Process Coordinator