Technical Guide

NETWORK	Document No	:	NW000-T0005
	Amendment No	:	3
	Approved By	:	Manager – Data Maintenance
	Approval Date	:	31/10/2023
	Review Date	:	31/10/2025
	Access	:	Internal + External

Minor amendments approved – 31/10/2023

NW000-T0005 FIELD RECORDING GUIDE

ISSUE

For issue to all company, contractors and Accredited Service Providers' employees involved with the recording of field assets, and is for reference by field, technical and engineering employees.

The company maintains a copy of this and other technical documents together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document

DISCLAIMER

As the company's Technical Guides are subject to ongoing review, the information contained in this document may be amended by the company at any time.

It is possible that conflict may exist between technical guidelines and other documents. In this event, the most recent document shall prevail.

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

The company disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Technical Guide.

INTERPRETATION

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

AMENDMENTS TO THIS TECHNICAL GUIDE

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

Technical Guide
T0005
Field Recording Guide

Contents

1.0 PURPOSE

To describe the processes that should be followed when recording information about the company's network assets and third-party fibre assets interacting with company assets, such that the information gathered and presented meets the requirements set out in NS100 Field Recording of Network Assets.

2.0 SCOPE

This guideline applies to all employees, contractors, and Accredited Service Providers (ASPs) who produce field recordings of network assets and third-party fibre assets interacting with company assets for the company's asset information systems. Asset information should be recorded whenever an asset is installed, changed, or removed.

Clauses and subclauses that apply only to employees are marked "(Internal Process)."

Clauses and subclauses that only apply when field recordings are produced and submitted by contractors or ASPs are marked "(External Process)."

3.0 REFERENCES

3.1 General

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

3.2 Company documents

- Company Form (Governance) - Network Technical Document Endorsement and Approvals
- Company Form (Network) – Certification Of As-builts
- Company Procedure (Governance) - Network Technical Document Endorsement and Approvals
- Company Procedure (Network) - Field Recording of Network Assets
- Company Procedure (Network) - Production / review of Engineering Technical Documents within BMS
- Division Workplace Instruction (Network) – Production/review of Technical Guides
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- ES4 Service Provider Authorisation
- NS100 Field Recording of Network Assets
- NS104 Specification for Electrical Network Project Design Plans
- NS130 Specification for Laying of Underground Cables Up to and including 11kV
- NS156 Working Near or Around Underground Cables
- NS161 Specification for Testing of Underground Cables
- NS168 Specification for the Design and Construction of 33kV, 66kV and 132kV Underground Cables
- NS172 Design Requirements for Cable Jointing Pits and Vaults
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS203 Telecommunications Network: Master Policy Document
- NS204 Communication Pits – Specification & Installation Guidelines
- NS205 Telecommunications Route Markers
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS234 Telecommunications Underground Physical Plant Installation
- NS241 Working Near or Around Ausgrid Telecommunication Cables
- NS242 Recording of Telecommunications Physical Network Assets
- NS261 Requirement for Design Compliance Framework for Network Standards

3.3 Other standards and documents

- AS1742.3 Manual of uniform traffic control devices: Traffic control for works on roads
- AS/NZS 2053.2 Conduits and fittings for electrical installations: Rigid plain conduits and fittings of insulating material
- AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
- AS 4799 Installation of underground utility services and pipelines within railway boundaries
- AS 5488-2013 Subsurface Utilities Information
- ENA Doc 001-2008 National Electricity Network Safety Code
- Master Access Deed for Railway Crossings 2002
- Streets Opening Conference publication Guide to Codes and Practices for Streets Opening, 2009
- WorkCover Guide, Work Near Underground Assets, 2007
- WorkCover Code of Practice, Work Near Overhead Power Lines, 2006
- WorkCover Code of Practice, Tunnels Under Construction, 2006

3.4 Acts and regulations

- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014
- National Energy Customer Framework (NECF) 2013
- Work Health and Safety Act 2011 and Regulation 2017

4.0 DEFINITIONS

Accredited Service Provider (ASP)	An individual or entity accredited by the NSW Department of Planning and Environment, Energy, Water and Portfolio Strategy Division, in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).
ASP Compliance & Practices Compliance Officer (ASP CO)	A company officer, who carries out specific functions, to monitor compliance by ASPs with the company's contestable works specifications, standards and safety requirements
As-Built	Drawing made during construction to record the actual size, location and nature of assets. See also "Field Recording"
Certification of As-builts (COA)	A certificate required for external field recording of network assets to verify compliance with the field recording requirements as detailed in NS100 – Field Recording of Network Assets. A COA must be validated by DM RTL / SDC prior to submission. Prior to validation by DM RTL / SDC, the COA is referred to as a COA Request. The COA form has two sections, the Preliminary COA and Final COA. The required section for a given submission is dependent on the rules defined in this document. From 6/11/2023, the COA form will no longer be used for Contestable works but will remain in use for field recording of Major Projects and UCLW works.
Conduit	Duct and conduit are interchangeable terms to describe a tube or pipe through which electrical or communications cables may be installed.
Contestable Work	Contestable Work is work such as the design, construction and installation of electricity works, which are required to connect a customer's installation to an electricity network. Customers are required to fund the cost of contestable work and they have the choice of selecting the ASP to carry out the work. The legislation relevant to contestable work is the NSW Electricity Supply (General) Regulation (2001).
Data Capture (DC)	The process of entering geospatial asset information into the company's GIS.

Data Maintenance (DM)	The company group which forms part of the Asset Management branch which is responsible for the management of spatial and technical asset information.
Duct	Duct and conduit are interchangeable terms to describe a tube through which electrical or communications cables may be installed.
Field Recording	Refers both to the process of measuring and documenting as-built network information (FRNA) and the drawings produced to document that information (As-built)
Field Recording of Network Assets (FRNA)	The process of measuring and documenting as-built network information.
Final Certification of As-builts (FCOA)	The Final Certification of As-builts (FCOA) section of the COA form is used to document and confirm that all required as-built information for the project/stage has been received and complies with company standards. An FCOA is required for Underground Cable Laying Works (UCLW) and Major Projects Final Payment Claim.
GIS	Geographical Information System (GIS) is the database of records for spatial and connectivity data related to the company's network.
Global Positioning System (GPS)	A system incorporating a network of orbital satellites to calculate the position of a receiving unit near Earth's surface.
Hazard Assessment Check (HAC)	A risk management tool to be used in conjunction with a Safe Work Method Statement to identify hazards, asses and control risks associated with circumstances or conditions arising from the nature of the location.
NECF	The National Energy Customer Framework is an initiative to introduce a consistent national framework for providing electricity and gas services to retail customers.
Notification of Service Work (NOSW)	The form used by Level 2 ASPs to inform the company whenever contestable work is carried out.
Person in Charge	The term used in this procedure as a catch-all term to encompass all organisation employees responsible for managing maintenance and construction projects. This involves a wide variety of works including (but not limited to) emergency fault repair, planned fault repair and jointing works for cable construction projects. Positions covered by this term include (but are not limited to) ASP Compliance Officer, Field Supervisor, Project Officer, Project Delivery Officer, and Project Manager.
Preliminary Certification of As-builts (PCOA)	The Preliminary Certification of As-builts (PCOA) section of the COA form is used to acknowledge formal acceptance of all as-builts submissions prior to the completion of a project or stage.
Quality Assurance (QA)	The process or task of reviewing and checking issued work against standards for completeness and accuracy.
Region Team Leader (RTL)	The company officer in DM responsible for the effective management and coordination of data flows into the GIS in order to achieve on time processing (OTP), data quality and productivity targets.

System Alteration Order (SAO)	System Alteration Orders (SAOs) may be included as part of a NAR (Network Access Request), formerly known as 'cut outs' and processed by Network Outage Coordinators (NOCs). This document provides mandatory information required for carrying out work and amending the system diagram. Details should include identification of the mains and apparatus connected, any related access permits or equipping permits, provide a brief description of work to be completed, provide a diagram of the system alteration, identify all parties contacted in relation to the work and include reference to the disconnect and reconnect order the SAO is cancelling if it is on a different date.
Source Data Coordinator (SDC)	A company officer in Data Maintenance who obtains, receives, collates and assesses all source documentation and data for the GIS. Monitors and pursues all source information as required in the data tracking systems. Coordinates field recording of network assets and DC activities and performs field validation as and when required.
SAP	The Asset Management System (SAP) is the system which manages the financial and technical asset information for the company's assets.
Underground Cable Laying Works (UCLW)	The company section that engages a contractor via a contract to carry out excavation, conduit and cable installation as per a scope of works.
Major Projects	Typically design and construct projects put out for tender by the company for 132kV, 66kV or 33 kV for cable laying.

5.0 GENERAL PRINCIPLES

5.1 Quality

5.1.1 General

The quality of a Field Recording document refers to its useability, which is defined in terms of completeness, legibility, and how it will be interpreted.

5.1.2 Completeness

5.1.2.1 General

Any field recording must contain all information relevant to the job. Missing information can cause costs in rework, may delay capture, lead to incorrect data being captured, or information being lost entirely. Details of the following elements must be included where they are applicable. See Annexure C for examples.

5.1.2.2 Location related data

- Municipality
- Suburb
- Street
- Nearest cross street
- North point
- Company Mapsheet number (1:250)

5.1.2.3 Job data

- Job Description
  - Description of works carried out
  - Can be useful to explain why (eg to commission new sub, repair a fault, etc)
- Date completed
- Gang
  - Company field supervisor's name (for duct and cable laying) or
  - Contracting/ASP crew
- Voltage of any cables / apparatus
- Cable codes and descriptions for all cables
  - (eg 314 - 11kV 300 CU3PHLYQ)
  - May be included in the drawing area, especially to allow more room for job description, or where multiple cables are used
- Joint description (including Pot Ends)
  - Voltage, type, cable codes, PL/COV, jointer's name
  - For removed joints – old FBK number and joint number
  - Joint description to be shown in the drawing area
- Feeder/Distributor – full number including substation
  - eg S1020 – 3
  - eg ZN 384 Camperdown PA31

5.1.2.4 Administrative data

- Field recording number
- Name of person completing the field recording
- PrjTrak Number (project number)
- SAP Number (project number)
- System Alteration Order (SAO) reference number (if applicable)

5.1.2.5 Diagram

- Diagram of all newly constructed assets (eg ducts, cables, joints)
- Relevant existing assets (must be noted as existing)
- Baseline (eg, property line)
- Nature of baseline eg PL (paling fence)

- Measurements relative to baseline (chainage and offset)
- Depth of cover (COV) (for cables or buried objects)
- Street names
- Lot divisions with house numbers
- Relevant assets, including asset number
  - eg Substations, poles, pits, and pillars
- Any other electrical asset with an identifiable asset number.
- Where the entire length of a cable is not shown, it is recommended to include an annotation to indicate the destination
  - eg “TO ZN 4990 PA51B”
  - eg “TO UGOH ON POLE SY-15465”

5.1.3 Legibility

5.1.3.1 General

It is important that the information on the field recording be clear and presented in such a way that it is easily understood. Key factors include clear and consistent text, appropriately sized diagrams and correct alignment of all information. Other factors include the general aesthetic and balance of the field recording.

5.1.3.2 Text

- All text must be clearly printed in English.
- Text Style
  - A chosen text style should be used consistently. Text must be printed in upper case.
  - All text must be neat and clear enough to be easily read and understood.
- Text Orientation
  - Text must be aligned in accordance with the Text Alignment Guide below. Where North is not aligned directly up the page, the Text Alignment Guide should align to the north point.

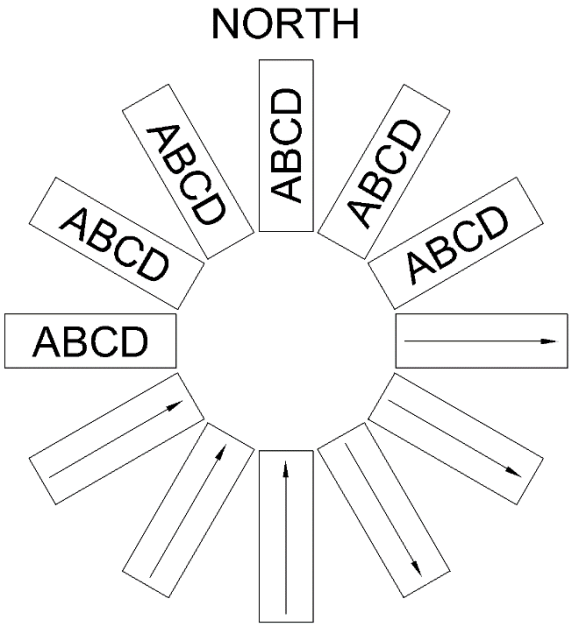


Figure 1 Text Alignment Guide

  - Text for a particular annotation (such a series of dimensions) should always be aligned in one consistent direction. Text should not follow corners or be written around the boundaries of shapes.

- Text Size
  - Text should generally be of a consistent size across 3 basic types. Major annotations such as street names should be of a slightly larger size. Subscript notations such as duct numbering should be of a slightly smaller size. All other general annotations should be a consistent standard size. Care should be taken that subscript annotations are still large enough to be easily legible after documents are copied, scanned, or faxed.

5.1.3.3 Clarity

All text and diagrams must be of sufficient line weight to be clear and visible. A line weight that is too soft or light can result in loss of image quality, especially in regards to copying, scanning and faxing.

Text and drawing elements should be spaced appropriately so as not to seem cluttered together, and all drawings should be of a size that each element is clear and distinct.

5.1.3.4 Expanded detail

Where the diagram line work is dense, it is acceptable to use an expanded detail diagram to identify particular features.

When producing an expanded detail window using AutoCAD, fine details (eg dimensions, cable codes etc) should not be displayed in the overview diagram.

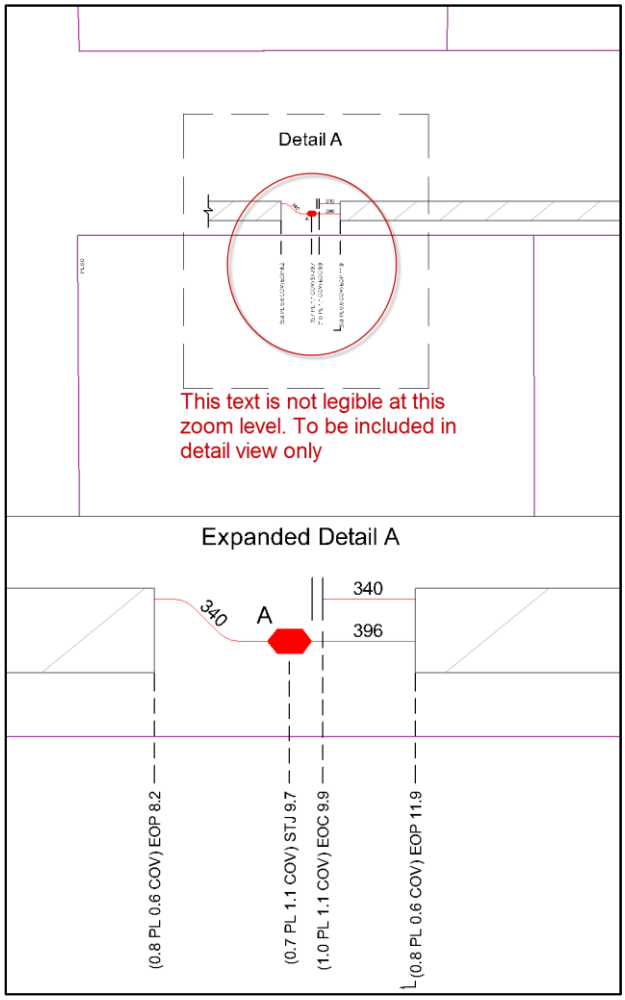


Figure 2 Incorrect use of expanded detail

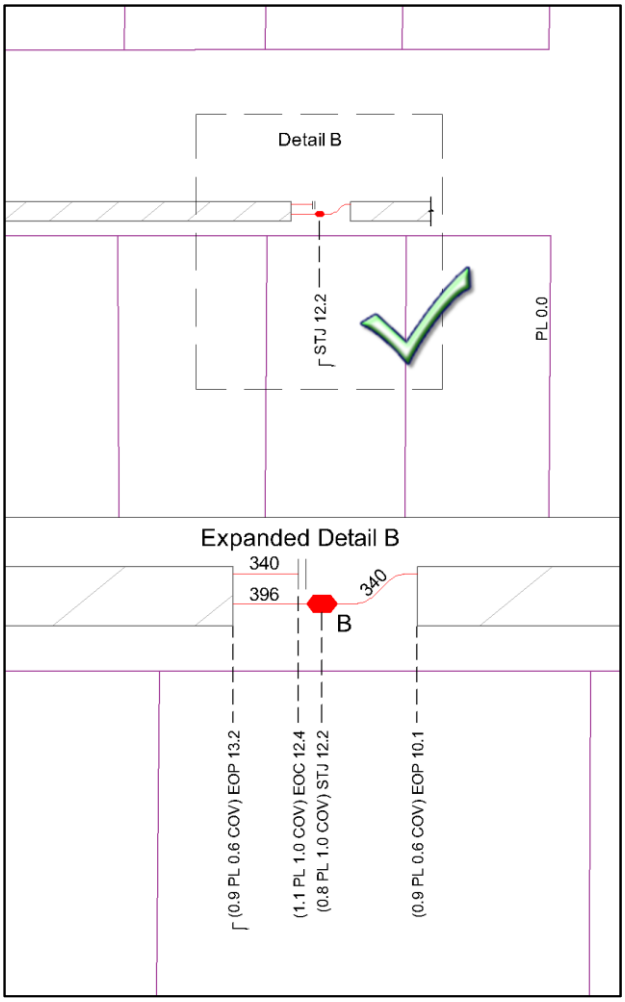


Figure 3 Correct use of expanded detail

5.1.3.5 Aesthetics and balance

Information on a field recording is more easily absorbed when the presentation is aesthetically pleasing. Practices such as ruling straight lines, evenly spacing annotations and balancing drawing elements across the page all contribute to the desired result.

Care should be taken while planning a drawing to ensure all the elements are set out in a way that makes maximum use of the space provided. It should be noted that features do not have to be drawn to scale, for example where a set of dimensions begin at a cross street that is remote from the area of interest. In such cases a 'break line' symbol may be used to indicate that the distance has been shortened.

Figure 4 Poor balance

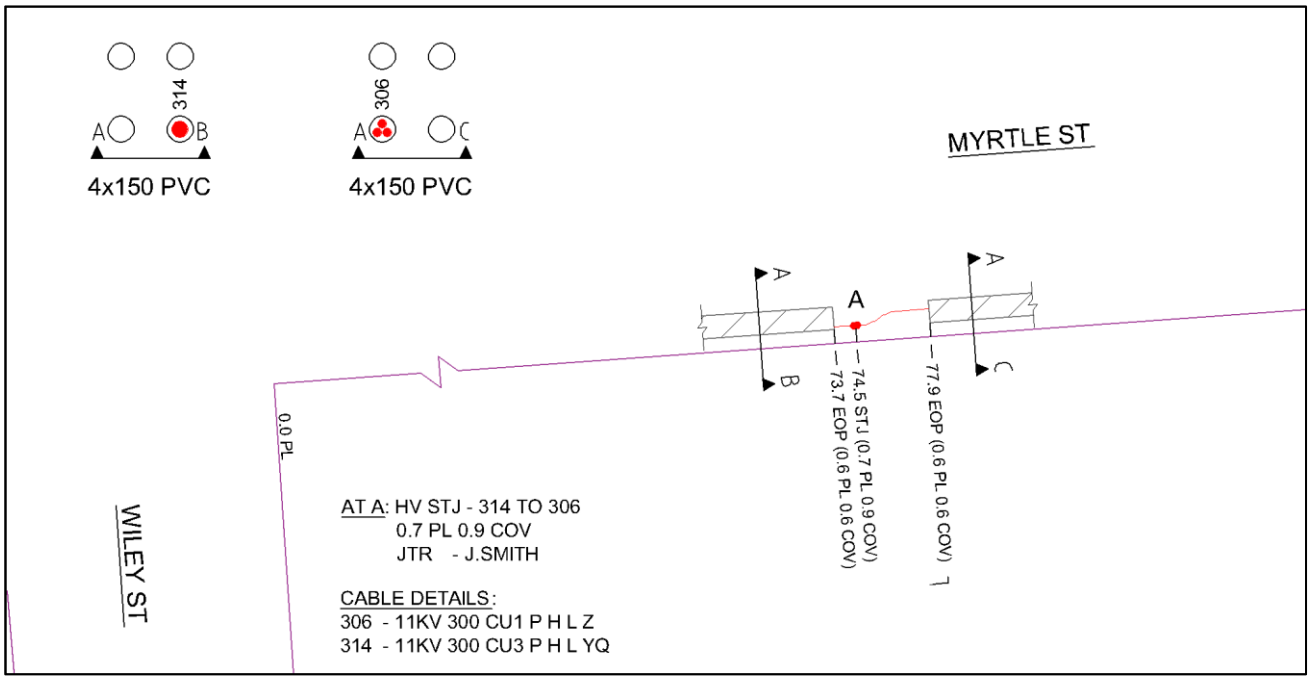


Figure 5 Good balance

Elements such as cross section diagrams, joint detail descriptions, lists of cable codes or GPS coordinates, and other notes, should be positioned in the drawing area in such a way as to avoid congestion in one region of the page but leaving other areas bare.

5.1.3.6 Relative positioning

While it is not necessary to draw all objects to scale, it is important that all assets and features are shown in the correct location relative to each other. Particular care should be taken to ensure non-visible underground assets are drawn on the correct side of visible, surface assets, to avoid potential mix-ups where misleading visual cues might lead field crews to excavate on the wrong side of a pole or boundary

5.1.4 Orientation

It is essential that the orientation of the diagrammatical information be indicated on the field recording by a north pointer. Without a north pointer the information could be entered into the GIS on the opposite side of the road or on the diagonally opposite corner.

In the field, north may be determined by the use of a compass, GPS, or street directory. The top of the page in a street directory is north. Project plans should also include a north point for reference.

Diagrams should be oriented such that the North Pointer is aligned upward, within 45 degrees to the left or right of vertical on the page. The acceptable range for the North orientation is indicated by the shaded area on the diagram below.

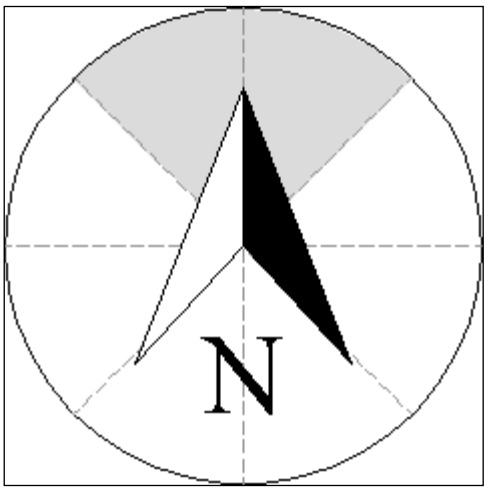


Figure 6 North point diagram

Where appropriate, a portrait style Field Book Template should be utilised, rather than attempting to rotate a horizontally aligned template.

All text and cross sections should be aligned on the page in such a way that they are aligned above the horizontal with respect to the north pointer.

5.1.5 Symbols, colours, and terminology

All symbols, acronyms and terminology used on a field recording must conform to company GIS standards. Field recordings may be produced in either black and white, or in colour. Colour can be useful for adding information at a glance, but where colour is used, it must conform to the standard colours for company GIS objects.

The standards for GIS acronyms and terminology are set out in NS100 Annexure A.

The standards for GIS symbols and colours are set out in NS100 Annexure B.

Incorrect usage of symbols, colours, acronyms and terminology will cause confusion and can result in false information.

5.2 ACCURACY

5.2.1 General

Accuracy is essential in the capture of data and the manner in which it is recorded. Without accurately recorded location data, assets buried underground become difficult and costly to find during future maintenance or construction work, they become vulnerable to damage from unrelated excavation, and may even become a hazard.

In most cases, this section will deal with accuracy in terms of measuring the geographic position of assets, but the importance of accuracy also applies to non-geographic data such as asset labels, cable types etc.

5.2.2 Method of measurement

There are many tools that may be utilised in the recording of geographic measurements. Each tool will have benefits and limitations, therefore consideration should be made that the most appropriate tool is used in each circumstance.

The most common tools used for field recording are measuring wheels, laser distance finders, tape measures and GPS.

Other methods of measurement must not be used unless they give a superior result, eg theodolite or other survey instruments used by qualified operators.

5.2.3 Units of measure

All measurements must be metric.

Relative local measurements must be made in metres, rounded off to the nearest 0.1m.

Absolute spatial co-ordinates must be made according to GDA2020 MGA Zone 56 and AHD71.

5.2.4 Accuracy and tolerances

Measurements should conform to the standards set out in NS100.

The procedures set out in this guide are intended to satisfy Quality Level B for relative local measurements. The nominal order of accuracy required is ±0.1m.

All information must be recorded whilst on the job site and not entered later from memory.

5.2.5 Non-geographic accuracy

It is important that all the information provided on a field recording is accurate. This includes non-measurement data such as cable codes, asset labels, electrical connectivity including feeder and distributor details, dates, street and suburb names and many others. Where a field recording is part of a project, the recorder should validate the work done with the project plan, SAO, and any other documentation.

6.0 MAKING MEASUREMENTS

6.1 Dimensions

6.1.1 General

All assets must be measured in two dimensions at the surface: distance along a baseline and an offset distance from that baseline. Underground assets must also be measured in terms of depth below the surface, or Cover.

6.1.2 Baseline

The system of measuring normally used is referred to as running measurement, or 'chainage'. A series of measurements must have a defined starting point (origin) and alignment (baseline) that corresponds to a known datum to ensure they are reproducible. In general, measurements are usually tied to the cadastre along property lines.

Measurements are taken by measuring along the ground and where possible the measurements should be carried on to the next cross street to tie off the run. Measurements to the lot boundaries nearest the job site, and preferably other lot boundaries within the extent of the measuring run, should also be included to improve accuracy.

No correction is made for any slope along the cable run. This gives the actual amount of cable laid and simulates the method of locating faults that occur.

The starting point for any measurement must be clearly indicated on the field recording by showing the Origin or "0.0". The feature used as the baseline should be described with a label (eg Colorbond Fence) to assist in relocating the asset in the future.

Where more than one run of measurement is required care should be taken to record each starting point. The orientation of recorded measurements on the field recording shall be the same as the corresponding 0.0 point.

6.1.3 Offset

The offset or "PL" is a measurement of the perpendicular (or 'Squared Off') distance from the Baseline to the feature being recorded. This measurement is made to the centre of a group of ducts or cables; to the centre of each individual object in the case of small assets such as cable joints, terminations, pillars, etc; and to the outer edge of large objects such as substations.

The larger the distance squared off, the greater the possibility of error and more care must be taken. For this reason it is generally preferable to take measurements from the nearest side of the road to the work area.

6.1.4 Cover

A measurement of distance below surface level must be recorded for all underground assets. This is referred to as the Cover over an asset. This measurement is taken from ground level to the top of the upper most duct or cable in a set of ducts and cables, and for each individual item in the case of cable joints, terminations or other objects.

In situations where the final ground level is not yet known (such as construction sites) a notation referring to "unmade ground" should be included on the field recording.

In situations where surface cover/level is not established, field recording Quality Level A (ie measurements must be absolute spatial position in terms of GDA2020 MGA56 and AHD71) is mandatory. (Refer to network standard: *NS100 Field Recording of Network Assets – QUALITY LEVELS*)

6.2 Establishing an origin

6.2.1 General

The origin is the starting point for any series of measurements, often referred to as the “0.0 point”. Situations where many different sets of dimensions exist in the same alignment, each with a separate 0.0 point, cause confusion and may result in errors where dimensions are misinterpreted. For this reason, and for general aesthetics, it is best to group together all measurements in a given alignment, relating each to a common 0.0 point.

The following list details the preferred order of priority for establishing an origin point (0.0) on the baseline.

1. Existing 0.0
2. Street corner
3. Lot boundary
4. Substation
5. Other permanent feature (location must be established by GPS or survey)

Each of the above should normally be within 100meters of the work being carried out to be considered suitable. Appropriate features may be extended from the far side of the road; however, it is preferable to choose a feature on the same side of the road.

6.2.2 Priority 1: existing 0.0

Ideally the recorder will have previewed the work area as represented in the GIS prior to conducting a site visit. An existing origin point should be reused for future measurements if it is suitably located.

Where job preparation identifies multiple existing origin points, these should be measured while on site so they may be tied together into a common dimension set, using the following priority order.

6.2.3 Priority 2: street corner

Where a suitable existing 0.0 point does not exist (or has not been identified) the first choice for the origin should be a street corner. A street corner is established by intersecting two property lines, which includes extending splays and extending one property line to the intersecting property line on the far side of the road. Where there is no street corner within 100m of the job on the same side of the road, an extended street corner may be used if it is within 100m.

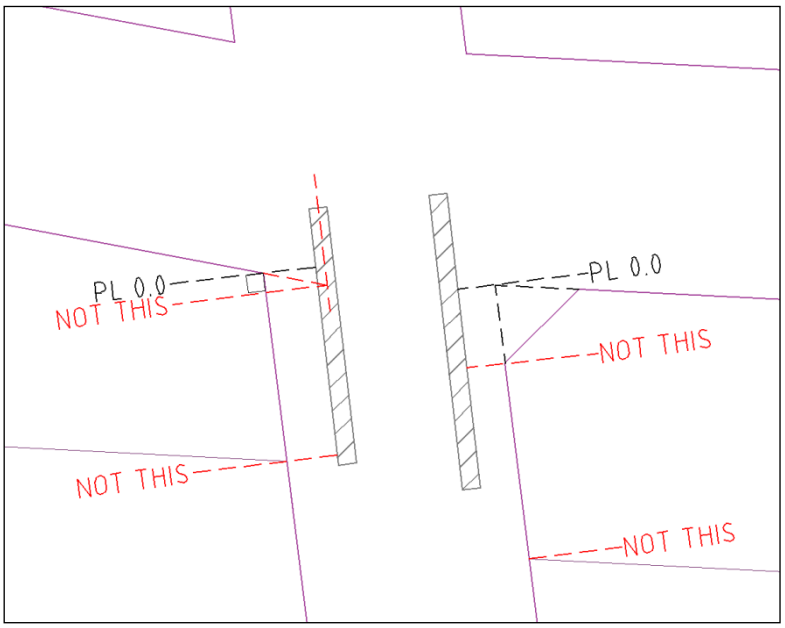


Figure 7 First choice – near side of road

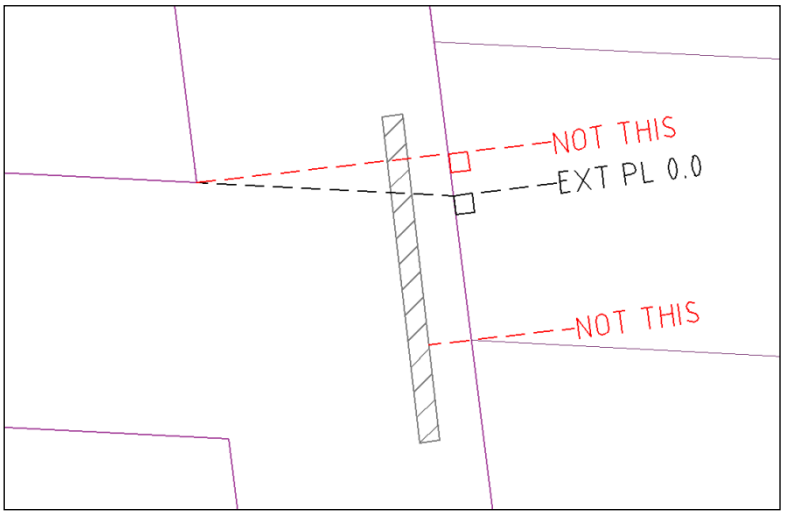


Figure 8 Second choice – far side of road

6.2.4 Priority 3: lot boundary

Where no street corners exist within 100m of the job on either side of the road, a clear boundary between two lots may be used to establish the 0.0 point. Again, this boundary should be within 100m of the job location and preferably on the near side of the road.

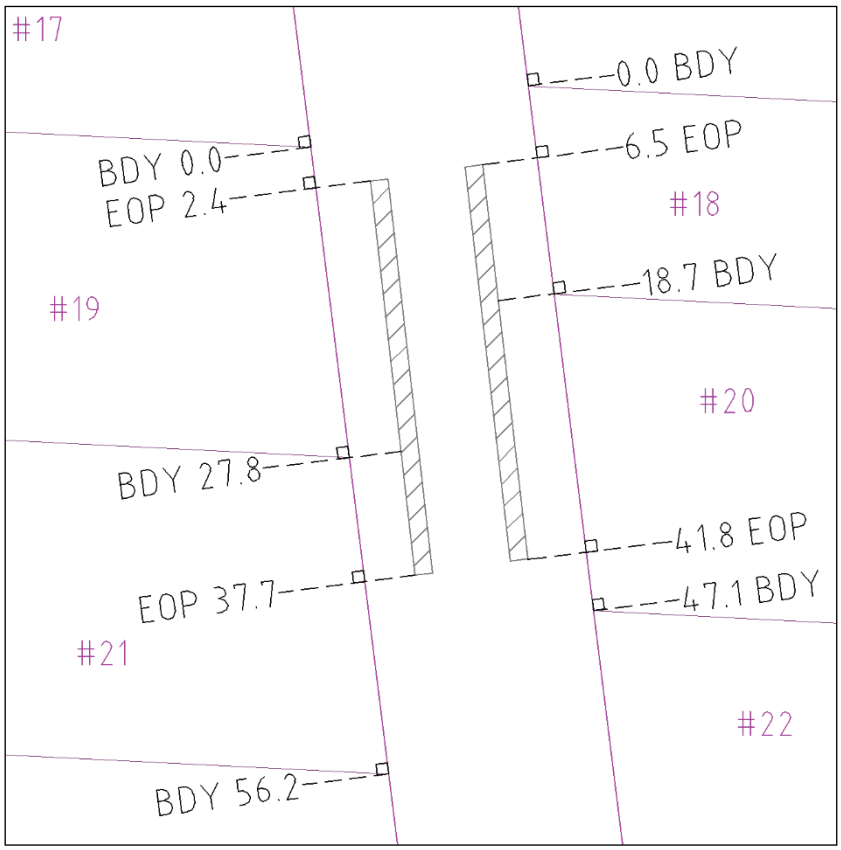


Figure 9 First choice – near side of road

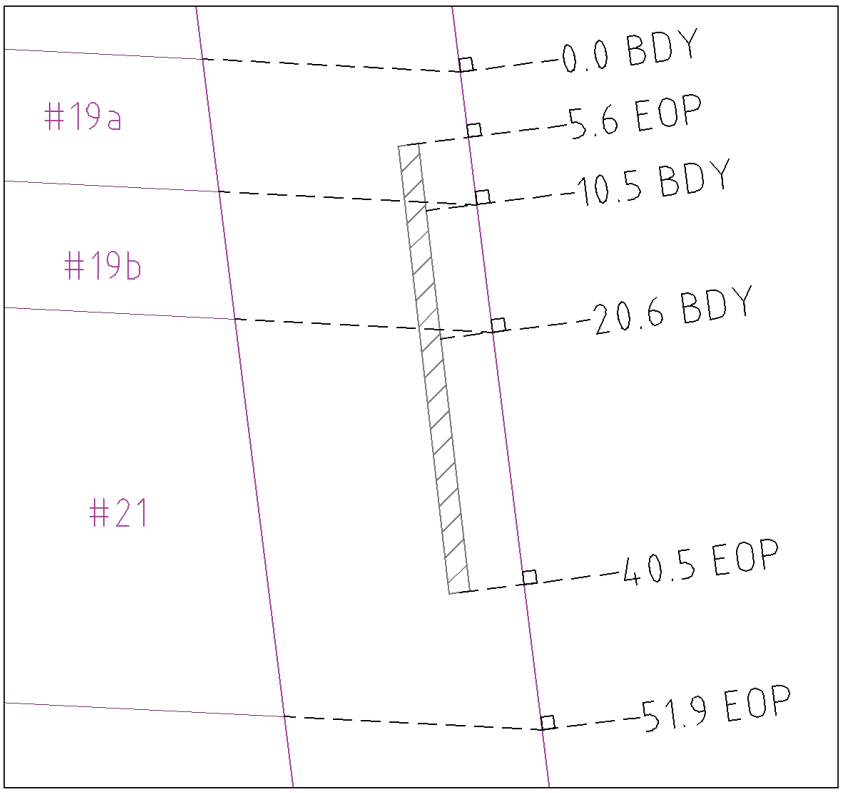


Figure 10 Second choice – far side of road

6.2.5 Priority 4: substation

Where no street corners or lot boundaries exist within 100m of the job on either side of the road, a substation may be used to establish the 0.0 point. Again, the substation should be within 100m of the job location and preferably on the near side of the road. It should be made clear which feature of the substation has been used (eg perimeter fence, sub building). Pole transformers may never be used as an origin for measurements.

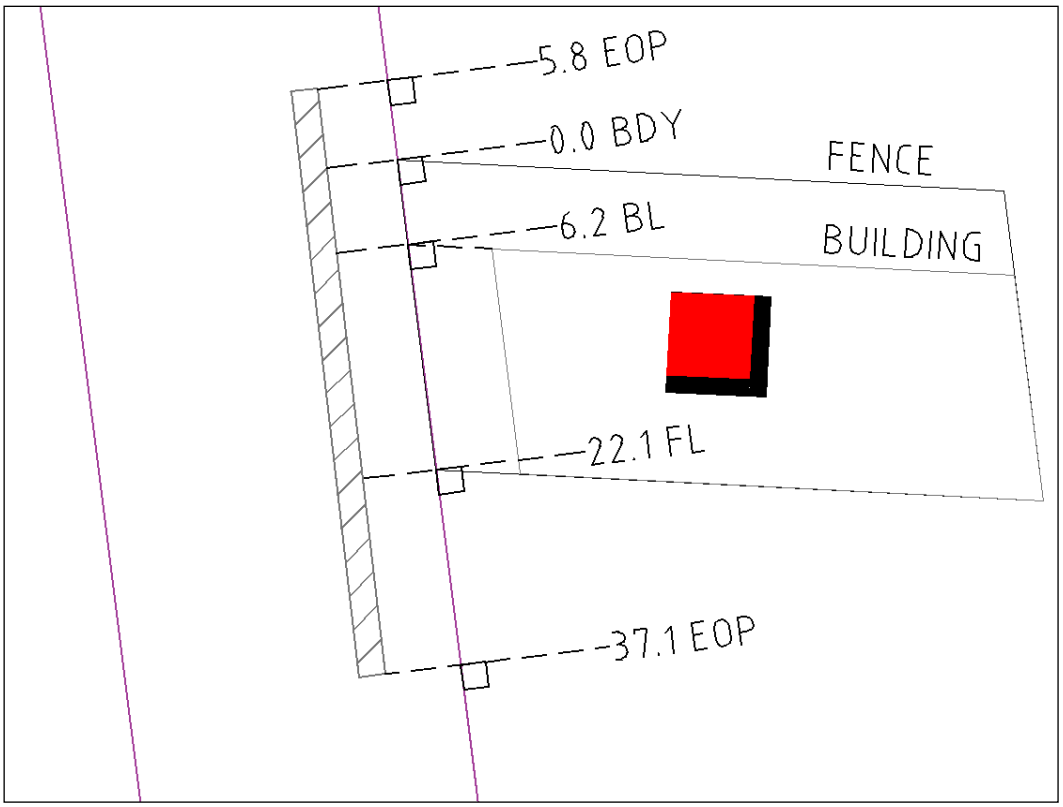


Figure 11 First choice – near side of road

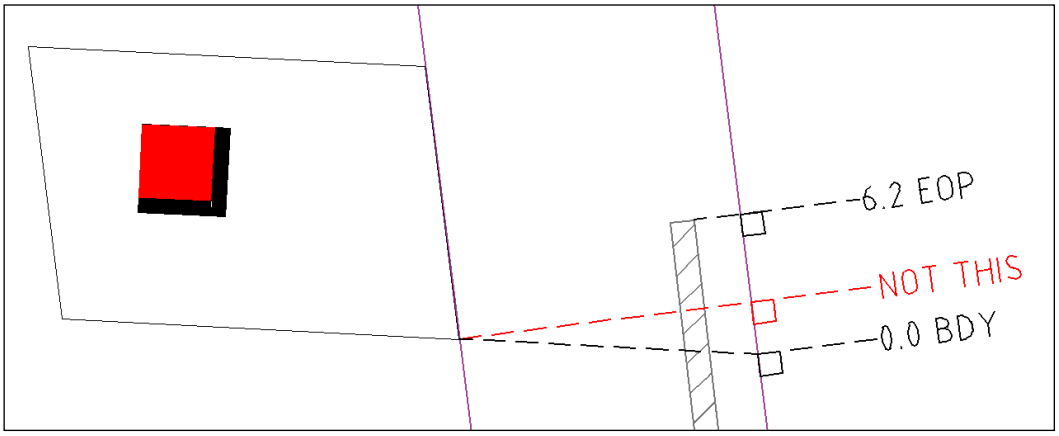


Figure 12 Second choice – far side of road

6.2.6 Priority 5: other permanent feature

Where none of the previous features exist along the property lines near a specific job site, or where there are no property lines at all, it is acceptable to nominate some other feature to serve as the origin and/or baseline for a series of measurements. Any such feature must be a permanent construction, clearly identifiable, and provide a distinct baseline and alignment. These features must then be geo-referenced using GPS or surveying methods.

Suitable examples might include buildings, retaining walls and kerb lines.

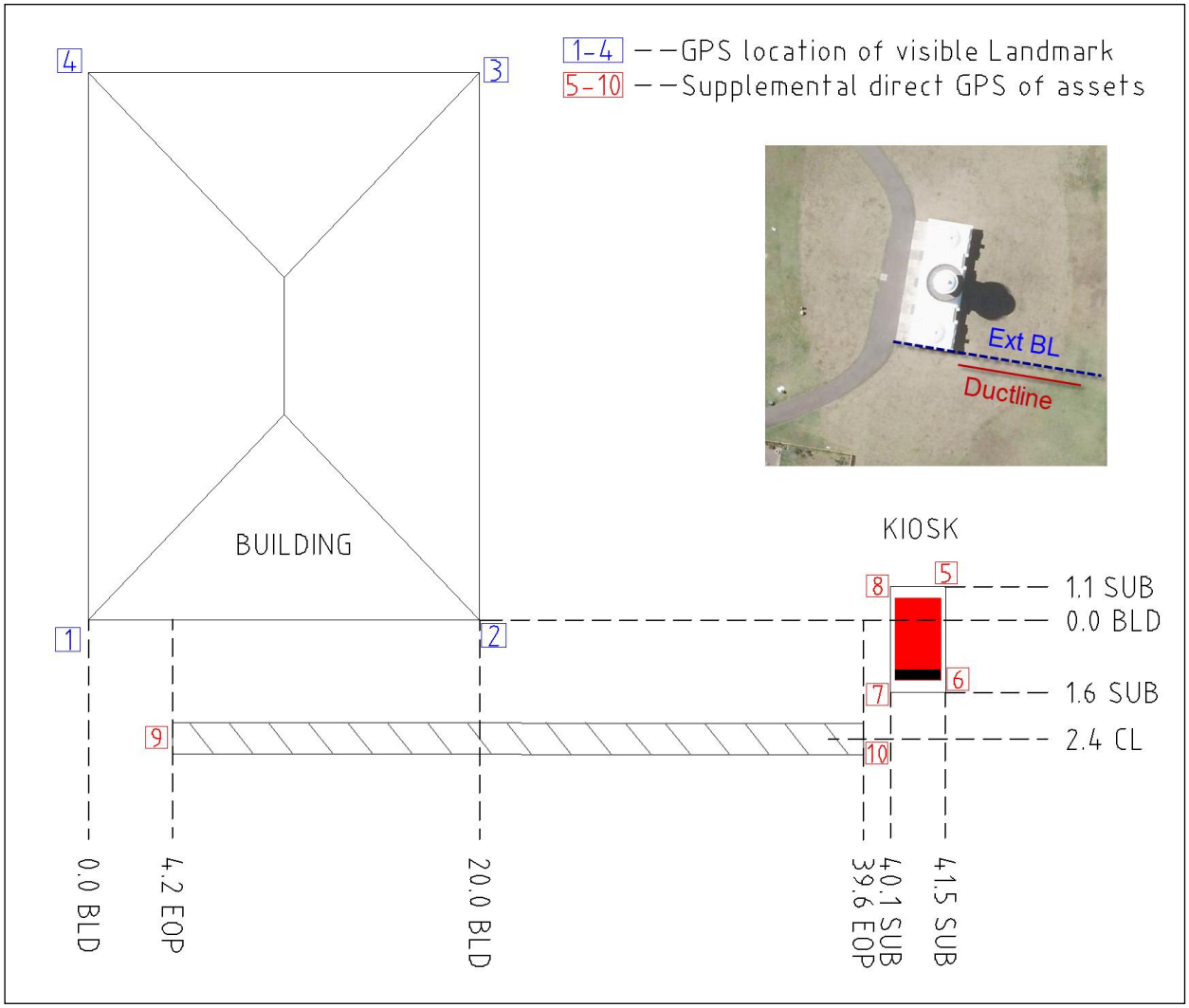


Figure 13 First choice – measured from visible landmark

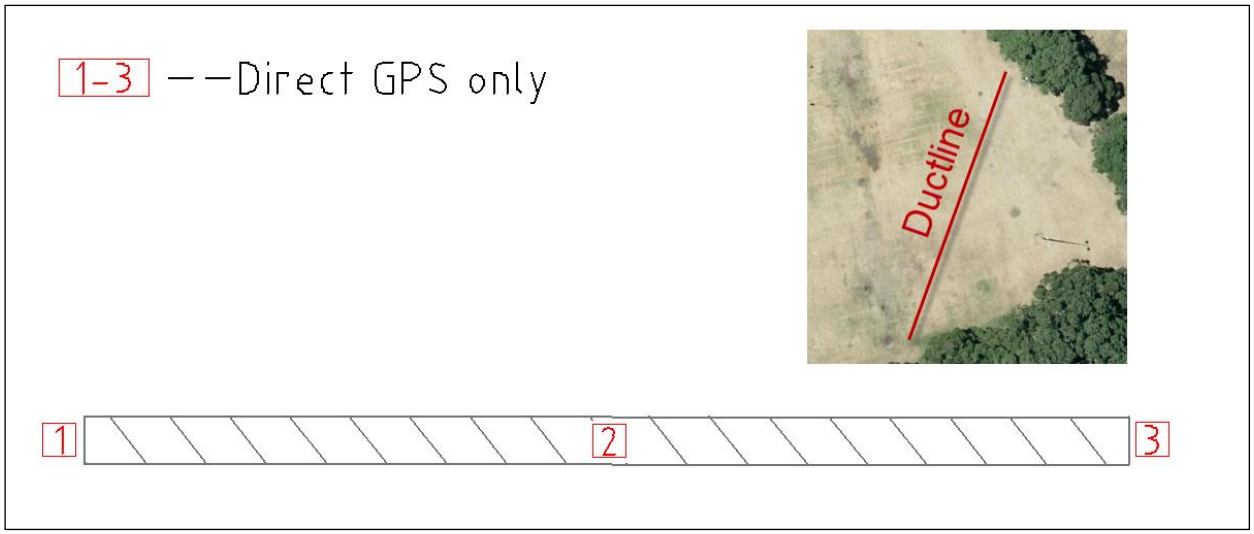


Figure 14 Second choice – no visible landmark

6.2.7 Example

In the example below, the corner on the same side of the road (Opt 1) is 130.8m away, the extended street crossing (Opt 2) is 7.8m from the job, and a lot boundary on the same side of the road (Opt 3) is 3m away. Opt 1 would normally be the highest priority feature to use as the origin except in this case it is too far away (over 100m). The extended street intersection should be used as the origin (even though the lot boundary is closer), as it is the highest ranked feature within 100m. Note that the near side lot boundary should still be included in the measurement (just not used as the 0.0 point).

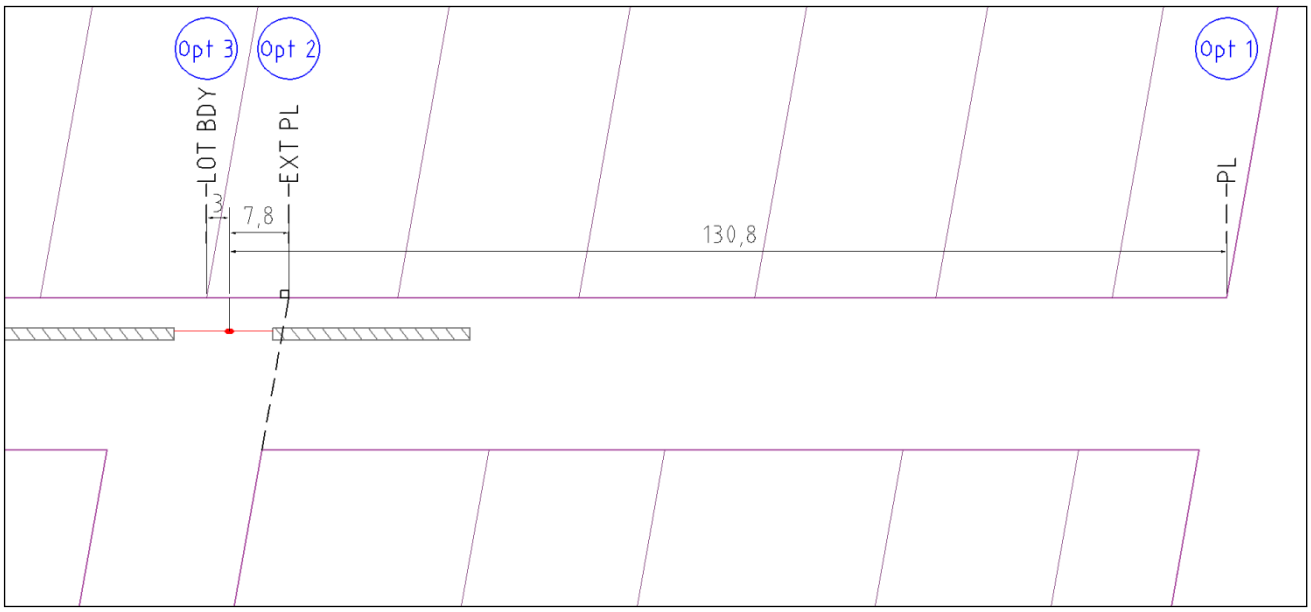


Figure 15 Example of choosing the most suitable origin

6.3 Squaring off and extending

6.3.1 Extending

The practice of extending a line is used when establishing an origin. Where two baselines do not actually meet, such as the far side of a T-intersection or a splayed corner, one or both of the baselines should be virtualised by extension in a straight line until the lines intersect each other.

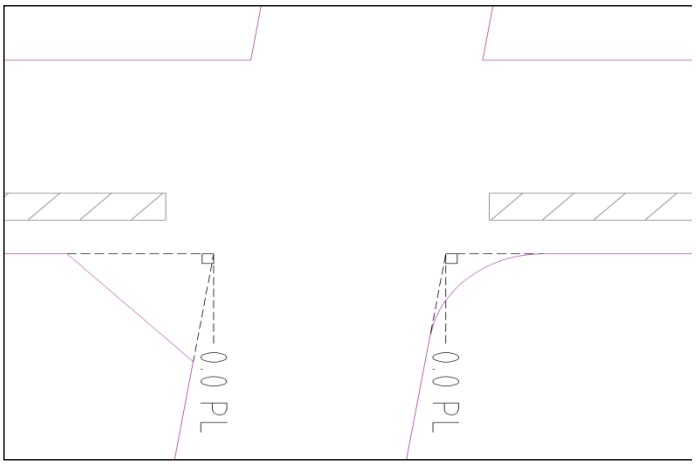


Figure 16 Splay and curved corner

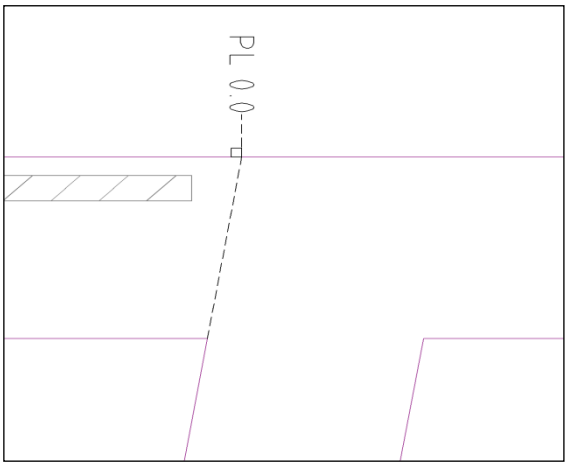


Figure 17 PL extended through T intersection

When extending a property line or lot boundary, it is important that the line is extended all the way until it intersects the baseline. If the extended line stops short, in alignment with a duct lay, for example, the angle can result in an error in the measurement.

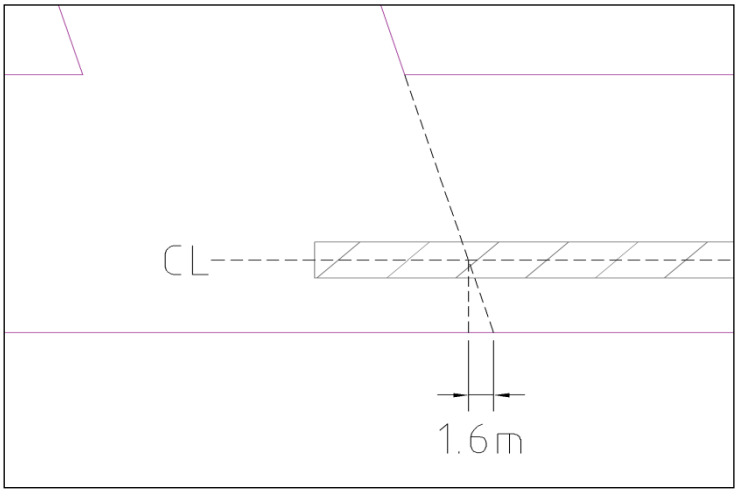


Figure 18 Measurement error when PL not extended properly

Where it is not possible to extend the line, for example the lot boundary between shop fronts where the direction of the boundary is not visible, it is acceptable to square off instead of extending.

6.3.2 Squaring off

All chainage measurements for assets and features should be squared off back to the baseline.

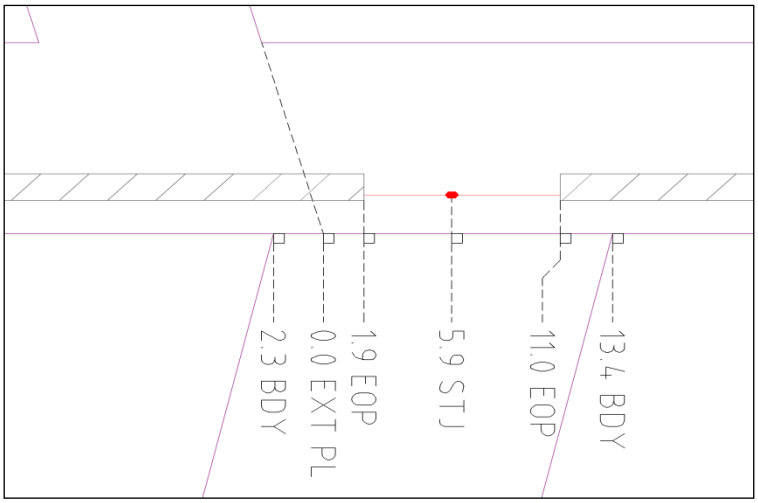


Figure 19 Example showing squared off measurements

6.4 Measuring devices

6.4.1 Measuring wheel

Measuring wheels are ideal for measuring medium length runs, for example distances along a single block. Measuring wheels are cheap, portable and easy to use. Measurements can be made fairly quickly and are easily reproducible. Measuring wheels become less accurate over longer distances (more than 100m) and do not have the fine scale to be used at very small distances (less than 0.1m). Measuring wheels are inaccurate over rough ground, and are virtually impossible to use for vertical depth measurements.

Measurements should never be made over obstacles (eg piles of dirt).

6.4.2 Laser distance measurers

Laser distance measurers (LDM) are highly accurate over short distances (up to 20m). They are highly portable and are unaffected by rough terrain. LDMs are useful for taking measurements of objects which are difficult to reach, inaccessible, or dangerous (eg the bottom of a deep trench, across a road, or measurements where people are working overhead). Care must be exercised when using LDMs, as the laser poses a hazard to eyes. The laser should always be used and aimed below eye level, and not used at all around highly reflective surfaces. Over longer distances, or in full sunlight, it can be difficult to see where the laser is aimed. Taking measurements in the field can sometimes pose a challenge where there is no physical object at which to aim the laser (eg no fence on the property line). Where this is the case, a suitable object may be placed at the required position as an aiming point for the LDM. It is also sometimes necessary to take multiple readings of the same measurement where there is a possibility that the laser has momentarily reflected off intervening objects (eg people walking across the path of the measurement).

6.4.3 Tape Measure

Much like laser distance measurers, tape measures are most useful for measuring short distances, such as cover depths or the distance to a property line. They have an advantage over LDMs where there is no safe or suitable object for aiming a laser. Over very short distances (under 2m) some types of tape measure can be used by one person. At greater distances, however, one end of the tape will need to be secured to an object or held in place by a second person. An extended tape measure could potentially pose a trip hazard to pedestrians, and should not be used across lanes of vehicular traffic. Conductive tape measures should never be used near live, exposed conductors, or where there is a risk of electric shock.

6.4.4 GPS

Global Positioning System (GPS) equipment is invaluable for recording the location of assets in areas that are remote from an identifiable cadastre or other geo-referenced features. GPS provides absolute spatial data, and as such is not dependent upon the permanence of other features for relocation. GPS equipment is expensive (and therefore of limited availability) and taking measurements is time consuming. Measurements also require time spent in post-processing. Using GPS equipment requires a skilled operator, especially during relocation. GPS measurements can become inaccurate or even unobtainable near objects that affect line of sight to the satellites (such as trees or buildings).

6.5 Shape of detail

6.5.1 General

Every endeavour should be made to depict the shape of the street or location of curves within the field recording. If a street runs off at an acute angle, that angle should be simulated on the field recording. If a street is curved, changes direction, or a radius appears at a bend, it should be shown in a similar manner to that which exists in the field. Similarly, stepped street alignments, splayed corners, or any other related features should be depicted on the field recording.

6.5.2 Curves

Most cable recording problems arise at points where cables change direction. Where ducts or cables are laid around curves, the recorder shall provide sufficient information to enable the route to be plotted accurately. Generally, five main features define a minimum set of required points; the measurement where the curve starts & ends, the midpoint of the curve, and the position where the duct or cable crosses the extended property line or other baseline. More points may be necessary on large or complex curves.

Dimension abbreviations are used to clearly define features of the curve, along with reference to any changes in the bend (in degrees) and its direction, and the radius of the bend. (**Figure 20**)

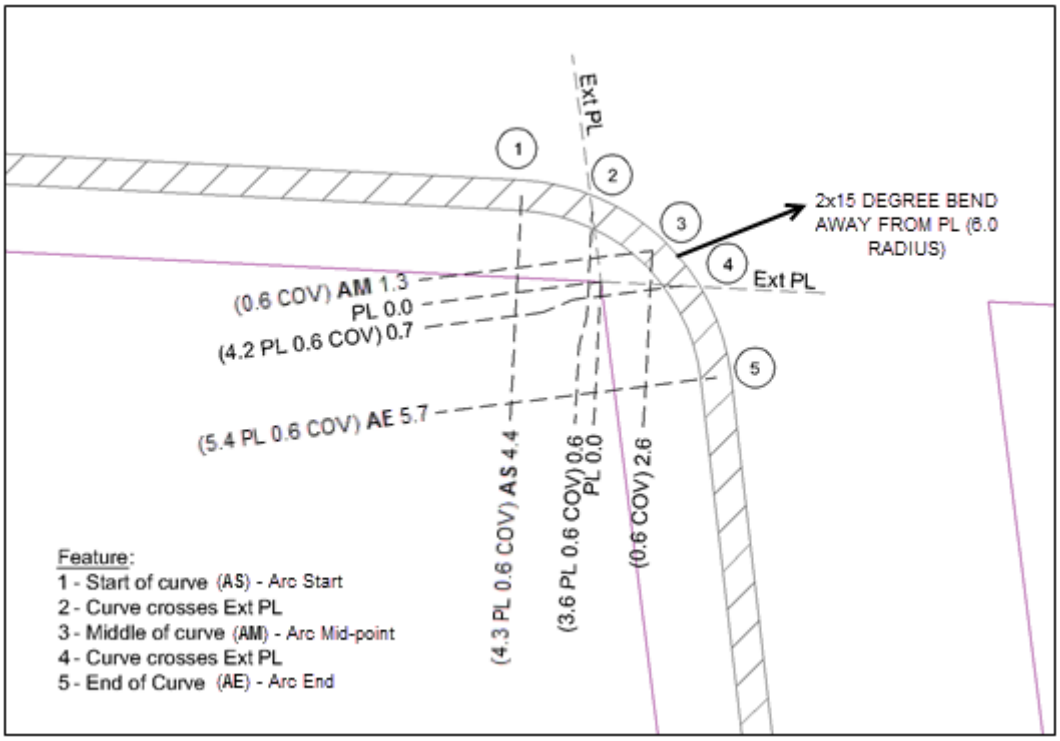


Figure 20 Measuring curves

6.5.2.1 Linear bend changes

Where a cable/duct bends the standard linear measurement ("BEND") is required (with property line and cover details), *as well as* the degree of change at *each* bend and its general direction.

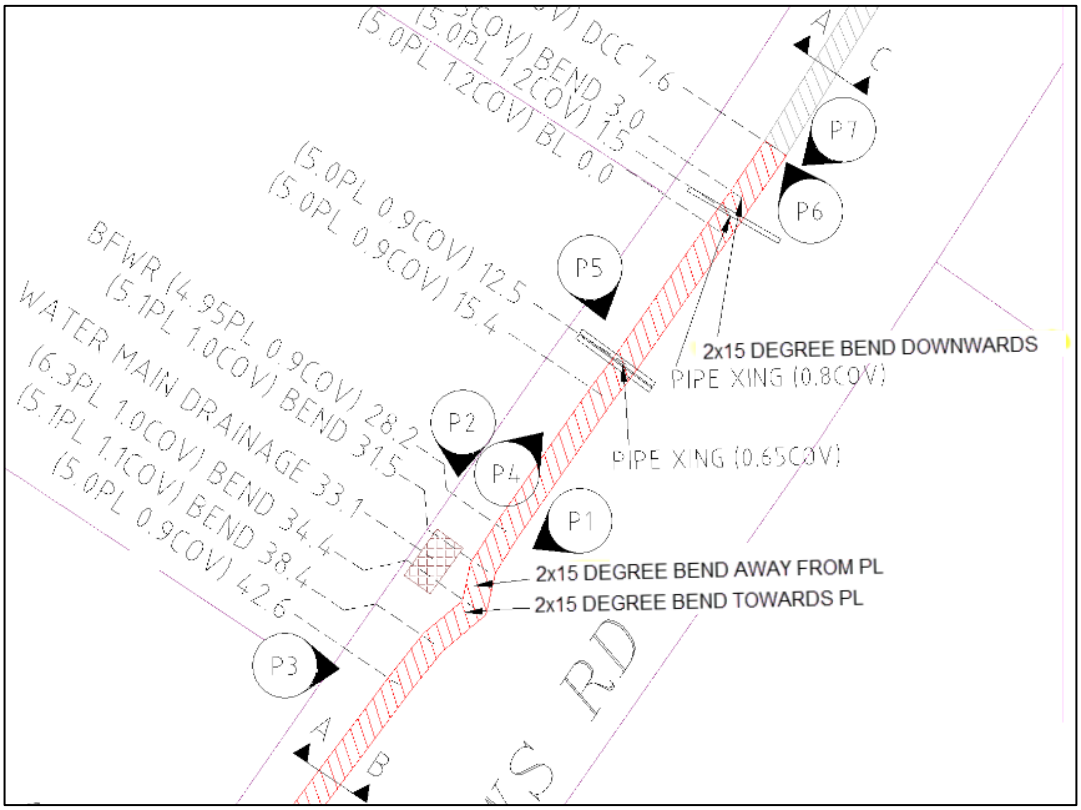


Figure 21 Linear bend changes example

6.5.3 Splays

6.5.3.1 General

A splay should not usually be used as the origin for a set of measurements as there is often a variance of size and/or shape between the cadastre and physical constructions on site. In other cases a splay may be purely decorative and not reflected in the cadastre at all. As such, the general practice should be to extend a splay when establishing an origin.

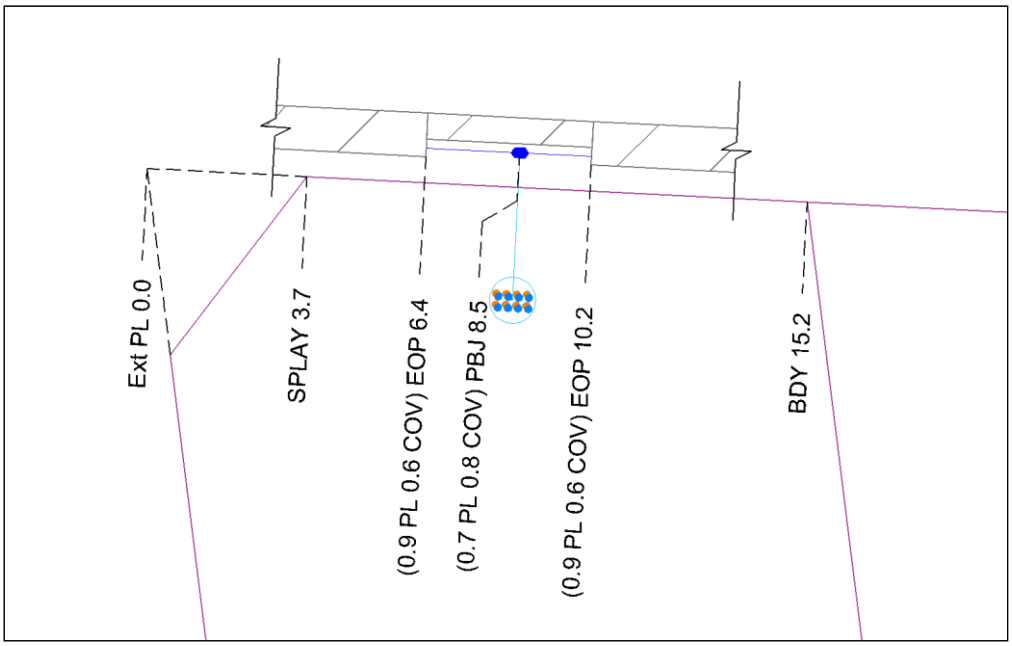


Figure 22 Extending the splay

6.5.3.2 Exceptions to extending a splay

There are some situations where it may not be safe, accurate or practical to extend a splay. The following list details exceptions to the usual method of extending a splay:

- Assets within the Splay

  Where assets pass within the area that would be formed by extending the splay, it is acceptable or even preferable to identify the face of the splay as a separate baseline.

- Road within the Splay

  Where the road or other thoroughfare passes within the area that would be formed by extending the splay, extending the splay would pose a hazard.

- Acute angle

  The margin of error inherent in intersecting two extended lines grows higher as the two lines become closer to parallel, such as where the property lines are at an extremely acute angle (less than 45 degrees).

- Large splay

Where any of the listed exceptions become a consideration, it is acceptable (and often preferable) to treat the face of the splay as a separate baseline, and the corners of the splay may be used to establish an origin. In such cases, a measurement along the street to the next lot boundary is of particular importance, to verify the dimensions of the splay.

The following diagram shows a case where to extend the splay would mean stepping into the road, which poses a safety risk. Even though there may be a pedestrian island, squaring off

measurements might still require standing in the middle of the roadway, or the extension may not actually intersect on the island, etc.

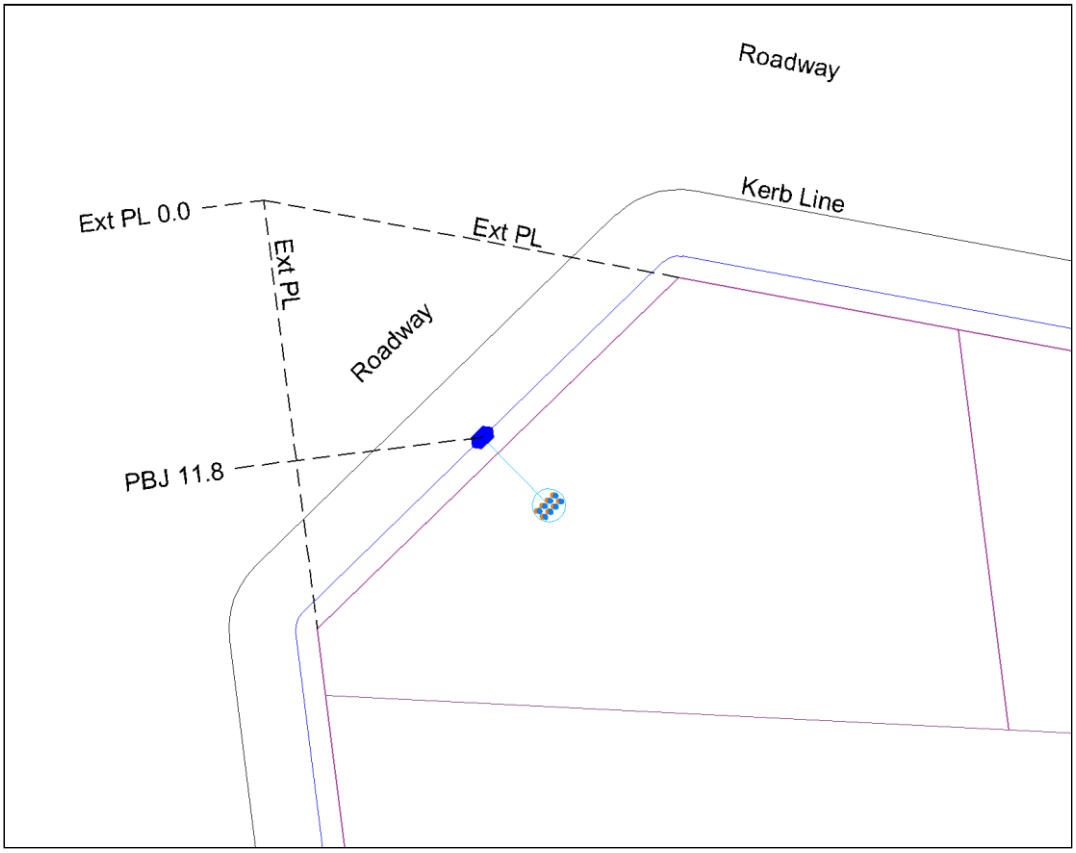


Figure 23 Extended splay runs into roadway

In this case, it is safer to use the face of the splay as the baseline for the recording, remembering to tie-in the dimensions of the splay by measuring to the next lot boundary, as shown in the diagram below.

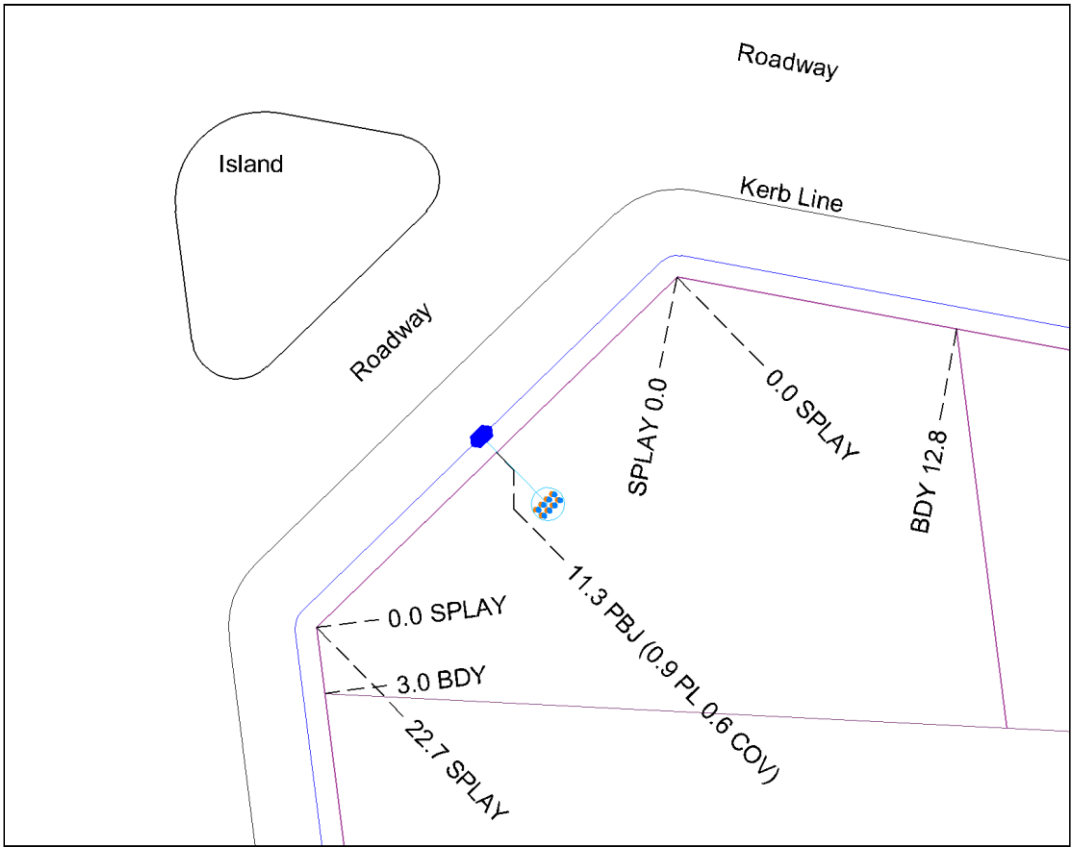


Figure 24 Face of splay used as baseline

6.6 GPS/GNSS field recording

6.6.1 Accuracy requirements

- Data collected with minimum horizontal precision of 10cm.
- All GPS data should be provided in GDA2020 MGA coordinate system (Zone 56) and AHD71 for QL1.

6.6.2 Safety requirements

When using GPS poles near OH line and in substation switchyards, care must be taken by maintaining minimum safe working distances.

Do not use GPS range-pole in Zone substation switchyard, as per SWMS GIS01.(See chapter 7.1.4 of Ausgrid Electrical Safety Rules and NS156 Working Near or around Live Cables.)

6.6.3 General process for GPS recording

All GPS users must be competent to perform the relevant task.

GPS should be used only when conventional measurements to standard cadastral features are not possible (i.e. park land, lack of property/building lines, construction site with no useable boundaries, accessibility issues, etc…).

The first priority should be to use GPS to record the location of a surface feature to serve as the baseline for conventional measurements, as shown in the Making Measurements section. This must be a clearly visible permanent structure e. g. the wall of a building. In either case, a direct GPS recording of the asset should also be made.

Where conventional measurements are not possible from any surface reference point, GPS is used to record the location of the asset directly at the centre of the asset.

Poles may be located by having the GPS receiver against the pole on the side with the best satellite configuration.

Offset technique to be used when the asset to be recorded is not accessible for safety reasons or for better satellite configuration.

For single point capture a second control point capture is required on the next nearest property line or in a remote location the next nearest asset or permanent visible structure (local reliability check).

6.6.4 Quality control

Every GPS coordinate must have a data quality check.

A GPS QA sheet must be created and supplied with at least the following information, but not limited to:

- Point ID
- MGA coordinates
- AHD elevation (Quality Level 1 only)
- Receiver type
- Horizontal precision
- Vertical precision (Quality Level 1 only)
- Standard deviation
- HDOP
- VDOP (Quality Level 1 only)
- Clear description of recorded point
- Date
- Number of positions recorded at each location

6.6.5 Field recording data sheet

For each recorded point of an asset, a point ID is to be shown and clearly marked on the field recording at the corresponding location.

A coordinate table has to be shown on the field recording or shown on a separate sheet when numerous points have been recorded in the field.

The table must include but is not limited to:

- Point ID
- Easting MGA coordinate
- Northing MGA coordinate
- AHD elevation (Quality Level 1 only)
- Clear description of recorded point
- Horizontal Precision QA
- Vertical Precision QA (Quality Level 1 only)

Refer to Annexure C (examples)

6.6.6 Equipment calibration check

GPS/GNSS equipment must have a calibration check done every 6 months. Calibration check is performed by collecting data on a State Survey Mark (SSM-centimetre accuracy). Comparison results with SSM coordinates should not be bigger than 10cm.

Refer to *Annexure C* (example).

6.7 Trilateration

6.7.1 General

On certain work sites it may prove difficult or impossible to take accurate measurements using the standard system of chainage and offset from a baseline, such as where cables pass through parkland or large establishments, when the squared off distance from the baseline is large, or other unusual locations and situations. At such times, the position of assets may be measured and recorded using trilateration.

6.7.2 Recording

Trilateration involves measuring the distances of the asset from two other fixed points to form a triangle of three known sides. These reference points must correspond to permanent features that either exist currently in the GIS or are located and fixed using GPS afterwards (or by a surveyor if requested). State Survey Marks (SSMs) are ideal for use as a trilateration reference point.

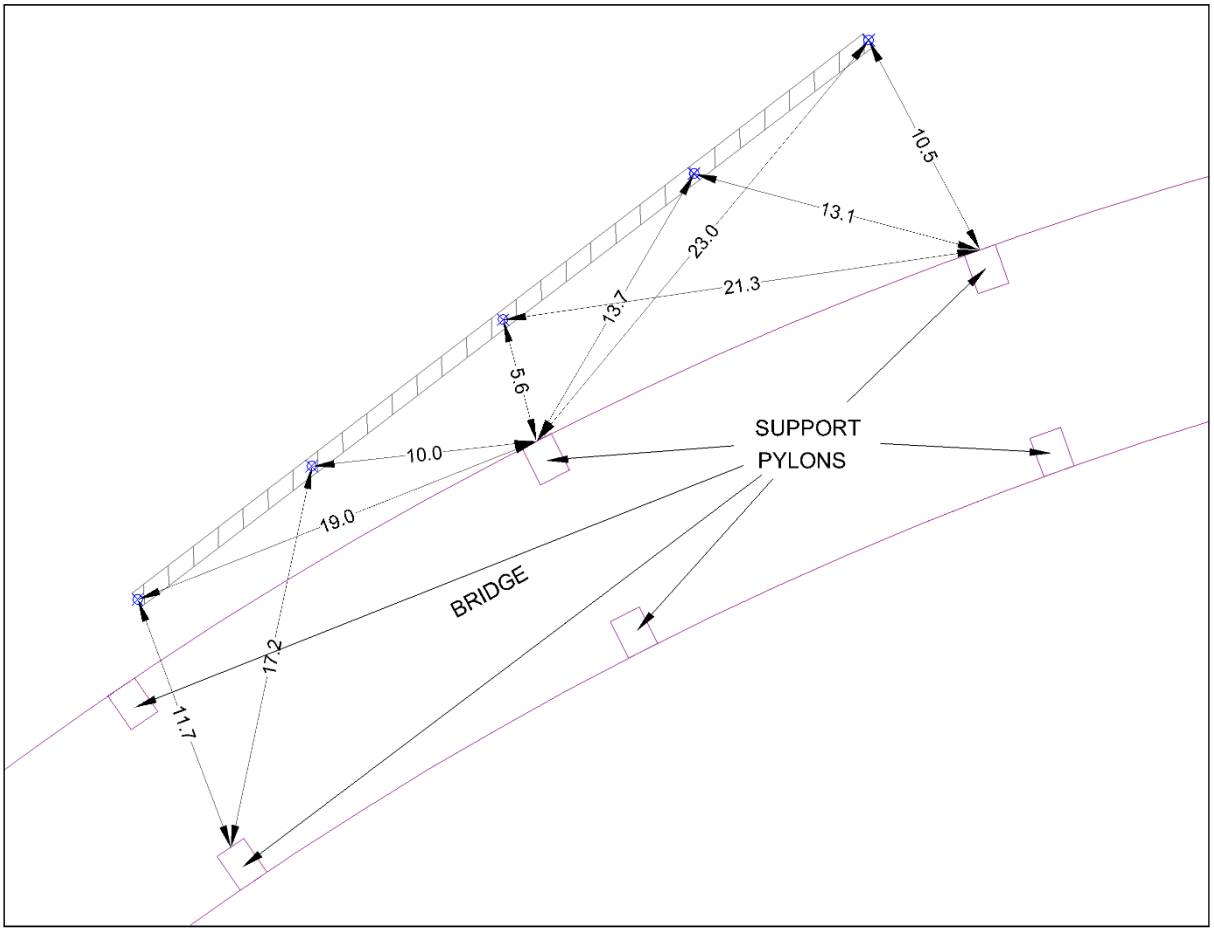


Figure 25 Ducts measured from bridge supports

For best results, the angle formed at the asset being measured should be as close as possible to 90 degrees. If the two bearings from each reference point back to the asset approach parallel or directly opposite, the chance of error becomes very high, and different reference points should be used.

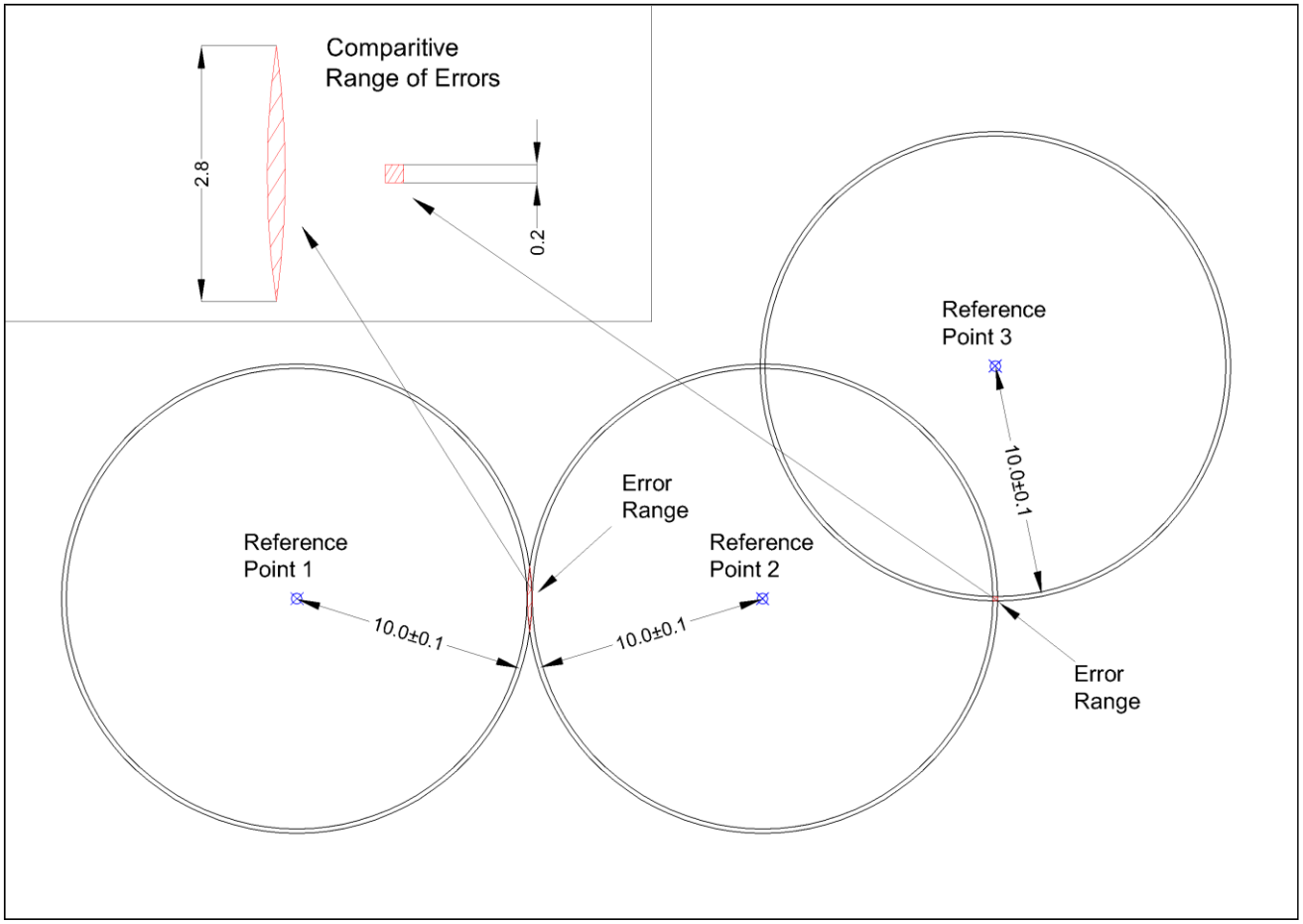


Figure 26 Range of error relates to geometry of reference points

6.7.3 Relocation

If full circles were marked out for the distance specified from each reference point, it would be discovered that the distances intersect each other in two places, one to either side of the base reference points. Refer to the original recording in order to determine the relevant point of intersection.

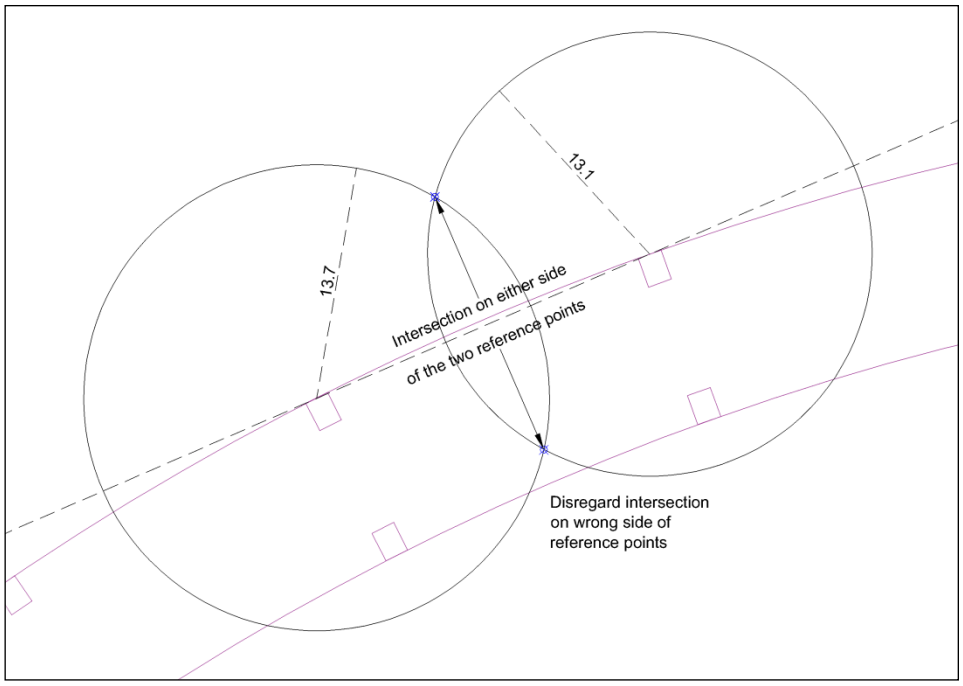


Figure 27 Insertion of distances

In practice, a tape measure or string is anchored at the first reference point, extended to a length matching the recorded measurement, and used as a compass to scribe a short arc at the estimated location. The same process is repeated from the second reference point and the desired positional fix is established at the point where the two arcs intersect.

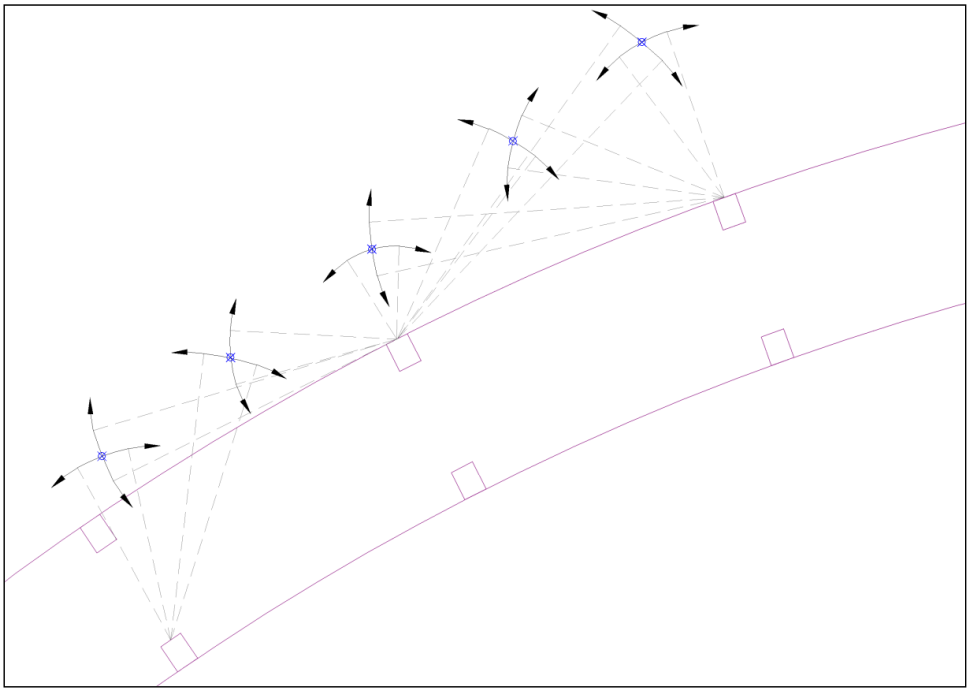


Figure 28 Intersect arcs to relocate recorded positions

6.8 Survey

6.8.1 Using State Survey Marks

State Survey Marks (SSM) are placed by the Land & Property Information (LPI) for survey control purposes. SSMs take the form of a labelled and uniquely numbered brass plate, generally embedded in the kerb line at streets intersections.

Figure 29 State Survey Mark

SSMs are a single point directionless surface feature, so may only be used in conjunction with other features to measure assets; for instance a SSM may be used as one of the base reference points in a trilateration measurement, or squared off to a boundary line for use as a “0.0” point.

If the SSM will be required for asset capture in the GIS, it must be recorded using GPS to establish approximate geographic location coordinates. On the field recording, the comment in the GPS coordinates table (for SSM item only) should read “SSM, approximate coordinate” as they have not been provided by the LPI.

6.8.2 Using survey pegs

Generally, when recording at a site where no assets, buildings or dwellings currently exist (most typically a new housing development), a surveyor supplied by the civil contractor will install construction pegs to ensure the trench is dug in the location specified on the plan. These pegs can be used to help locate features that are useful when recording.

It is important to always check any notations written on the peg by the surveyor, as this will provide the recorder with critical information such as:

- Feature peg refers to (lot boundary, boundary line, splay, easement etc)
- If the peg is offset and, if so, in which direction it is offset
- Lot number (if applicable)

These pegs will often have brightly coloured tape at the top. The colour of the tape does not have any relevance to the feature and is for visibility purposes only.

Figure 30 Splay peg

Figure 31 Road crossing at lot # 207 boundary

Figure 32 LV cables turned up at boundary peg for future pillar

6.8.3 Requesting surveyor's assistance (Internal Process)

Surveyors with their instrumentation can accurately measure long distances, which are impossible for a field recorder to measure. Surveyors are generally requested for assistance where there are no obvious reference points to record from. Company surveyors can provide assistance to company field recorders throughout all of the company's regions for recording or relocation.

In the situation where there is no obvious property line, boundary or kerb line, or other available company asset from which to take measurements, the recorder should reference a feature in the immediate vicinity. The field recorder should make a note of the reference point from which measurements have been taken, or mark it using survey paint, ensuring that the mark will be visible for several days.

The location details, including the exact requirements, drawings of where the reference point is situated, and any other relevant details should then be provided to the appropriate Data Maintenance Regional Team Leader (RTL). The RTL will then forward the request to the Survey Group (Geographic Engineering).

The surveyor will attend the site, and can then relate the reference point, and hence the cable or joint information, to the land boundary system on which all mapping is based.

7.0 ASSET DETAILS

7.1 Cross sections

7.1.1 General

Cross sections should be included on field recordings for new duct and/or cable runs, and again for any location where there are changes in arrangement. When new cables or conduits are incorporated into an existing run of cables and conduits, a cross section detailing the new arrangement should be clearly noted. Cross sections should also be shown where relevant to network alterations such as jointing works.

Cross-sections must be marked on the field recording through the placement of a cross section location line crossing the point of interest. Cross Section Diagrams may be shown Adjacent or Remote to the point of interest.

7.1.2 Remote cross sections

Each end of the cross section location line must be marked with arrows and a reference in accordance with those listed below.

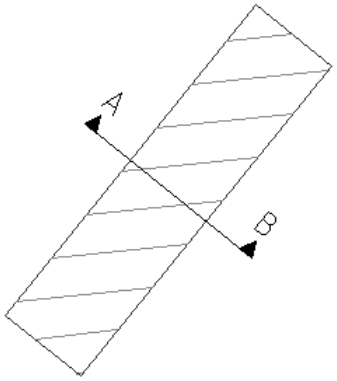


Figure 33

Table 1 Cross section sequencing

Cross-section sequence	Start Point	End Point
1	A	B
2	A	C
3	A	D
•	•	•

Each cross-section must be drawn in detail with the two reference marks clearly marked so as to enable orientation of the cross-sectional information.

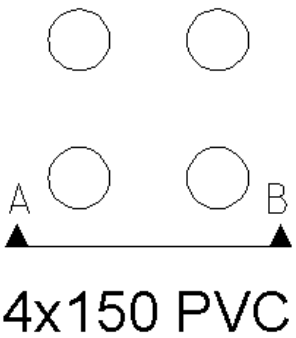


Figure 34

7.1.3 Adjacent cross sections

The cross section location line is extended to one side of the area of interest. The duct and cable configuration is shown above the line, and cross section summary text is shown below the line. The cross section diagram is aligned to the corresponding duct / cables

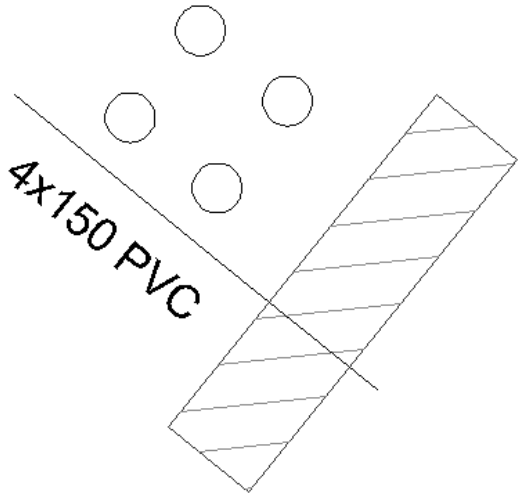


Figure 35

7.1.4 Cross section details

Cross section diagrams (both Remote and Adjacent) must include all of the following details where relevant.

- Ducts and cables shown in relational position to each other
- Include service/communications cables/ducts
- Include 3rd party communications cables/ducts where they interaction with or run in the same trench as company assets
- Existing or new ducts / cables if seen
  - Ducts shaded if known to be occupied
  - Where all ducts are existing, this may instead be noted in the Job Description
- Ducts and cables are assumed to be new unless labelled as existing
- Ducts of similar sizes range should be drawn in a consistent size, grouped as small, standard or large duct size.
  - Small - equal or less than 80mm diameter
  - Standard - up to and including 150mm diameter
  - Large - larger than 150mm diameter
- Summary of quantity, size, and material of any ducts
- Cable code for each new cable
- Offset distance from measurement baseline (PL) (optional)
- Cover depth to top of ducts / cables (COV) (optional)
- Bore, bedding, and/or covering plate details
- Other utilities assets should be shown if they cross in between layers of the company assets

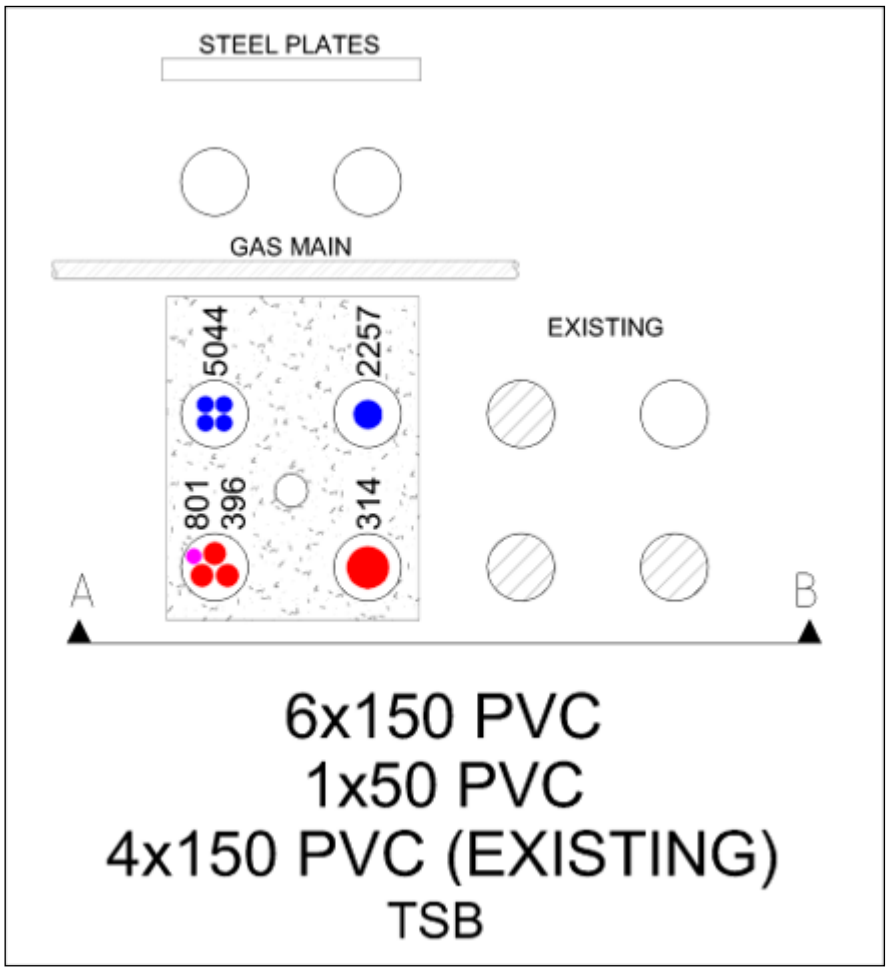


Figure 36 Example cross section

7.1.5 Duct numbering

Where the configuration of conduits changes along a common run, individual ducts should be numbered to show where ducts continue between various cross section diagrams.

Common numbering should only be used to tie together unbroken sections of duct or large transmission projects.

Where multiple cables of the same type continue through various cross sections and the configuration changes, individual cables may be designated with a letter to show continuity. The recommended letters are “X”, “Y”, and “Z”; the letters “A”, “B”, and “C” should not be used except to specify electrical phases. The normal scope for a series of duct numbers or cable letters is limited to the individual field recording, or series of field recordings.

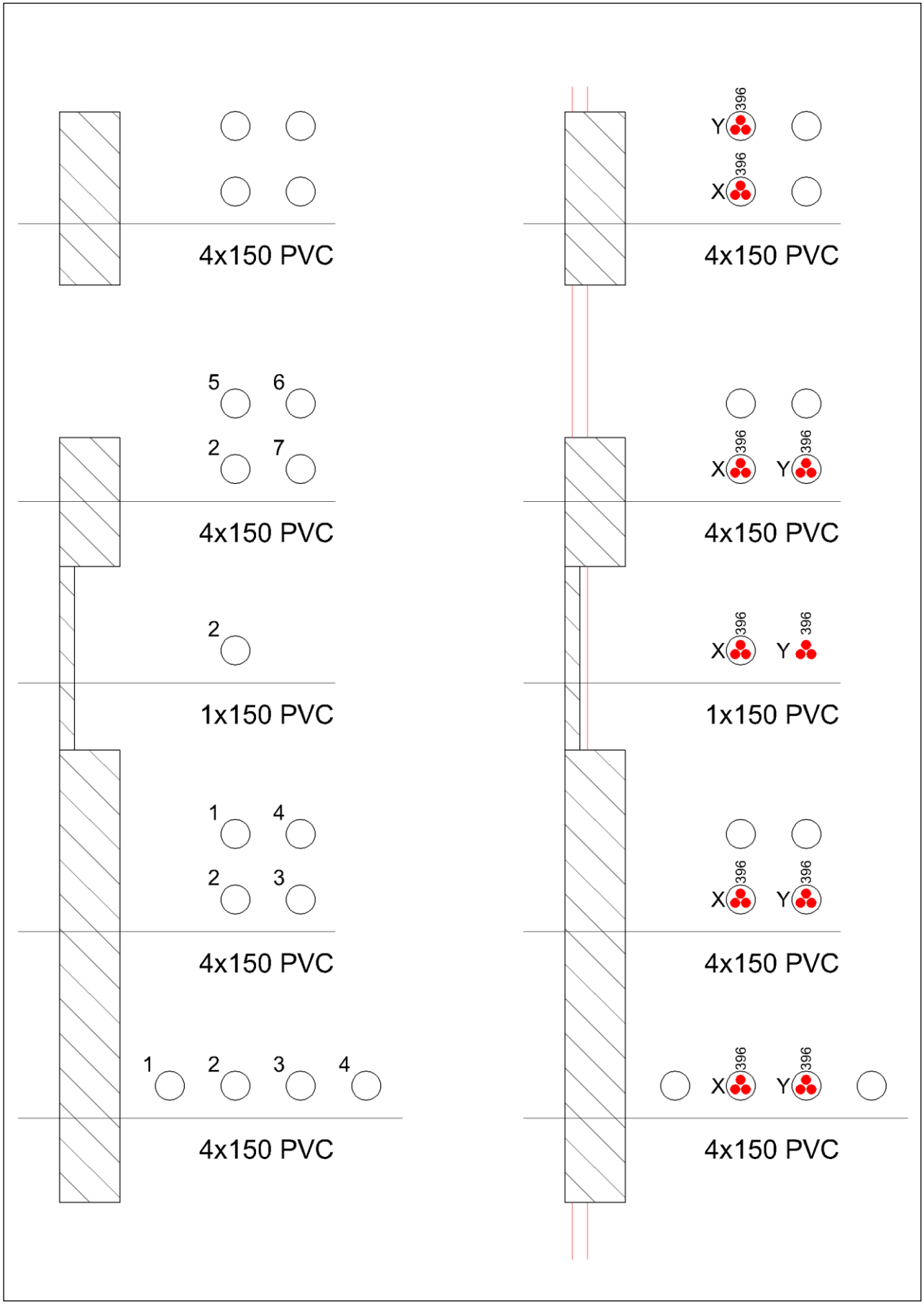


Figure 37 Example of duct numbering and cable letters

7.1.6 Obstructions

Any obstructions (pipes etc) which cross a duct or cable run should be shown on the field recording, indicating whether they are over or under the cable, and their size and cover. Other major obstructions which are visible, such as trees, pits, and access holes should be shown if the ducts or cables change direction to avoid them.

7.1.7 Encasements

Where cables or ducts are supported by a structure, are encased, or have cover altered by excavation or filling, all relevant dimensions must be recorded.

Backfill can comprise of different components and must be recorded in accordance with the company's Network Standard NS 130. Concrete encasement or Thermally Stable Bedding (TSB) must be noted for any relevant cross section diagrams on the field recording. Generally, cable design should not require the use of thermal backfill above the cable warning tapes on distribution projects. It should be noted whether the TSB is only poured to top of conduits or to top of trench.

Thermally Stable Bedding is bedding or backfill material which has been designed to achieve specific thermal characteristics. TSB mix consists of cement, flyash, gravel and sand. It may be also referred to as slump/slurry mix. It appears as a concrete-like substance, poured from the concrete truck onto conduits. During excavations TSB may appear as a weak, unreinforced concrete.

7.1.8 Reduced cover

Reduced cover installations that require steel plates or permanent surface marking such as steel warning plates need to be recorded on the field recording, with measurements defining the extent of the steel plating.

7.1.9 Bore ducts

Trenchless technology for duct or cable-laying is encouraged where local conditions preclude the use of open trenching. PVC or Polyethylene (PE) pressure pipe are used without cover strips. PE pressure pipes differ from the PVC standards in that the pipe sizes are defined by the external diameter rather than the internal diameter. Therefore generally 140mm, 160mm and 180mm PE pipes are used in the bore and should be noted on field recording. When available retrieve a copy of bore log (details the length / depth of the bore profile) from the Person in Charge. Depth of cover must also be noted at ends of bore and show if conduits rotate in bore, provided every conduit is identifiable from each end.

7.1.10 Unsighted ducts and cables

When field crews excavate around existing conduits to install cables or for jointing works, they will commonly expose only those conduits required for the job at hand. This can pose a challenge for the field recorder to determine the full extent of a bank of ducts. Nonetheless, it is the responsibility of the field recorder to correctly identify and record which conduits are associated with the work. When a duct is sighted but continues unbroken through the excavated area it will be impossible (and unnecessary) to determine if the duct contains cables. Any conduits not visually sighted, or with unknown contents, may be indicated as such on the field recording, as shown in the following example.

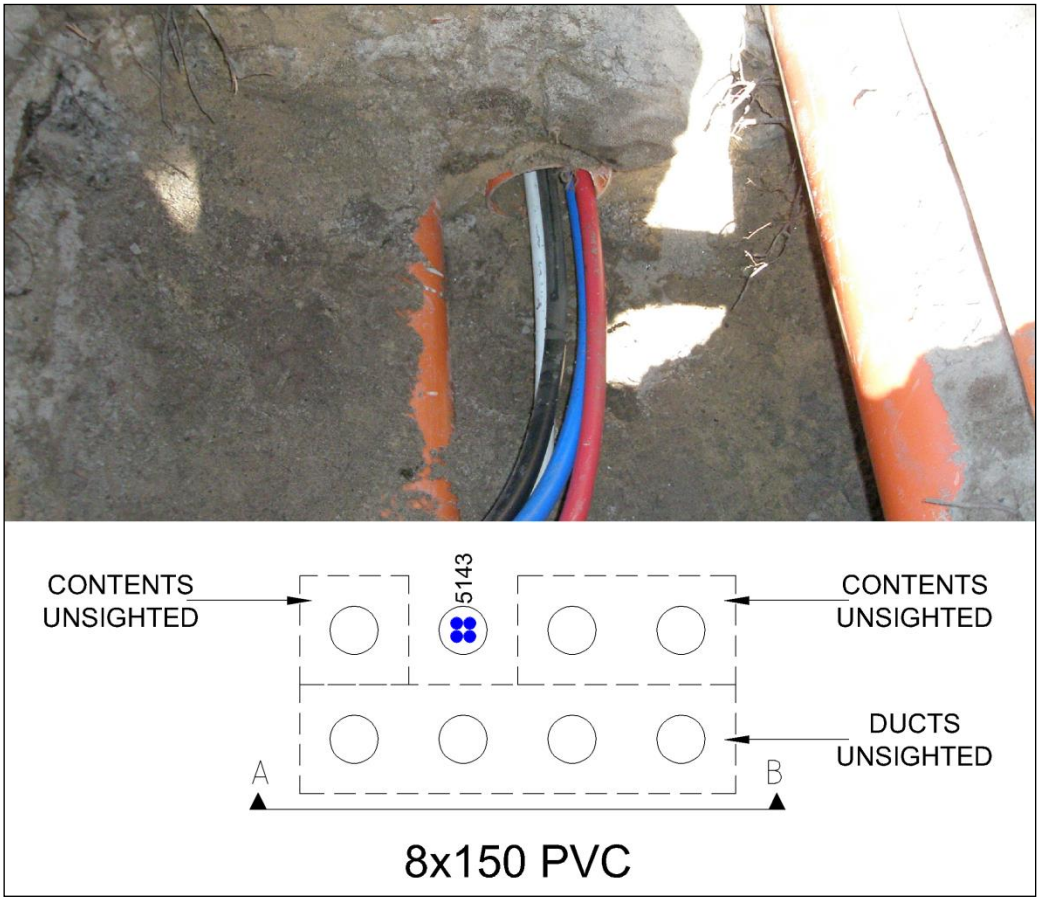


Figure 38 Example of unsighted conduits

7.2 Cable description

7.2.1 General

The word ‘cable’ is used to describe several possibilities. It can refer to a (multicore) cable with separate internal conductors that carry individual electrical phases or a group of single cored cables where each phase is carried on a different cable. In each case, a single line is used to represent all conductors, except where necessary to show separation of individual phases into different conduits. Arrangements described as “double-banked” (multiple conductors per phase) should also be depicted using a separate line for each “bank”.

All cables depicted in a field recording must be labelled with the corresponding cable code.

A list of cable descriptions must be included on the field recording, including the type, size, voltage, quantity, insulating layers, fibre count and code number of all relevant cables. Where the job primarily describes a new cable installation, the cable description should be recorded in the Job Description section if space is available.

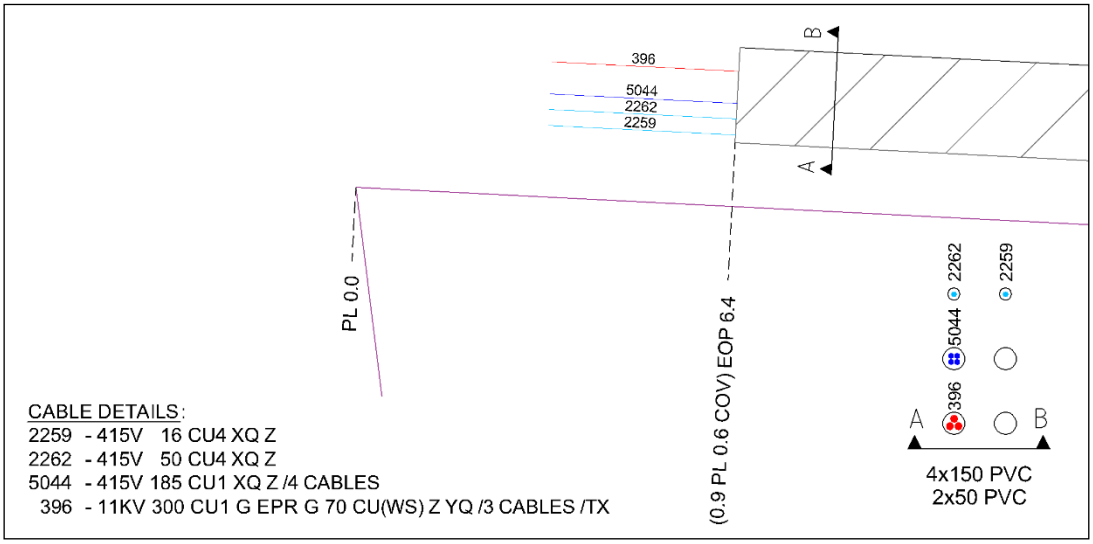


Figure 39 List of cable descriptions

7.2.2 Identifying cables

There are several ways to determine the particular cable type being used in the field.

- For existing cables, referring to existing documentation is a good starting point. The field recorder should take care to validate existing information against the actual cable used.
- Newer cables usually have the full description printed at intervals along the exterior.

Figure 40 Cable details

- When new cable is installed, the cable description may be printed on the cable drum. Note that sometimes the cable sticker may not match the actual cable on the drum.

Figure 41 Cable drum details

See NS100 Annexure C for details of cable construction.

7.3 Joints and Terminations

All new joints and terminations must be measured and recorded. Where the work primarily involves a single joint, the joint description should be detailed in the Job Description section of the field recording. When a number of joints are made as part of a single field recording, they should be designated A, B, C, etc and the description of each detailed on the field recording. All joint descriptions should include (where relevant):

- Joint reference letter;
- Voltage;
- Type of joint/termination (eg STJ, PE, etc);
- Cable codes of relevant cables;
- PL/COV;
- Jointer's name (includes external / school jointers) and company name;
- Date constructed (if different from field recording date); and
- If the joint hole was wet.

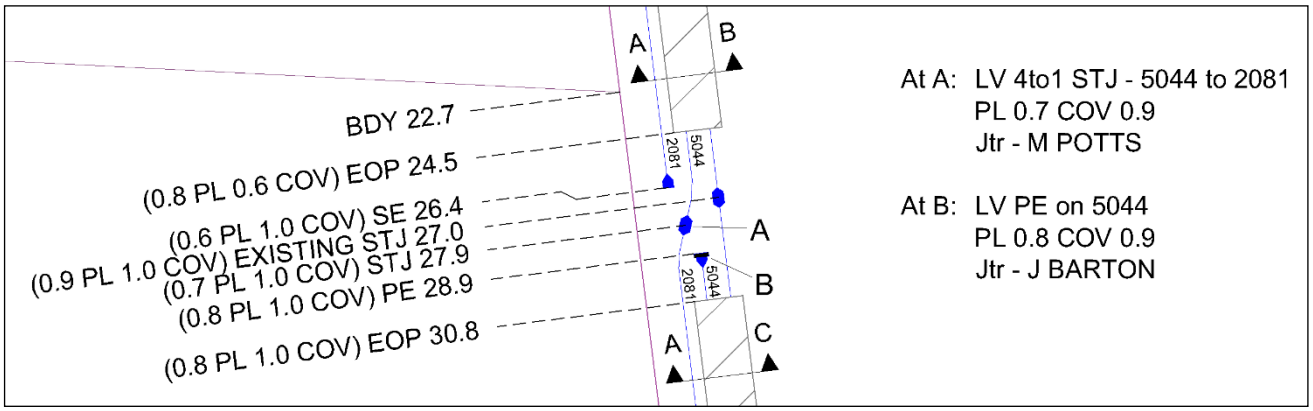


Figure 42 Example of joint bay

Where there are a number of cables in a joint hole their relative position to the jointed cable shall be shown. Alternatively this can be shown using a photograph. Where a jointed cable enters a duct line, the end of pipe should be measured and recorded, and a cross section included identifying the relevant cable. Where there are multiple cables it may be useful to indicate where each cable goes (eg feeder/distributor numbers or pillar/pole number, etc).

When an existing joint is removed, include a note of the FBK number and joint number of the removed joint.

7.3.1 Fire Blankets near Joints in Substation Cable Rooms

When a new joint is to be constructed in the cable room/basement of a zone substation, existing cables (primary and secondary) near the new joint within the zone of influence will have fire protection material (cable blankets) applied to them to minimise the risk of a joint failure damaging adjacent cables or initiating a fire (see NS 171 Firestopping in Substations).

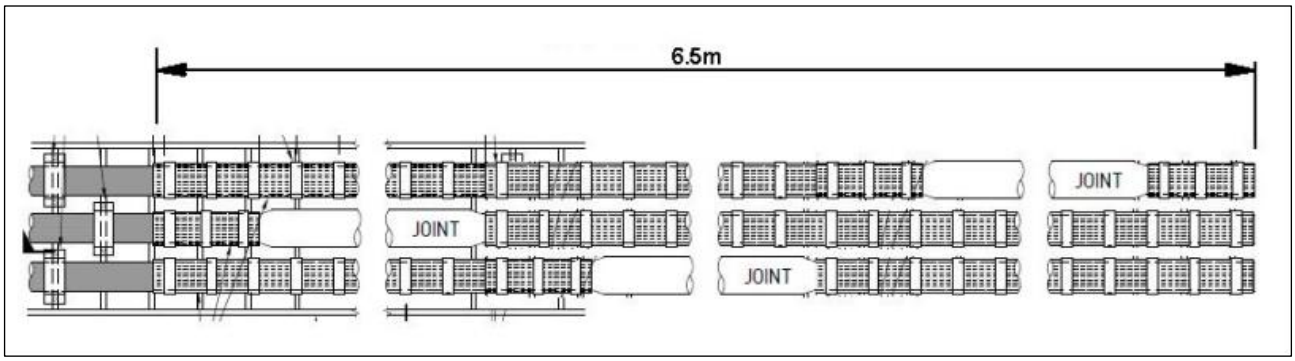


Figure 43 Example of fire blankets wrapping cables in proximity to joints

When recording a joint in the cable room/basement of a zone substation, any nearby cables to which fire blankets are added must be documented as part of the field recording. These neighbouring cables may be laying adjacent and running parallel, laying in cable trays above or below, or even crossing the jointed cable. Information to record includes:

- Visual representation of the covered cables in relation to the jointed cable;
- Dimensions to show the extent of the fire blankets;
- Feeder details for covered cables; and
- Type of blankets or thermal resistivity of the blankets (if known).

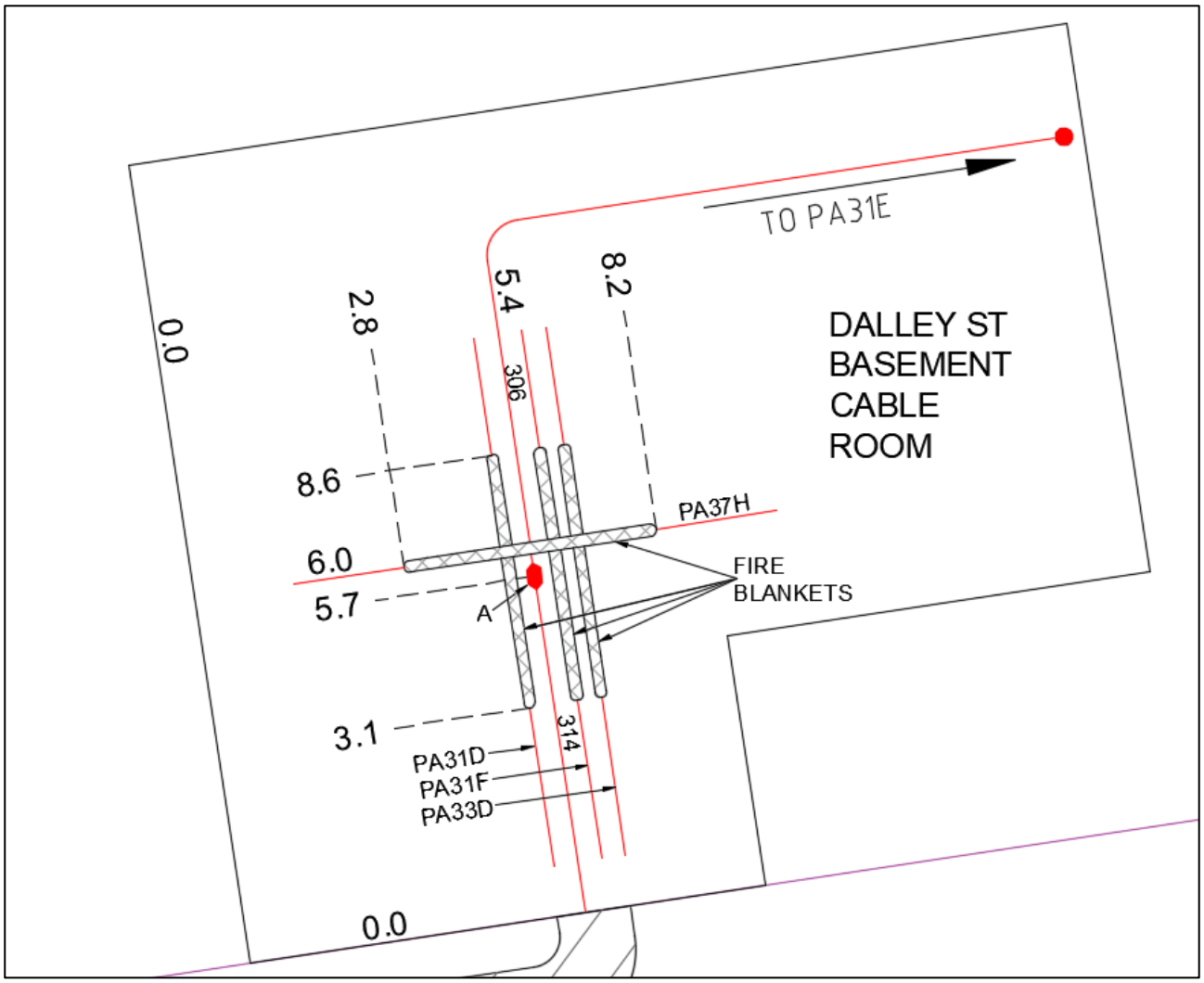


Figure 44 Example recording of fire blankets

7.4 Pits

7.4.1 General

Pits are permanent underground structures that allow access to cables, ducts and joints without the need for excavation. Due to the unique nature of pits, the requirements for field recording in a pit are slightly different than is normally the case.

7.4.2 Location of pit

Pits should be connected to the nearest cross street by running measurement and also by PL offset measurement. The centre line of the pit must be located in each case. The depth from the surface to the bottom of the pit should also be recorded.

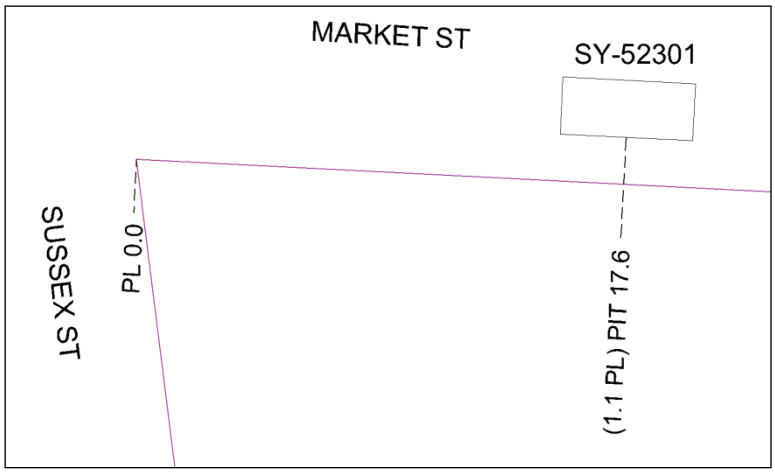


Figure 45 Pit location overview

7.4.3 Construction of new pits

When the installation of a pit is being recorded, the detail of the pit should be recorded and an exploded view entered on the field recording. The shape of the pit should be shown in the diagram, including the measurements for the external bounds and depth of the pit. The relative location of all entry hatches should also be shown.

All existing groups (banks) of conduits and cables entering or passing through the pit should be shown on the correct wall of the pit diagram, in relative position to each other. The upper level (cover) of each group of ducts should be recorded together with the size and type of all ducts.

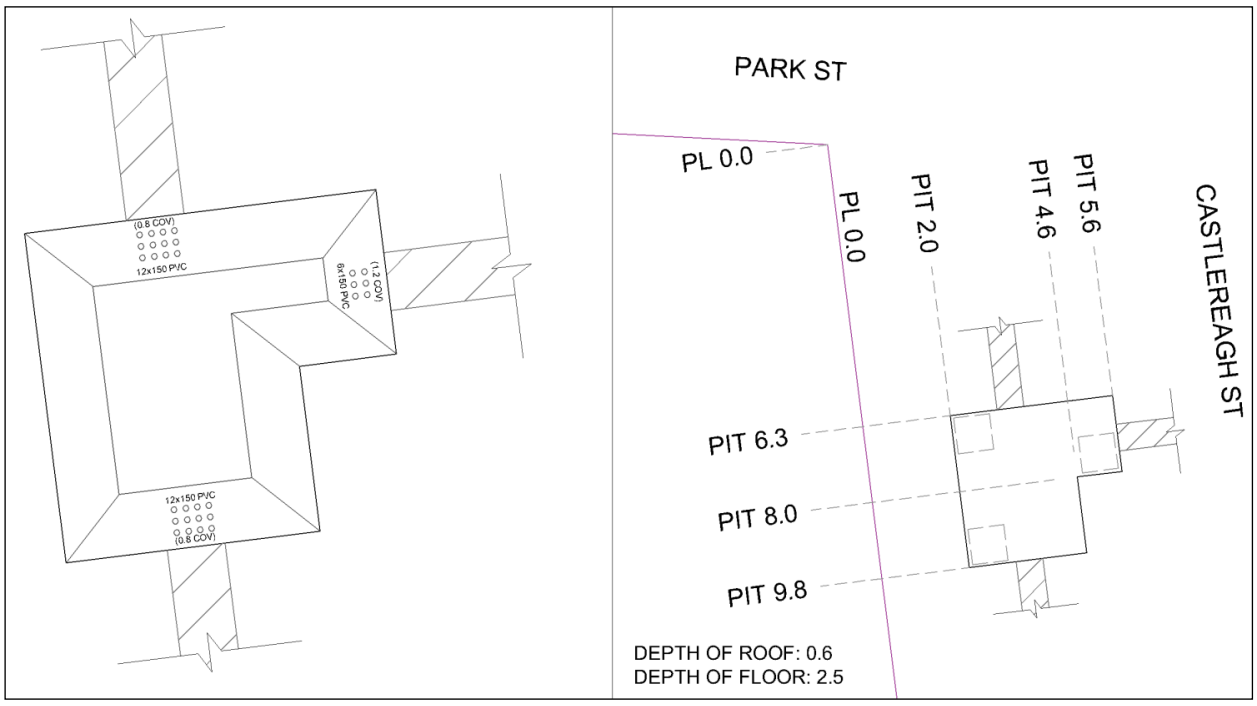


Figure 46 Recording of pit construction

7.4.4 Recording in established pits

In all cases of recording in an existing pit, it is necessary to depict the shape of the pit, pit walls and all existing conduit arrangements in relative position and size. Other existing assets are not usually

required to be shown unless they become part of the current work being carried out. The overall location of the pit should be recorded as described in making measurements section.

Where new ducts enter the pit, the size, material, quantity, and arrangement of the new ducts should be shown in relation to existing ducts in the pit wall. The cover over the ducts should also be recorded.

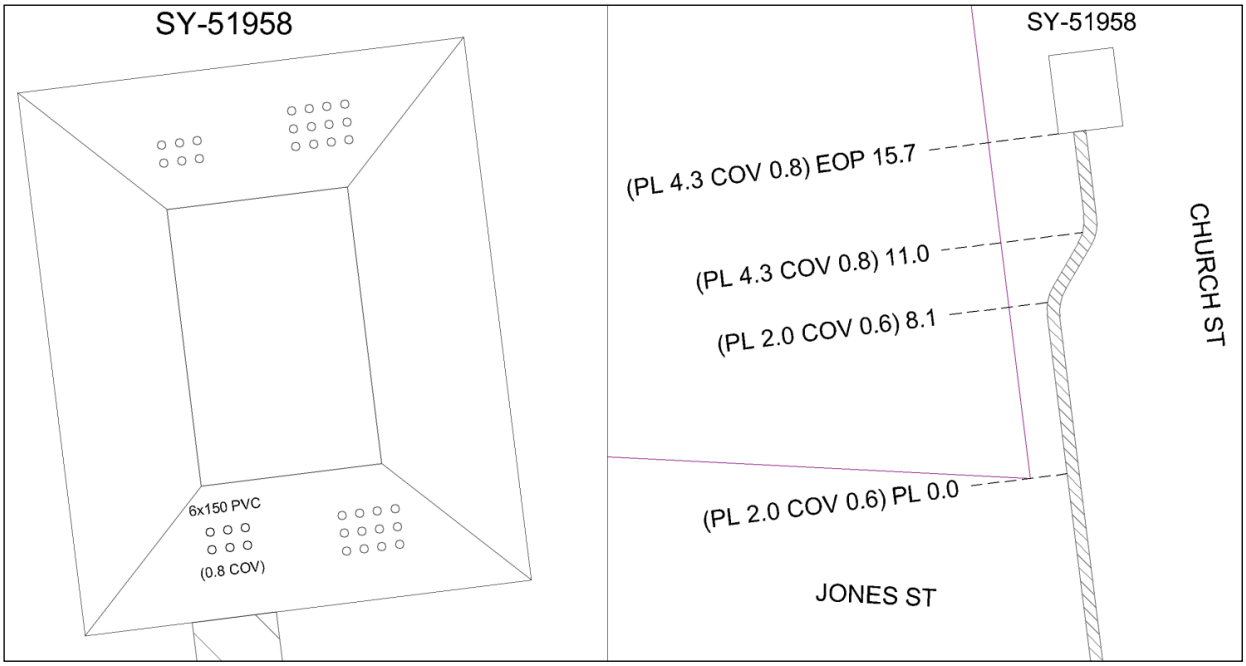


Figure 47 New ducts enter existing pit

Where jointing works (joints, terminations and cut cables) are carried out in a pit, it is not required to record dimensions such as chainage, PL offset or cover. Instead it is necessary to identify the relevant cable(s), and which ducts or holes the cables pass through when entering and exiting the pit. The joint description should be recorded .Existing joints on the relevant cables must also be shown, in the correct order along the cable.

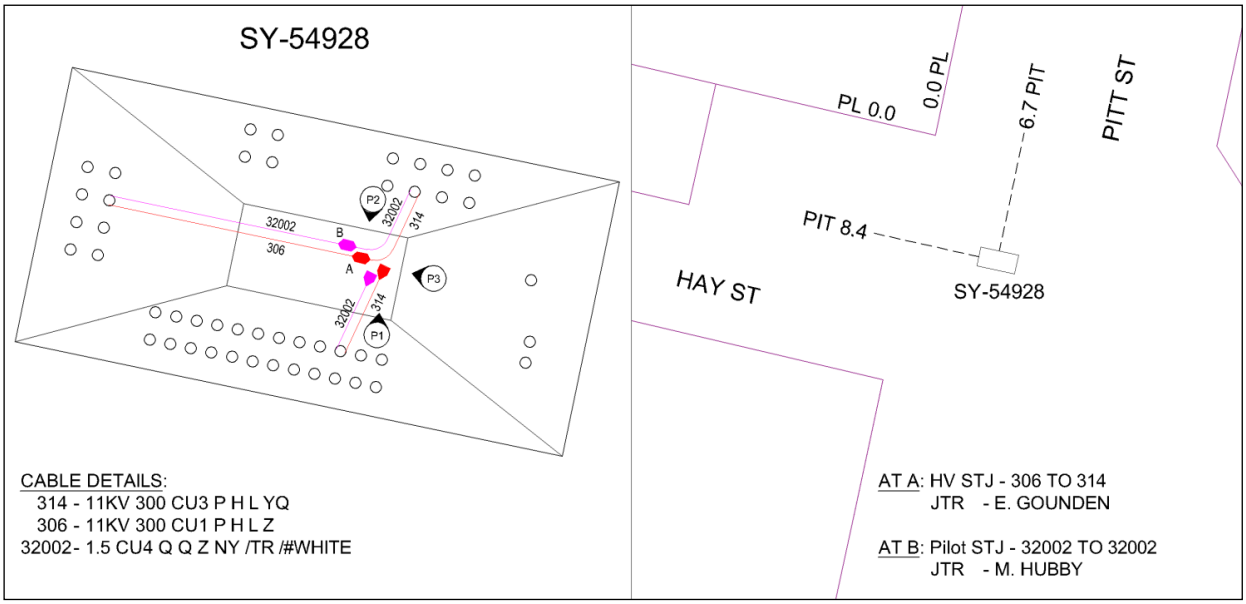


Figure 48 Jointing works in existing pit

Where new cables are pulled into or through the pit, particular care should be taken to show exactly which duct(s) the cable passes through. In the case of direct buried cables, the position at which the cable passes through the wall should be recorded, relative to other features in that wall. It is not necessary to measure or record the exact path of a cable through a pit. The cable description should be recorded as detailed in transmission cables section.

Where a pit is prone to flooding and contains excessive water, asbestos or faulty joints/cables, the hazard should be noted on the field recording. Any safety hazards identified (eg those previously mentioned, unsafe ladders, syringes, etc) should be reported and dealt with according to the proper procedures.

7.4.5 Multi-level pits

Some large pits have multiple internal levels. Where this is the case, each level should be drawn inside the layer above it as shown in the following diagram. Each set of ducts should be shown in relative position on the correct level.

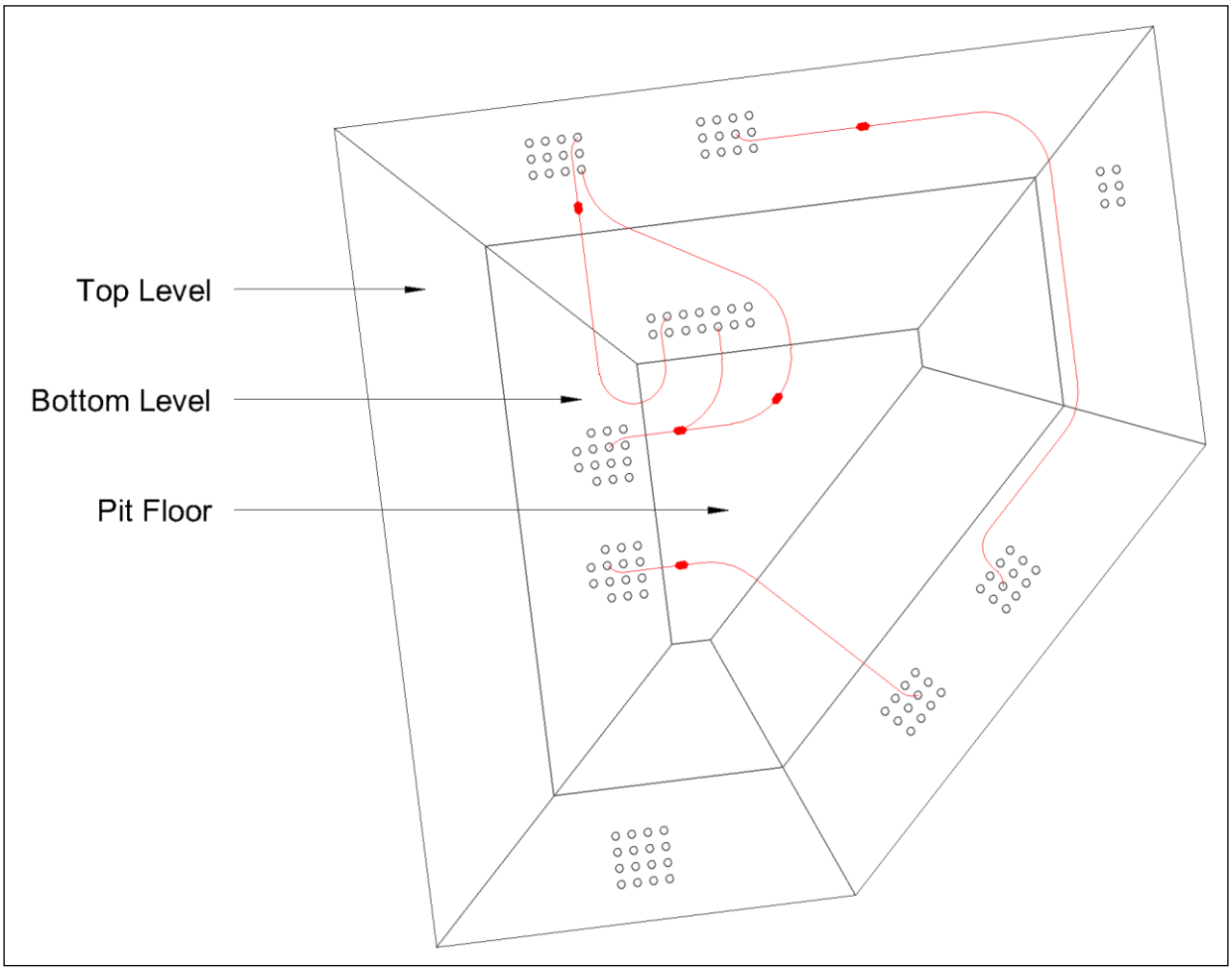


Figure 49 Multi-level pit diagram

7.5 Pillars

Pillars are part of the low voltage underground network and are used in both residential and commercial areas. Company owned pillars can be found on footpaths or on easements in private property. Pillars are used for isolation and switching, as a connection point for services, and street lighting control points. Although they all work in similar ways, there are many different types of pillars:

- Distribution pillar
- Town pillar
- Commercial pillar
- Bathtub
- Fargo
- Feeder
- SL cubicle
- SL pillar
- Pillar standard
- Olympic standard

When recording pillars, the following information should be included:

- The pillar location (measured to the centre of the pillar)
- The pillar number

Additionally, where a pillar contains any links or more than one LV Mains cable:

- A diagram of the internals arrangement, including arrangement of links and cable connections
- A photo of the internal arrangement
- Pillar switch number if applicable
- An indication of where each connected cable leads (eg next pillar, substation, etc.)

The pillar internal diagram should be oriented vertically or horizontally to match the actual pillar arrangement as it exists in the field. If internal connections have not been constructed at the time of recording, it may be applicable to contact the project supervisor to determine the configuration.

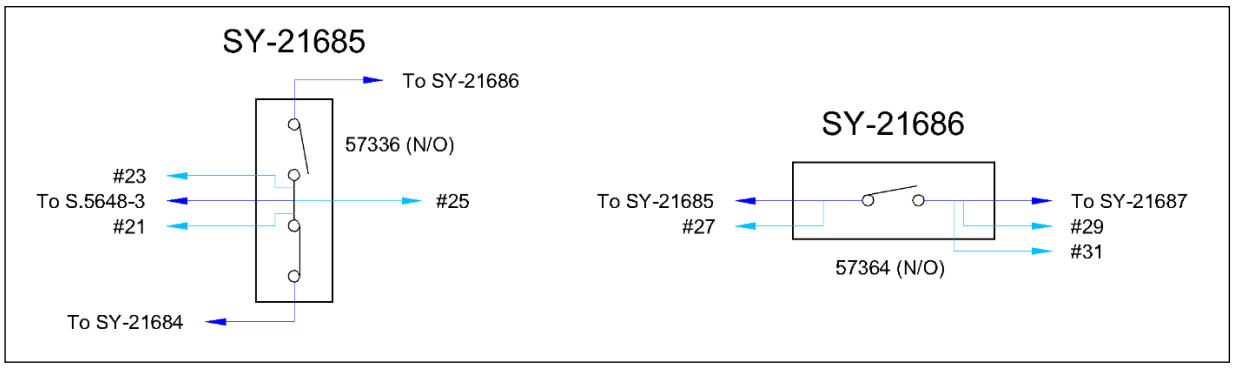


Figure 50 Example of double link and single link pillar diagrams

Figure 51 Double links - vertically aligned

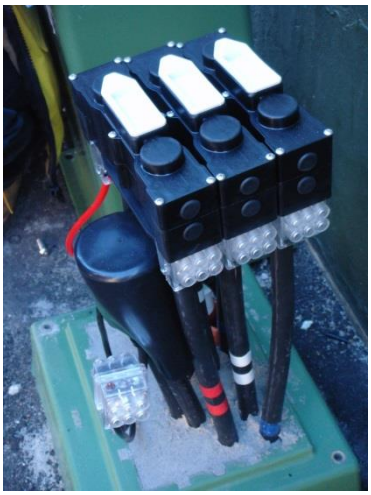


Figure 52 Single link – horizontally aligned

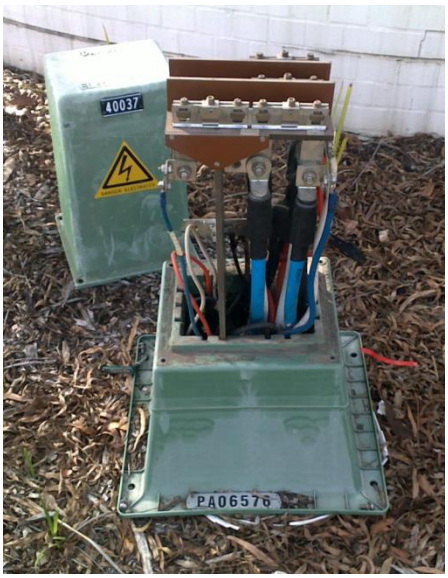


Figure 53 Double links – horizontally aligned

Figure 54 Double link – Town pillar

7.6 Link boxes

An Underground Link Box is a low voltage cable junction box that incorporates removable links for network alterations, or isolating cables without impacting other parts of the network.

The following should be recorded by the field recorder while out on the field site:

- The Link Box location (centre of the link box)
- Link Box number
- Diagram and photo of the internal arrangement (switch numbers)
- Open links
- Immediate lay of cables connected to each switch
- Next connected asset along each cable

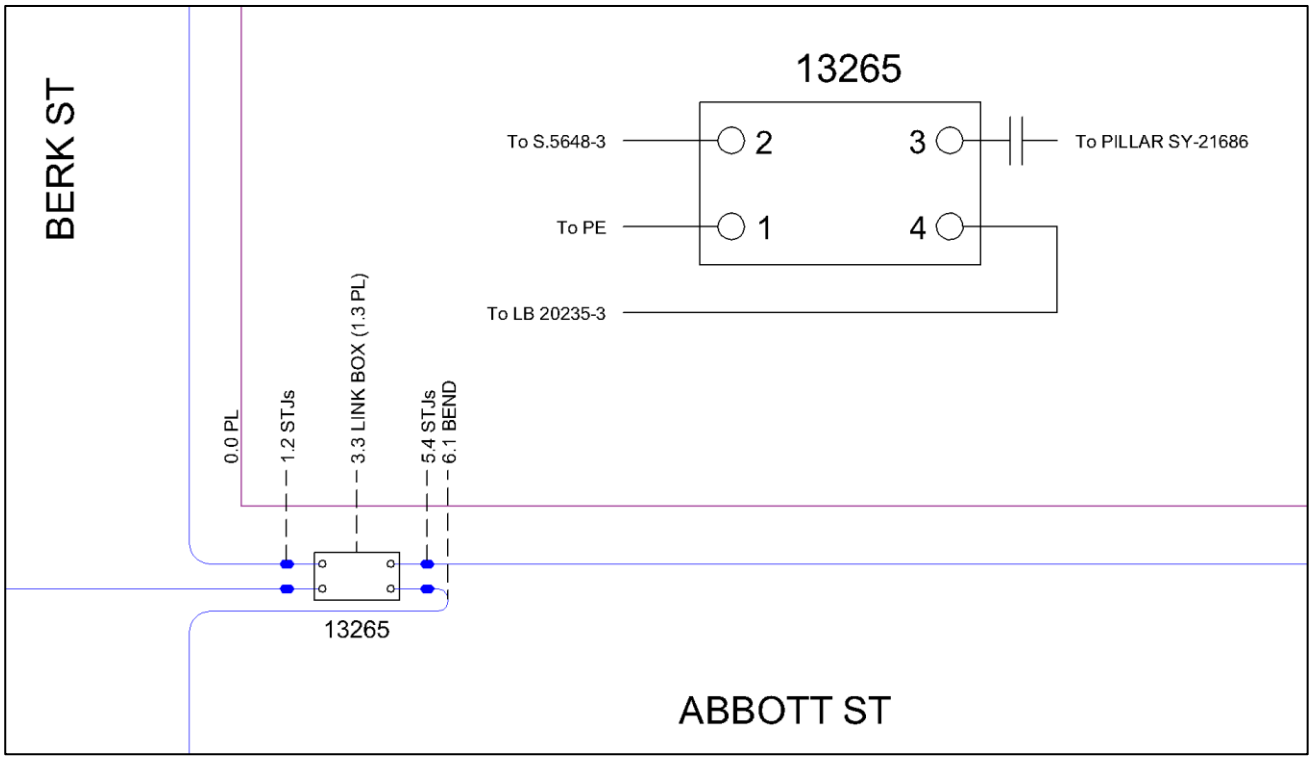


Figure 55 4-way link box

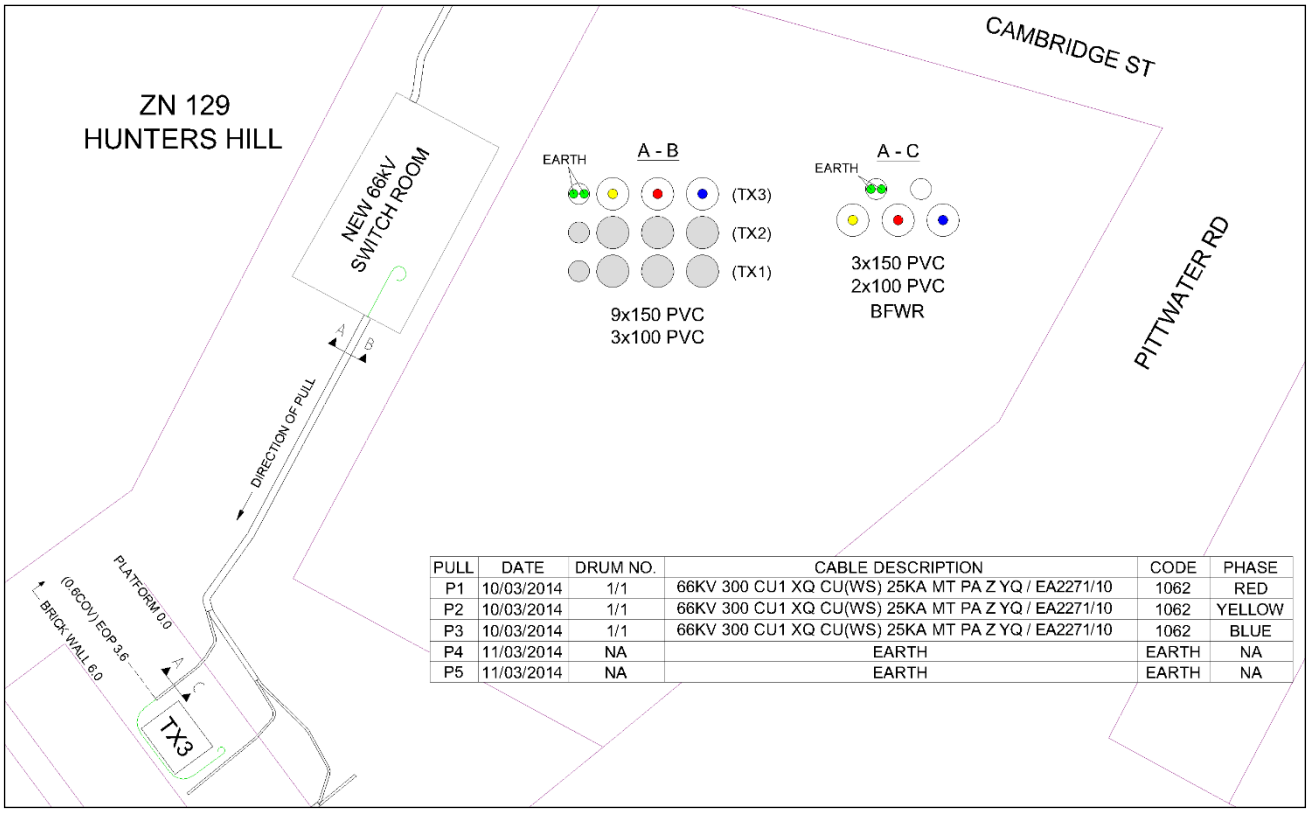
7.7 Transmission assets

7.7.1 General

Sub-transmission cables and assets require some additional information to be recorded, such as the direction of the cable pull, makers name, the drum number, specification number and contract number of the cable, the feeder number and spacing between the dual 132KV circuits.

7.7.2 Transmission cables

The size and type of cable, maker's name, the drum number and specification number are all shown on the cable drum. In addition, the specification number is also printed on the fabric tape which is located under the sheathing of the individual core of the cable. The jointer can see the specific number when the cores are stripped back during the jointing process. This information should be photographed, noted and added to the field recording in the form of table, an example of which is shown below. The direction of the cable should also be noted and transposed on to the field book.



PULL	DATE	DRUM NO.	CABLE DESCRIPTION	CODE	PHASE
P1	10/03/2014	1/1	66KV 300 CU1 XQ CU(WS) 25KA MT PA Z YQ / EA2271/10	1062	RED
P2	10/03/2014	1/1	66KV 300 CU1 XQ CU(WS) 25KA MT PA Z YQ / EA2271/10	1062	YELLOW
P3	10/03/2014	1/1	66KV 300 CU1 XQ CU(WS) 25KA MT PA Z YQ / EA2271/10	1062	BLUE
P4	11/03/2014	NA	EARTH	EARTH	NA
P5	11/03/2014	NA	EARTH	EARTH	NA

Figure 56 Drum details and direction of pull

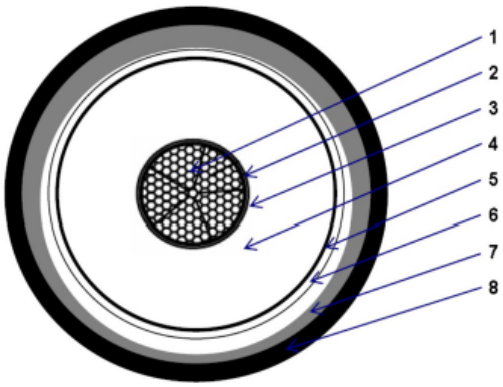
(Internal Process) Check RIC to ensure the cable on the drum is entered; in particular ensure the contract number matches. If there is not an exact match, source the cable specification information (see example below) from the project manager and forward the details to the company's ratings team. A new cable code and description will be raised in RIC and, in turn, the GIS.

132kV 1600mm² COPPER MILLIKEN CIRCLE CONDUCTOR WB

XLPE INSULATED CORRUGATED AL SHEATH POLYMER SERVING

Electrical stress，3.3-5.52kV/mm

1.CABLE CROSS-SECTIONAL DRAWING



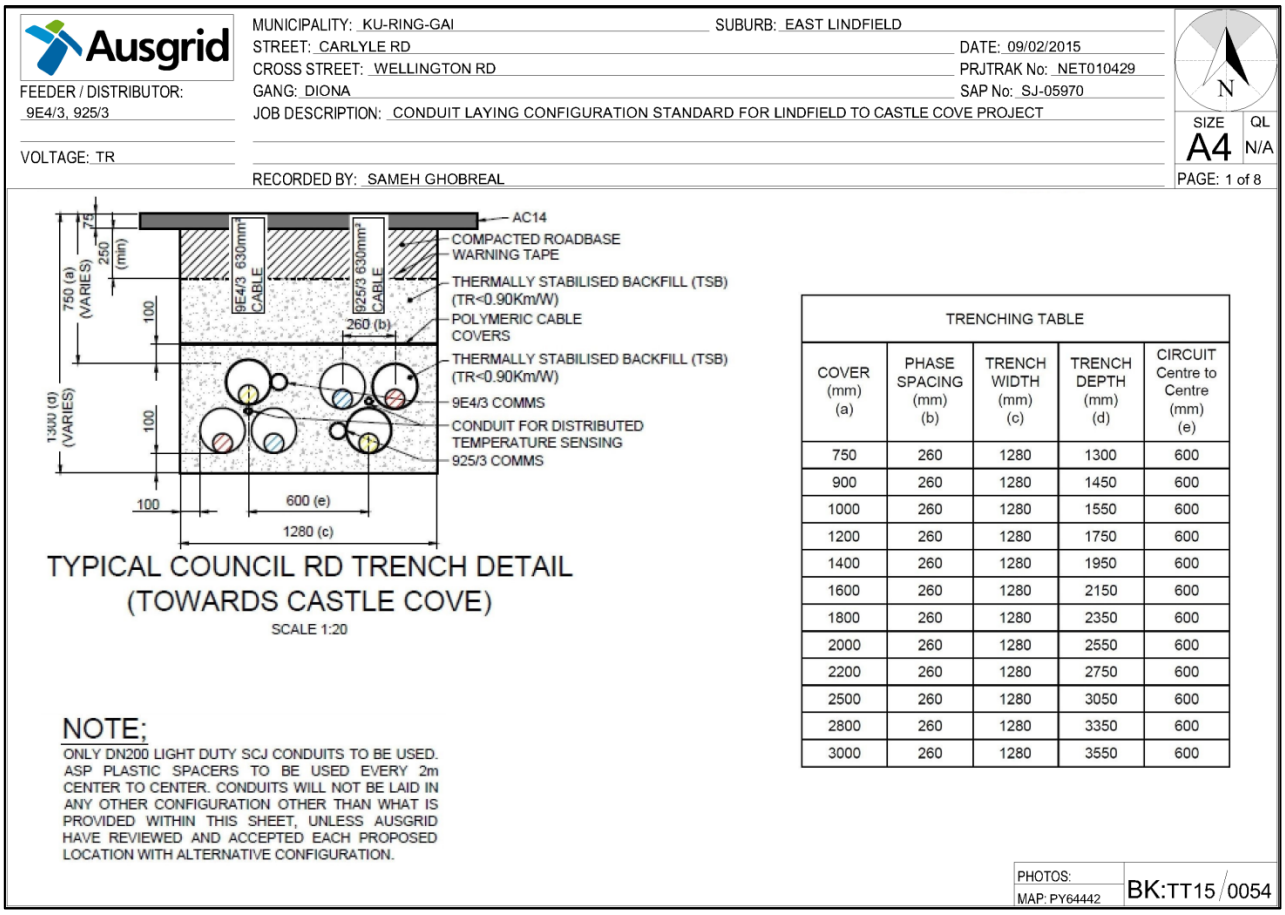
2.DIMENSION

Item	Compenent	Nominal Thickness mm	Nominal Diameter mm	Details
1	Conductor		48.8	Copper,5 segments,circle with water blocking tape
2	Binder	0.9	50.6	Semi Conductive water blocking tape
3	Conductor Screen	1.5	53.6	Semi conductive polymer
4	Insulation	18.0	89.6	XLPE
5	Insulation Screen	1.0	91.6	Semi conductive polymer
6	Watertight Swellable Tape	3.0	97.6	S/C water swellable cushion tape
7	Metal Sheath	2.0	113.8	Corrugated Al sheath+Bitumen
8	Outer Sheath	4.2	122.2	HDPE，BK+graphite

Figure 57 Cable specification information

7.7.3 132kV feeder separation

The recording of spacing for the 132kV dual circuits is required for the ratings group for their calculations. The spacing will be decided at the design stage and is generally around 0.6 meters from the centre of each circuit. The design for the feeder configuration should be acquired, then the information should be transferred on to a field book (see example TT15 -0054) and referenced in subsequent field books .Any variation from the separation specified on the plan needs to be noted and shown on the field recording. The backfill material is also critical information and should be noted. Generally this will be TSB (Brand name FTB also allowable); any variation of this should be noted and recorded.



TRENCHING TABLE

COVER (mm) (a)	PHASE SPACING (mm) (b)	TRENCH WIDTH (mm) (c)	TRENCH DEPTH (mm) (d)	CIRCUIT Centre to Centre (mm) (e)
750	260	1280	1300	600
900	260	1280	1450	600
1000	260	1280	1550	600
1200	260	1280	1750	600
1400	260	1280	1950	600
1600	260	1280	2150	600
1800	260	1280	2350	600
2000	260	1280	2550	600
2200	260	1280	2750	600
2500	260	1280	3050	600
2800	260	1280	3350	600
3000	260	1280	3550	600

Figure 58 Feeder separation

7.7.4 Transmission pilots

All sub-transmission feeders, their related pilots and fibres are numbered in the GIS and on the plans (eg Fdr 334, Pilot 334 and FOU 30095). When joints and splices are being made on these cables it is important that the recorder ascertain the numbers of the cables, so that they can be identified on the plan. This applies equally to the reconditioning of joints.

In the case of out-of-service cables being jointed to make up new feeders the field recorder should state for example the feeder number that was cut (eg Fdr 333) and jointed to form feeder number (eg Fdr 334). This information is important and will be used to populate the X Feeder attribute in the GIS.

7.7.5 Transmission joints

Additional information is also required for a transmission joint bay and that needs to be noted and added to the field recording. Items include link box pits, fibre pits, bonding leads, earth cables fibre conduit, and fibre cable. It is critical that the correct cable code and phasing is noted in the joint bay.

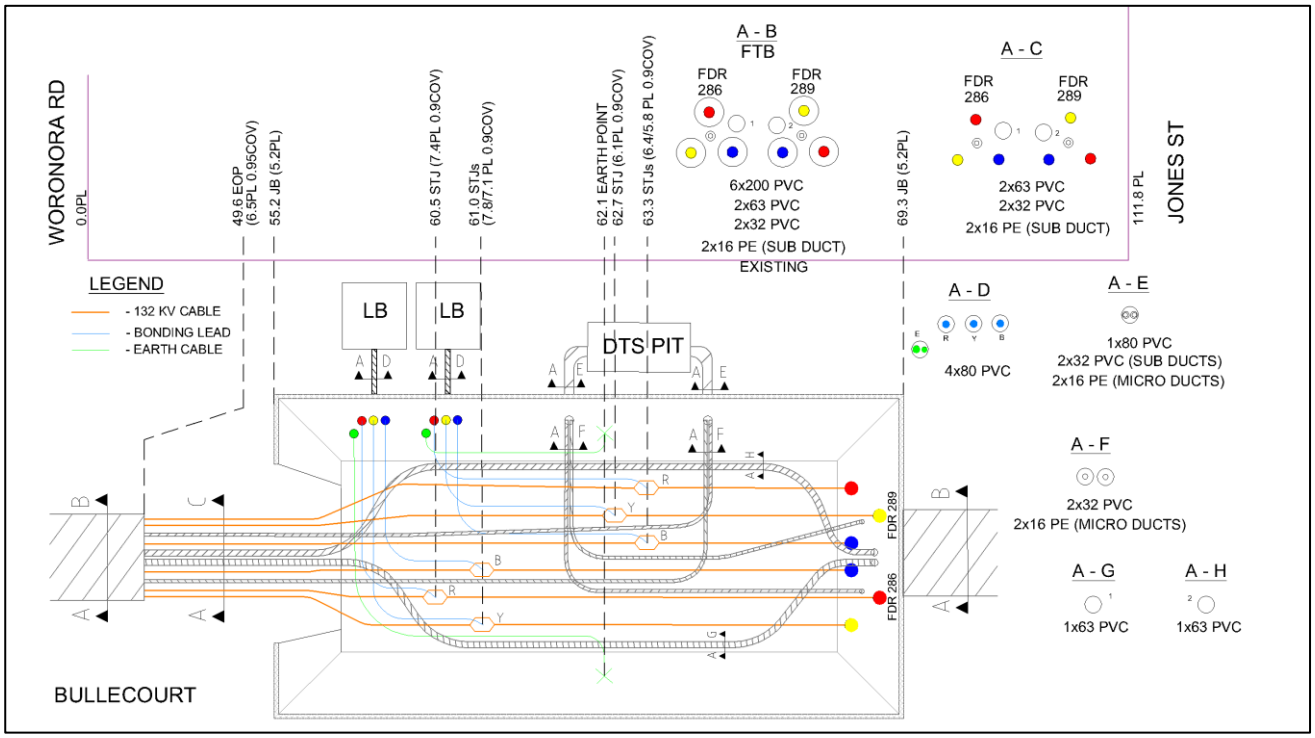


Figure 59 Example of a 132 kV joint bay

7.8 Private assets

7.8.1 General

Private assets are those that are connected to the company's network but are privately owned. Examples include, but are not limited to, pillars, poles and pits.

It is important to identify privately owned assets in the company's GIS to prevent any unnecessary field maintenance (unless under an external business agreement) or unnecessary GIS data capture maintenance. In addition to this it is good practice to record such assets (including dimensions) as this data can be quite valuable especially in cases of unplanned outages and also at the planning stage.

7.8.2 Private poles

Private poles may include service poles, WIMAX towers or Telstra poles that have the company's network connected to it. The dimensions of private poles should be recorded especially where such assets are on public land. Poles which are located on private property (eg private service pole in a front yard) do not require dimensions but should be shown on the field recording in their relative position.

7.8.3 Private pillars

Where it is safe, dimensions for private pillars must be recorded. Private pillars will usually be on private property but unlike poles their location may be obscured by vegetation, fences or other land feature. Internals for private pillars do not need to be recorded.

7.8.4 Private pits

Private pits are generally an access point relating to other private assets such as WIMAX towers, RMS boxes, phone booths or street furniture. Where the job involves such assets (eg service joints for street furniture) then the pit and its location must also be recorded.

7.8.5 Third Party Fibre assets

Third party fibre assets that interact with company assets, such as a communications provider's private fibre cable running through company conduits or pits, must be recorded. The recording

should indicate the ownership of each asset for clarification and follow the standards listed within *NS100 Field Recording of Network Assets*.

Third party assets that do *not* interact with company assets do not need to be recorded but may be referenced on field recordings if their location improves locating company assets and/or is a safety risk if not documented.

7.8.6 Other private assets

When recording work that relates to private assets such as RMS boxes, phone booths or street furniture (bus stops) it is important to also record the location of these assets. While not all of these private assets will be captured in the GIS, the information shown on the field book can be helpful to field employees.

8.0 ADMINISTRATION

8.1 Photographs

8.1.1 General

All field recordings must be accompanied by supporting photographs.

Photos are useful for relocating work and verifying that details such as Property Lines have not changed. Photos can assist with solving ambiguity and can show many details that are not necessarily recorded on the field recording.

Field recordings may be rejected if mandatory photographs have not been provided, and/or are unclear or do not indicate the subject.

8.1.2 Requirements for photographs

Photographs must be of sufficient visual quality that relevant features are clearly visible. It may be necessary to use flash photography at night or in dark areas. Care must also be taken to ensure photographs are well focused and at an appropriate zoom level. As a matter of courtesy, advise people on-site when taking photographs – especially when flash is required.

8.1.3 Subjects to photograph

One or more photos should show an over view of the work area to show each detail area in relation to the job as a whole, and to show the work area in relation to surrounding landmarks, such as property lines.

In addition to providing an overview, photographs must be used to show particular details.

Relevant detail areas include (but are not limited to):

- Duct and cable configurations;
- Cable joint or cable lay in relation to surrounding cables or assets;
- Pit walls, showing banks of ducts and the paths of cables (to the extent possible);
- Pillar and link box internal configurations;
- Origin point used in dimensions;
- Extended property lines used to establish an origin;
- Where major assets cross over or near company assets;
- Other assets with relevance to the work being done;
- Cable internal (cut end showing cable composition);
- Cable drum or cable type details;
- Asset numbers for relevant assets; and
- Substations internal configurations (HV and LV Switchgear connections and types, and Transformer details). See Annexure M, N and O for examples. In particular include:
    - > Substation overview (including number);
    - > HV switchgear overview;

> HV switchgear nameplate;
> Transformer details;
> Transformer serial number;
> Transformer nameplate;
> Painted transformer T number;
> Transformer tap changer handle;
> LV switchgear overview;
> LV switchgear nameplate:
> LV distribution management and control; and
> LV switchgear detail.

8.2 AutoCAD

8.2.1 General

Field recordings created in AutoCAD should meet the required standards for consistency and quality.

8.2.2 Standard symbols

Standard symbols for proposed and existing assets must be used for all field recordings.

Standard symbols and their correct layer and colour assignment are shown in NET CAD Tool Palettes and the Object Styles page of the GIS Field Book Template (AutoCAD), as well as NS100 Annexure B.

8.2.3 Import / export (Internal Process)

It is preferable that drawings produced using AutoCAD should be geo-referenced and drawn to scale in order that new objects may be electronically loaded into the GIS. Land base and existing assets may be exported from Scout, Smallworld, or WebGIS as a starting point for creating a geo-referenced drawing file.

All new objects intended for auto-loading into Smallworld must be on correctly named proposed layers, as per the NET CAD standard. Applicable objects should include attached attributes (such as cable codes for proposed cables) to assist eCapture.

8.2.4 Drawing line styles and weights

Standard line styles and line weights are set up on assigned layers in GIS Field Book Template. Standard line styles and weights are to be used on all field recordings produced with AutoCAD.

8.2.5 Font style and sizes

All labels and annotations must be scaled so as to be legible. Text should fall into three size categories as defined in All Text must be Arial font, as required by the company Rebrand Team. Place holder text is available on the GIS Field Book Template.

8.2.6 Standard CAD drawing templates

8.2.6.1 General

The GIS Field Book Template is to be used for all field recordings produced using AutoCAD.

8.2.6.2 Output Format (Internal Process)

Field recordings are to be printed as colour PNG files, for use with the WebGIS metadata portal. If a paper copy is required, it should be printed from the PNG file, not directly from AutoCAD.

The current version of the GIS Field Book Template can be found at:

G:\GIS_Maintenance\Field Books\CAD Fieldbook Template

8.2.6.3 Output Format (External Process)

Field recordings are to be produced as colour PDF files including all associated photographs as subsequent pages in the same file.

The current version of the GIS Field Book Template is available in the Accredited Service Provider page of the company website (Ausgrid.com.au)

8.2.7 Drawing sheet sizes

Field recordings may be drawn on A3 or A4 paper sizes, in landscape or portrait orientation as appropriate.

8.3 Archiving/storage of field recordings and photos

8.3.1 General

All field recordings and associated photographs must be stored electronically on the company's network drives and on the Technical Drawing Management System (TDMS).

8.3.2 Field book numbering

8.3.2.1 General

A Field Book is the collection of all numbered field recordings associated with a given project. Each Field Book has a seven character name consisting of the SAP project number.

Each individual field recording is assigned the first available number within the project's Field Book and named by a combination of its owning Field Book number followed by a hyphen and then its individual page number eg SC02315-1.

8.3.2.2 Storage of files (Internal Process)

All field recordings are stored in the appropriate region/year directory under:

G:\GIS_Maintenance\Field Books\

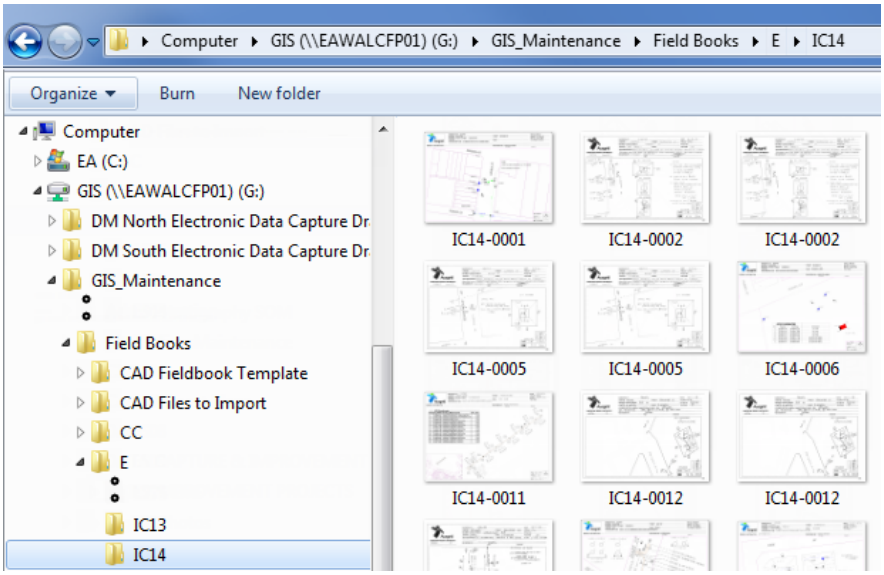


Figure 60 Example: Inner city 2014 – IC14

8.3.3 Photograph numbering (Internal Process)

8.3.3.1 General

Each photograph associated with a field recording is named using the field recording number, followed by a hyphen and a sequential photograph number eg SC02315-1-1

8.3.3.2 Storage of files

All photographs are stored in the appropriate region/year directory under:

G:\GIS_Maintenance\Digital Photos\

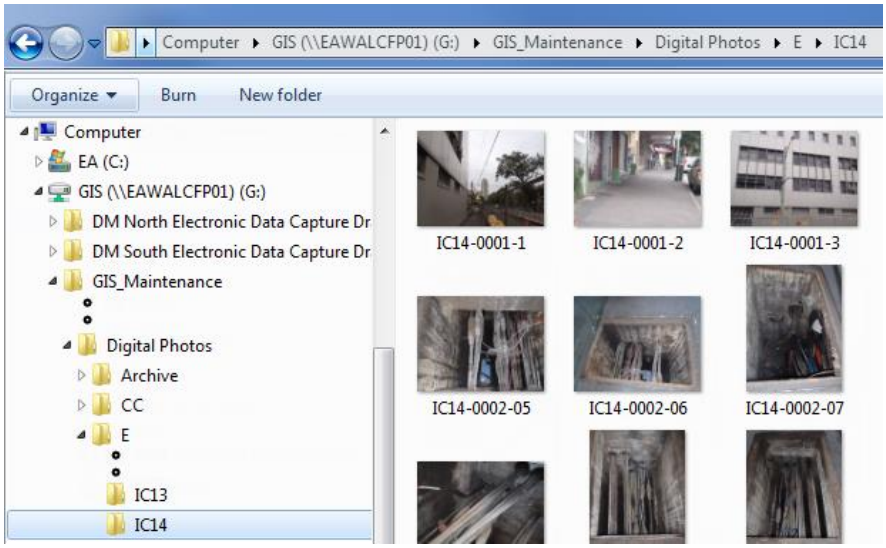


Figure 61 Example: Inner city 2014 – IC14

8.3.4 PrjTrak (Internal Process)

Each field recording should be entered into PrjTrak under the appropriate project or map sheet. A guide to using the PrjTrak software may be found on Balin:

http://balin.energy.com.au/techpub/software%20applications%20user%20guides/scout%20and%20prjtrak%20manuals/prjtrak%20mod%20c.pdf

8.3.5 Metadata

8.3.5.1 General

Producing metadata is the final step in the field recording process and should be done once the field recording is complete and is ready to be submitted for capture. The metadata process consists of attaching the supplemental material (eg photographs) to the field recording.

8.3.5.2 Metadata (Internal Process)

Creating the metadata using the WebGIS Fieldbook Uploader publishes the field recording and associated photos in TDMS, where they may be viewed by all company employees. It is important that this step occurs as it creates the version of the field recording that is used for all future references.

If the field recording is amended at any time, the Metadata process must be repeated so that TDMS contains the corrected version.

See *Annexure G* for the FB Uploading procedure.

8.3.5.3 Metadata (External Process)

The field recording, associated photographs and any additional sheets (such as bore logs) must be packaged into a single PDF file for submission to Data Maintenance. The field recording must be

the first page in the file. Photos and additional sheets must be individually labelled with the field recording number. Photos must also be individually labelled with the photo number and the date it was taken (which may differ from the date on the field recording.

Figure 62 Example: Labelling of photo

8.4 Mobile device field recording (internal process)

Field recording via a mobile device such as a computer tablet is an acceptable method of conducting field recording for company employees. The mobile device must have current access to Network Viewer (a GE product allowing offsite access to GIS data) and the accompanying sketching tools.
The process is expected to create a “mud map” (draft) for the final field book to then be completed to standard back in the office if required.

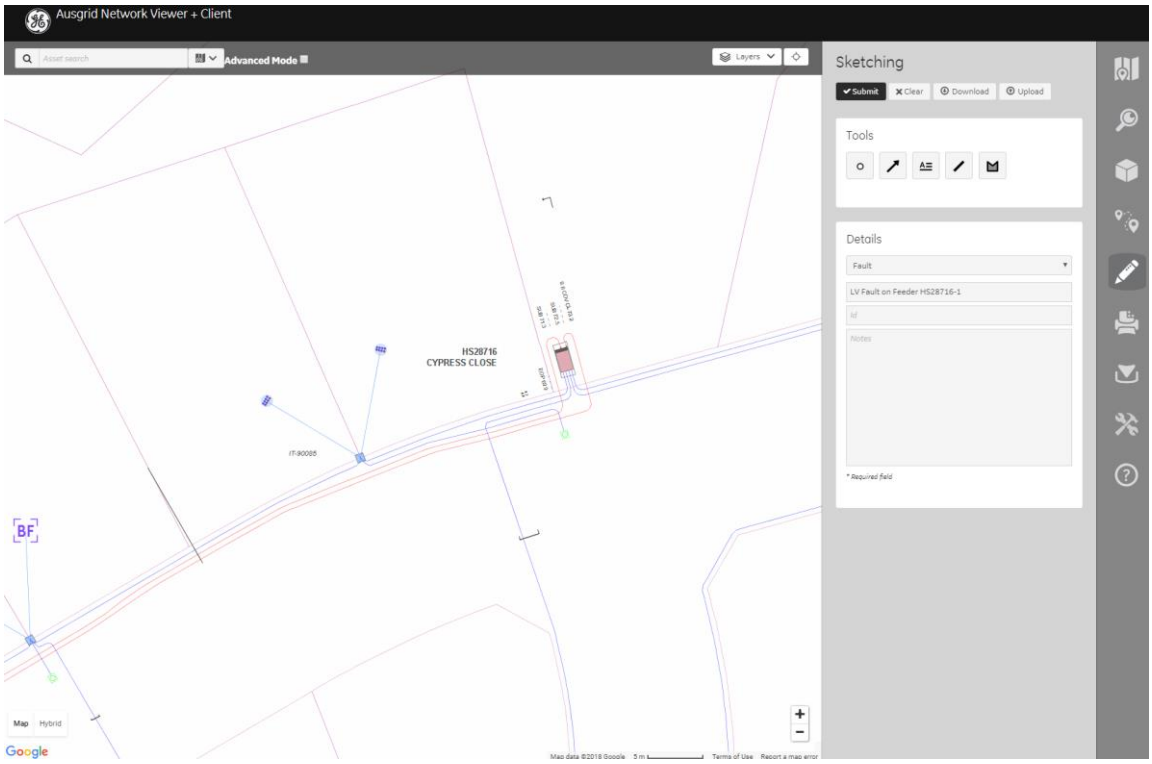


Figure 63 Example: Network Viewer

9.0 SUBMITTING FIELD RECORDINGS

9.1 General

For any construction or maintenance works that are connected, or will be connected to the company's transmission, fibre and distribution network, it is the responsibility of the relevant Person in Charge to verify that as-built drawings have been recorded and supplied. Additionally, recording and supply of as-built drawings for third party fibre assets interacting with the company's assets is also mandated.

Where such works will be carried out by ASP/1 or contractors, underground works must not commence unless the external party has nominated a suitably authorised person during the initial site meeting to carry out field recording for the project.

The current list of authorised field recorders can be found in the ASP/1 section of the company's website.

Refer to **Annexure K** for contingency details where an external party has not identified a suitable field recorder.

9.2 Underground works constructed/installed by the company (internal process)

9.2.1 General

Field recording of maintenance works, minor projects constructed/installed by the company's employees, and commissioning joints for major projects initiated by the company will be carried out by Data Maintenance employees with the correct authorisation and must comply with the requirements set out in *NS100 Field Recording of Network Assets*.

It is the responsibility of the Person in Charge to notify the relevant RTL / SDC when company employees will be required to record network assets, as described in **Clause 9.2.3** Notification to Record.

RTL / SDC will verify that DM employees recording network assets are authorised in accordance with company procedure *Field Recording of Network Assets Authorisation*.

Upon receipt of as-builts, the RTL / SDC will perform a quality assurance check as outlined in **Clause 10.0** Quality Assurance Checks.

Once all as-builts have been accepted, the RTL / SDC will arrange for the as-builts to be captured in the company's GIS.

9.2.2 Resolution of post-acceptance non-conformance

In the event that a field recording non-conformance is identified during the data capture process, the associated field recording will be deemed unacceptable and necessitate a resubmission. The RTL / SDC will update the FRNA database to reflect the non-conformance.

9.2.3 Notification to record

The Person in Charge must notify the Data Maintenance section when company employees will be required to carry out field recording.

For **planned project works**, notification must be lodged via email to gis@ausgrid.com.au *four (4) business days prior* to the works.

For **planned maintenance works**, notification must be given via email to gis@ausgrid.com.au by *close of business on the business day immediately prior* to the works.

Where a change is made to scheduled works after email notification has been sent, the Person in Charge must notify the relevant RTL / SDC as soon as practicably possible, and *prior to the start* of works.

For **unplanned emergency works**, notification must be given via telephone to the GIS On-call number when field crews are dispatched to the job.

- Data Maintenance On-call: **8001 3303**

Information supplied should include details of the site contact person along with any other relevant information regarding the works. A confirmation of works should also be given via email to gis@ausgrid.com.au.

Email notifications must be formatted with a standard email subject line including:

[Project Number / Fault Type – Region, Address, Suburb]

to enable coordination of the work associated with field recording. The body of the email should include details of the site contact person along with any other relevant information regarding the works.

9.3 Underground works constructed/installed by ASP (external process)

9.3.1 General

Field recording of works initiated by ASPs will be the responsibility of those parties. Field recording must be carried out by persons with the correct authorisation and must comply with the requirements set out in *NS100 Field Recording of Network Assets*.

The ASP Compliance Officer (ASP CO) will audit authorisation and training requirements for external parties recording network assets in conjunction with completing milestone inspections of Contestable works.

Where construction of new assets interacts with existing assets and records for those existing assets are found to be inaccurate, the contractor should raise a Data Correction with the company as set out in *NS100 Field Recording of Network Assets*. Failure to notify Data Maintenance of such errors may cause delays in processing of new as-builts.

Submission of As-builts

The process for submitting as-builts for contestable works is currently being migrated to the Ausgrid Customer Portal. The Certification of As-builts (COA) process no longer applies for contestable works.

See GI18_23 Improvements to Outage request and Private installation for advice in the interim.

9.4 Underground works constructed/installed by UCLW and Major Projects (external process)

9.4.1 General

Field recording of project and maintenance works constructed/installed by external parties will be the responsibility of those parties and must be carried out by people with the correct authorisation and lodged as per *NS100 - Field Recording of Network Assets*.

The contractor will notify Data Maintenance via email regarding project commencement *four (4) days prior to the start* of works. This correspondence shall include the name and contact details of the site supervisor and the authorised field recorder.

Contract managers will verify that external parties recording network assets are authorised in accordance with company procedure *Field Recording of Network Assets Authorisation*.

Where construction of new assets interacts with existing assets and records for those existing assets are found to be inaccurate, the contractor should raise a Data Correction with Data

Maintenance as set out in *NS100 - Field Recording of Network Assets*. Failure to notify Data Maintenance of such errors may cause delays in processing of new as-builts.

For Major Projects and larger UCLW projects, field recordings should be submitted progressively throughout duration of the project at appropriate intervals, such as the completion of a section of works, after each section between joint bays is completed, or when making monthly payment claims. Field recordings submitted in this manner must be accompanied by a PCOA with the "Contractor Request" section completed. The contractor must submit a certified PCOA when making a monthly payment claim.

Monthly contract payment should not be awarded without receipt of a certified PCOA.

Upon receipt of as-builts accompanied by a PCOA, the RTL/ SDC will perform a quality assurance check as outlined in **Clause 10.0** Quality Assurance Checks.

Once all as-builts have been assessed, the RTL/ SDC will mark the PCOA as either accepted or rejected (as appropriate), sign receipt, and return it to the submitter. The RTL/ SDC will arrange for accepted as-builts to be captured into the company's GIS.

Lodgement of the final set of field recordings will take place *within two (2) working days* after practical completion of works on a given project. These field recordings must be accompanied by an FCOA with the "Contractor Request - Final" section completed.

Upon receipt of as-builts accompanied by an FCOA, the RTL/ SDC will perform a quality assurance check as outlined in **Clause 10.0** Quality Assurance Checks.

Once all as-builts have been assessed, the RTL/ SDC will complete the company Recipient section on page two of the FCOA as either accepted or rejected (as appropriate), sign the FCOA and return the completed FCOA to the submitter.

The contractor must submit a certified FCOA when making a Final Payment Claim.

Final contract payment should not be awarded without receipt of a certified FCOA.

9.4.2 Resolution of post-acceptance non-conformance

In the event that a field recording non-conformance is identified during the data capture process, the associated as-built will be deemed unacceptable and necessitate a resubmission. The RTL/ SDC will update the FRNA database to reflect the non-conformance and refer the breach to the contract manager. Any COA request for the associated project will be rejected until such time as a corrected as-built has been accepted by DM.

Any such non-conformance identified ***after*** the COA has been issued will result in corrective actions including, but not limited to: resubmission of as-built; issuing of non-conformance; assets being re-exposed by contractor for validation by DM employees.

9.5 As-built information regarding overhead works

Any designs that include overhead components must include an "As-built Verification" sign-off box (see **Annexure L**). On completion and signing of the As-built Verification box, the design becomes an as-built record of the overhead components of the design. Any related underground works must be recorded in detail in a separate submission as previously specified.

On completion of works involving overhead components, it is the responsibility of the relevant Person in Charge to complete and sign the As-built Verification box, and submit the as-built design to Data Maintenance. Any changes from the design must be communicated and approved by the designer prior to construction. Such changes must be marked up on the as-built copy in red pen and the designer must also sign the As-built Verification prior to submission to Data Maintenance.

Receipt of an as-built design is the primary mechanism used to notify Data Maintenance of overhead works as some works may not require the use of other notification mechanisms such as System Alteration Orders (SAO).

For remedial works (including, but not limited to storm restorations) or minor works not associated with a design that are carried out by company employees, a completed Data Correction form may

be submitted as the as-built record in lieu of an as-built design. Refer to *NS100 - Field Recording of Network Assets*.

As-built records for overhead works must be submitted to Data Maintenance *within two (2) working days after completion* of works.

Upon receipt of an as-built design or Data Correction form, the RTL/ SDC will arrange for accepted as-builts to be captured into the organisation's asset information systems.

9.6 Correspondence and submission of as-built information to Data Maintenance

As-built field recordings produced by, or on behalf of, company contractors, or regarding overhead works, must be submitted to GIS by email to gis@ausgrid.com.au. In the case of UCLW projects the contract inspector shall be cc'd.

The email subject line shall be formatted as follows:

[Project Number & Title - Suburb - Subject of email]

eg "SC-04745 New KL S.64816 Epping Herring No.4 - Macquarie Park - Field Recordings & COA"

Individual field recordings shall take the form of a single PDF file consisting of the field recording itself followed by associated photographs. A COA or PCOA form must accompany each submission regarding underground works.

10.0 QUALITY ASSURANCE CHECKS

Upon receipt of as-builts, the Regional Team Leader/Source Data Coordinator will perform a quality assurance check against those field recordings. In conducting a quality assurance check, the RTL / SDC will evaluate the following:

- Check the submitter's name and authorisation number against the authorisations database. If the submitter does not hold a current authorisation to produce field recordings, the associated field recordings will be rejected, and corrective action will be taken in consultation with RTL and Person in Charge.
- Submitted as-builts must contain sufficient information to detail all works outlined on the relevant FCOA or PCOA. Any shortcomings in this regard should be communicated to the contractor to rectify. Processing of the field recordings will be delayed until such time as all necessary information has been received ***unless*** the field recordings have been submitted as part of a **final COA**, in which case the COA will be rejected and the non-conformance referred to the Person in Charge.
- Submitted field recordings will be assessed for compliance with *NS100 Field Recording of Network Assets*. The RTL / SDC will update the FRNA database to capture the submission and result of the check (Pass or Fail). Any non-compliance will necessitate a resubmission, rejection of the FCOA / PCOA (as relevant), and referral to the Person in Charge.
- Check submitted field recordings against the Certified Design. If a variation is found the RTL / SDC should consult with the Person in Charge to obtain an updated design or written advice of an accepted variation.
- In the case where a resubmission is required for any as-builts, revised as-builts must be resubmitted within two (2) business days of the resubmission request. Resubmitted as-builts will be subject to quality assurance checks prior to acceptance as a valid update to the original submission.

11.0 RECORDKEEPING

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

Table 2 - Recordkeeping

Type of Record	Storage Location	Retention Period*

Approved copy of the technical guide	BMS Network sub process Procedure – Company	Unlimited
Draft Copies of the technical guide during amendment/creation	HPRM Working Folder – Technical Guide (HPRM folder number 2015/15706/143)	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	HPRM Working Folder – Technical Guide (HPRM folder number 2015/15706/143)	Unlimited

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

12.0 AUTHORITIES AND RESPONSIBILITIES

For this technical guide the authorities and responsibilities of company employees and managers in relation to content, management and document control of this technical guide can be obtained from the Division Workplace Instruction (Network) – Production/Review of Technical Guides. The responsibilities of persons for the design or construction work detailed in this technical guide are identified throughout this guide in the context of the requirements to which they apply

13.0 DOCUMENT CONTROL

Content Coordinator **:** Manager – Date Maintenance

Distribution Coordinator **:** Manager – Asset Engineering Standards

Annexure A – Field Book Templates

The templates are provided on the following pages.

Ausgrid

FEEDER / DISTRIBUTOR:

VOLTAGE:

MUNICIPALITY: SUBURB:

STREET: DATE:

CROSS STREET: PRJTRAK No:

GANG: SAP No:

JOB DESCRIPTION:

RECORDED BY: AUTH No:

SIZE A4 QL

PAGE:

PHOTOS:

MAP:

BK:

Ausgrid

MUNICIPALITY: SUBURB:
STREET: DATE:
CROSS STREET: PRJTRAK No:
GANG: SAP No:
JOB DESCRIPTION:

FEEDER / DISTRIBUTOR:

VOLTAGE:

RECORDED BY: AUTH No:

SIZE A4 QL

PAGE:

PHOTOS:
MAP:
BK:

Ausgrid

FEEDER / DISTRIBUTOR:

VOLTAGE:

MUNICIPALITY: SUBURB:

STREET: DATE:

CROSS STREET: PRJTRAK No:

GANG: SAP No:

JOB DESCRIPTION:

RECORDED BY: AUTH No:

SIZE A3

QL

PAGE:

PHOTOS:

MAP:

BK:

Ausgrid

FEEDER / DISTRIBUTOR: _____

_____

VOLTAGE: _____

MUNICIPALITY: _____ SUBURB: _____

STREET: _____ DATE: _____

CROSS STREET: _____ PRJTRAK No: _____

GANG: _____ SAP No: _____

JOB DESCRIPTION: _____

_____

_____

RECORDED BY: _____ AUTH No: _____

SIZE A3 | QL

PAGE:

PHOTOS:

MAP:

BK: /

Annexure B – Field Book Checklist

The following table lists the requirements of each element that might form part of a field recording. Any of the listed items that are relevant to a particular recording must be included on the field recording and their particular details must be correct.

Errors should not be recorded where information is impossible to obtain at the time the field recording is submitted (eg pit construction where no asset number has yet been assigned).

Table 3 Required field book details

FB INFORMATION		
	LEGIBILITY	**CRITICAL**
	FEEDER / DIST DETAILS	**CRITICAL**
	LOCATION - STREET, CROSS STREET, SUBURB, LGA	**CRITICAL**
	DATE RECORDED	**CRITICAL**
	ASSET NUMBERS	**CRITICAL**
	NORTH POINT	**CRITICAL**
	ROAD NAMES ON DIAGRAM	**CRITICAL**
	CABLE TYPES, DUCTS, MATCH BETWEEN FIELDBOOKS	**CRITICAL**
	QUALITY LEVEL	**CRITICAL**
	GANG	**CRITICAL**
DUCT LAY		
	DIMENSIONS -CHAINAGE, PL, COV,	**CRITICAL**
	EOP CLEARLY DEPICTED AND LABELLED	**CRITICAL**
CABLES/CABLE PULL		
	DIMENSIONS - CHAINAGE, PL, COV,	**CRITICAL**
	CABLE CODE ANNOTATIONS	**CRITICAL**
	CABLES DRAWN IN CORRECT LOCATION	**CRITICAL**
	CABLE DESCRIPTION	**CRITICAL**
	CABLES IN CROSS SECTION	**CRITICAL**
	CORRECT CABLE COLOUR FOR AUTOCAD	**CRITICAL**
	NEXT SWITCH/FEATURE THAT CABLE CONNECTS TO	**CRITICAL**
	SERVICE/COMMS (Inc 3RD party) DUCTS/CABLES INCLUDED	**CRITICAL**
CROSS SECTION		
	CROSS SECTION DRAWING	**CRITICAL**
	CORRECT CONFIGURATION OF DUCTS AND CABLES	**CRITICAL**
	CROSS SECTION MATCHES CORRECT DUCT LAY (A-B, A-C)	**CRITICAL**
	DUCTS NUMBERED CORRECTLY WHERE RELEVANT	**CRITICAL**
	CORRECT CABLE REPRESENTATION IN DUCTS - MULTICORE - SINGLES	**CRITICAL**
	DUCT SIZES	**CRITICAL**
	DUCT TYPES (PVC-AC)	**CRITICAL**
	NEW OR EXISTING DUCTS	**CRITICAL**
JOINTS & TERMINATIONS		
	DIMENSIONS - CHAINAGE, PL, COV	**CRITICAL**
	CORRECT LOCATION	**CRITICAL**
	CABLES REFERENCED	**CRITICAL**
	CORRECT REFERENCE LETTERS FOR MULTIPLE JOINTS	**CRITICAL**
	JOINT COLOUR FOR AUTOCAD	**CRITICAL**
	CORRECT ANNOTATION USED - STJ, PBJ, PE, SE	**CRITICAL**
	TYPE OF SYMBOL	**CRITICAL**
	FIRE BLANKETS RECORDED (ZONE SUBSTATIONS)	**CRITICAL**

SUB		
	DIMENSIONS -CHAINAGE, PL	**CRITICAL**
	SUB NUMBER	**CRITICAL**
	FEEDER NUMBERS AND NAMES	**CRITICAL**
PIT CONSTRUCTION		
	PIT ASSET NUMBER	**CRITICAL**
	DIMENSIONS -CHAINAGE, PL FOR EACH WALL / CORNER	**CRITICAL**
	ALL WALLS SHOWN IN MEASURED SIZE AND LOCATION	**CRITICAL**
	DEPTH FROM SURFACE TO BOTTOM OF PIT	**CRITICAL**
	CONDUIT CONFIGURATION	**CRITICAL**
	CONDUIT SIZE AND MATERIALS	**CRITICAL**
EXISTING PITS		
	PIT ASSET NUMBER	**CRITICAL**
	ALL WALLS SHOWN IN RELATIVE SIZE AND LOCATION	**CRITICAL**
	ALL CONDUITS SHOWN IN RELATIVE POSITION AND CONFIGURATION	**CRITICAL**
	DIMENSIONS - CHAINAGE, PL FOR CENTRE OF PIT	**CRITICAL**
	RELEVANT CABLES SHOWN ENTERING CORRECT DUCTS	**CRITICAL**
	ALL JOINTS SHOWN IN RELATIVE ORDER (RELEVANT CABLES ONLY)	**CRITICAL**
PILLARS / LINK BOXES (ALSO INCLUDES POLES WITH INTERNALS)		
	DIMENSIONS -CHAINAGE, PL	**CRITICAL**
	ASSET NUMBER	**CRITICAL**
	DRAWN INTERNALS (Link pillars only – Include service connections)	**CRITICAL**
	PHOTO OF INTERNALS	**CRITICAL**
	LINKS OPEN OR CLOSED?	**CRITICAL**
POLES		
	ASSET NUMBER	**CRITICAL**
STREETLIGHT		
	TYPE OF STREETLIGHT	**CRITICAL**
PHOTOS		
	PHOTOS OF ALL REQUIRED SUBJECTS	**CRITICAL**
	METADATA COMPLETED	**CRITICAL**
	NUMBERED CORRECTLY	**CRITICAL**
	PHOTOS BACKED UP IN APPROPRIATE LOCATION	**CRITICAL**
	PHOTO SYMBOL LOCATION	**CRITICAL**
GPS		
	GPS POINTS TO BE CLEARLY MARKED IN CORRECT LOCATION	**CRITICAL**
	TABLE OF COORDINATES RELEVANT TO CURRENT FB SHEET	**CRITICAL**
	QA AND BACK UP OF GPS DATA	**CRITICAL**

Annexure C – Field Book Examples

Ausgrid

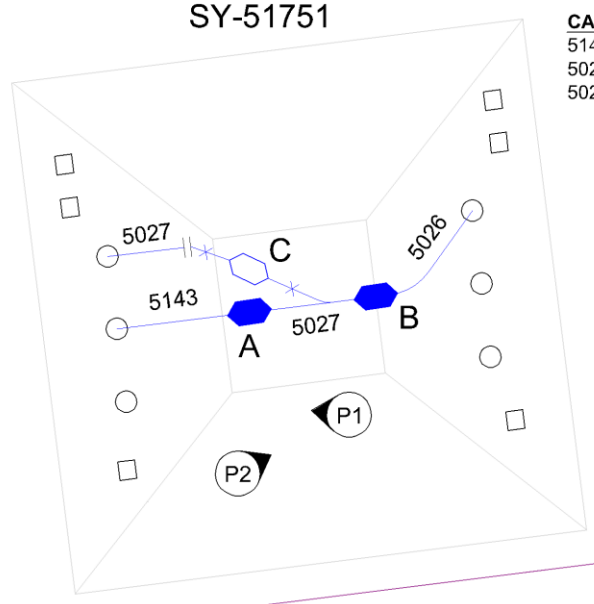
FEEDER / DISTRIBUTOR:
S.8508 DIST #2
FEEDER LINE 2
VOLTAGE: LV

MUNICIPALITY: SYDNEY SUBURB: SYDNEY
STREET: ERSKINE ST DATE: 30/01/2014
CROSS STREET: CLARENCE ST PRJTRAK No: FAULT
GANG: AUSGRID SAP No:
JOB DESCRIPTION: CUT AWAY LV JOINT, MAKE NEW STJ IN PIT SY-51751

RECORDED BY: KRIS WARAN

N
SIZE A4 QL C
PAGE: 1 of 1

SY-51751



CABLE DETAILS :
5143 - 415V 185 CU1 XQ Z /COLOUR /4 CABLES
5027 - 415V 185 CU1 P L / RIB / 4 CABLE
5026 - 415V 194 CU1 P L / RIB / 4 CABLE

JOINTS:
A - LV STJ (5143 TO 5027)
JOINTER : JACK BARTON
B - EXISTING LV STJ A PHASE ONLY
(5026 TO 5027)
FB: 1091 / 54
C - RECOVERED LV STJ
FB: 1623 / 20

CLARENCE ST
PL 0.0
PIT 15.0
SY-51751
ERSKINE ST

PHOTOS: 2
MAP: SY13211
BK: IC14/0054

Ausgrid

FEEDER / DISTRIBUTOR:

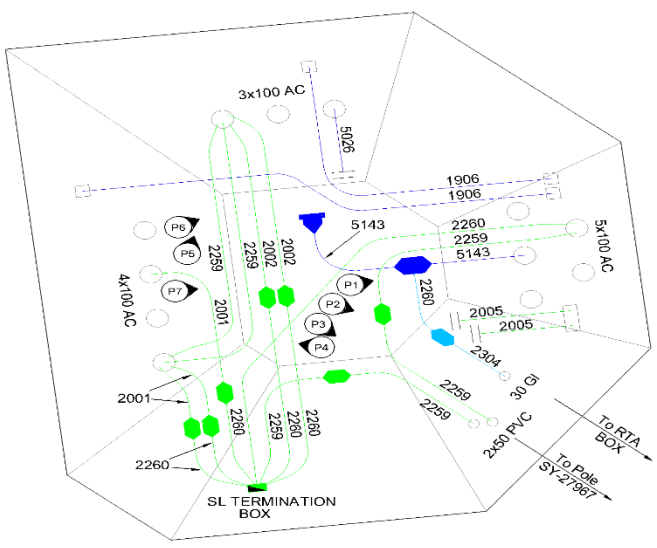
VOLTAGE: LV/SL

MUNICIPALITY: SYDNEY SUBURB: SYDNEY
STREET: ERSKINE ST DATE: 17/02/2014
CROSS STREET: KENT ST PRJTRAK No: AUDIT
GANG: SAP No:
JOB DESCRIPTION: CABLE AUDIT OF PIT SY-51761

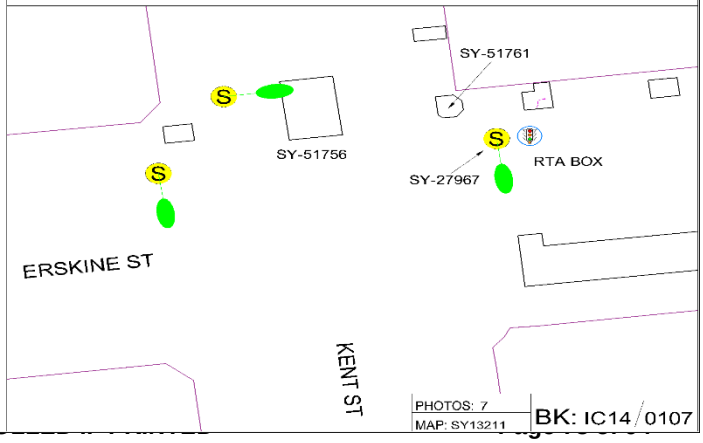
RECORDED BY: K. GAJEWSKI

N
SIZE A4 QL C
PAGE: 1 of 1

SY-51761



CABLE DETAILS :
1906 - DC / #NO SIZE
2001 - 415V 15 CU2 P L
2002 - 415V 15 CU2 R L
2005 - 415V 15 CU2 R L SW J
2259 - 415V 16 CU4 XQ Z
2260 - 415V 16 CU2 XQ Z
2304 - 415V 6 CU1 Z Z + 6 HDCU1 / NEUTRAL
5026 - 415V 194 CU1 P L /RIB /4 CABLES
5143 - 415V 185 CU1 XQ Z /COM /#COLOUR /4 CABLES



PHOTOS: 7
MAP: SY13211
BK: IC14/0107

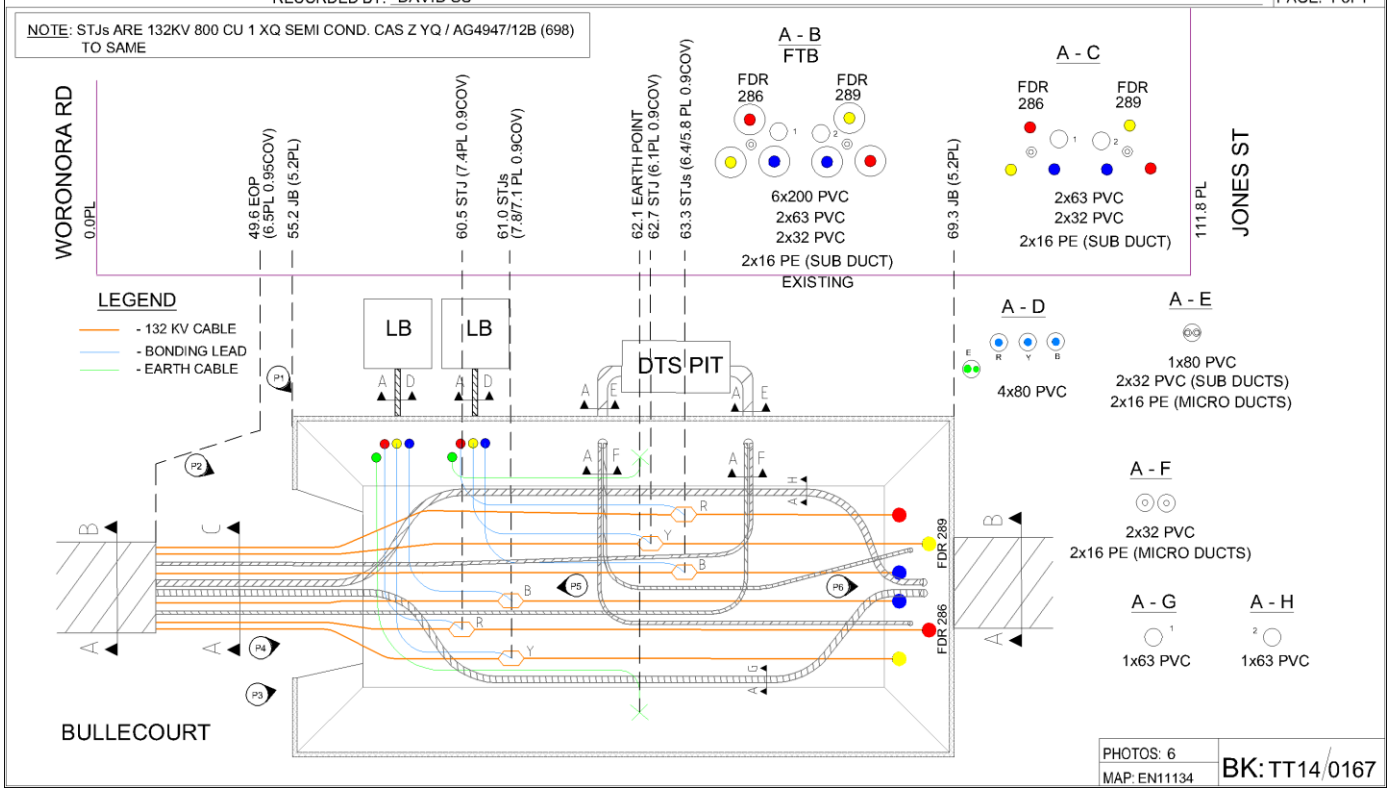
Ausgrid

MUNICIPALITY: SUTHERLAND SUBURB: ENGADINE
STREET: BULLCOURT AVE DATE: 01/07/2014
CROSS STREET: WORONORA RD PRJTRAK No: NET010402/J2
FEEDER / DISTRIBUTOR: FDR 286 & 289 GANG: GARDE. JNTR - PRYSMAN CONTRACTORS (SCOTT LIVING STONE SUB-CONTRACTORS) SAP No: SI05747
JOB DESCRIPTION: 6xSTJ's IN JB (2/3) AT BULLECOURT AVE. BONDING LEADS INSTALLED FROM JOINTS TO LINK BOXES
2x63 PVC RUNS STRAIGHT THROUGH JOINT BAY. 4x32 PVC CONNECTED TO DTS PIT.
VOLTAGE: 132KV
RECORDED BY: DAVID SU

N

SIZE A4 QL B
PAGE: 1 of 1

NOTE: STJs ARE 132KV 800 CU 1 XQ SEMI COND. CAS Z YQ / AG4947/12B (698) TO SAME



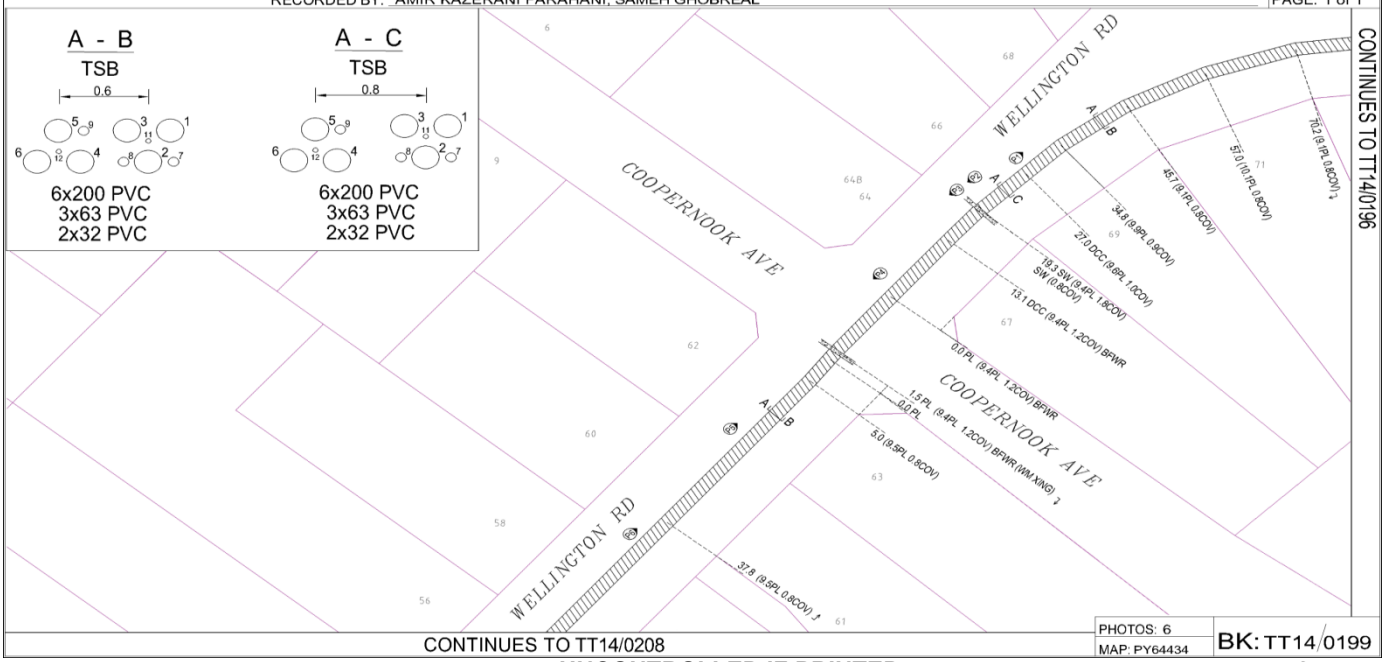
PHOTOS: 6
MAP: EN11134
BK: TT14/0167

Ausgrid

MUNICIPALITY: KU-RING-GAI SUBURB: EAST LINDFIELD
STREET: WELLINGTON RD DATE: 12/09/2014
CROSS STREET: COOPERNOOK AVE PRJTRAK No: NET010430/1
FEEDER / DISTRIBUTOR: 9E2 & 9E4/2 GANG: DIONA SAP No: SJ06046
JOB DESCRIPTION: DUCT LAY OF 6x200 PVC & 3x63 PVC BETWEEN LINDFIELD TW7210 AND JOINT BAY 1/2 ON WELLINGTON RD
DESCRIPTION LINE 3
VOLTAGE: 132KV
RECORDED BY: AMIR KAZERANI FARAHANI, SAMEH GHOBREAL

N

SIZE A4 QL B
PAGE: 1 of 1



PHOTOS: 6
MAP: PY64434
BK: TT14/0199

Ausgrid

FEEDER / DISTRIBUTOR: ZN14892 PAIH

VOLTAGE: HV

MUNICIPALITY: WYONG SUBURB: CHARMHAVEN

STREET: PACIFIC HWY DATE: 19/3/2014

CROSS STREET: LOWANA AVE PRJTRAK No: ACN 010380

GANG: DIONA SAP No: SM18925

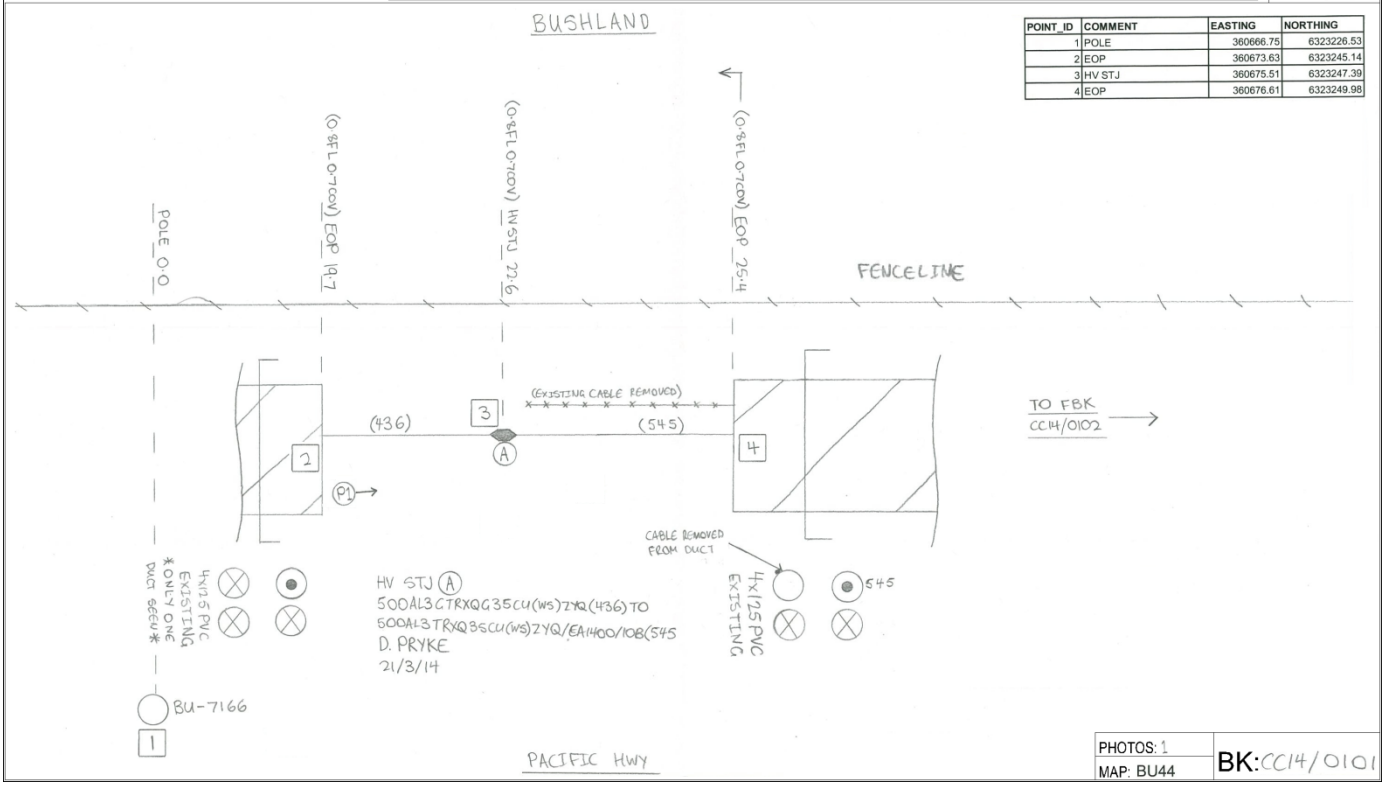
JOB DESCRIPTION: REMOVE EXISTING WET CABLE AND PULL NEW HV CABLE THEN JOINT ONTO EXISTING.

RECORDED BY: Joshua Paterson

SIZE A4 QL B

PAGE: 1 of 2

POINT_ID	COMMENT	EASTING	NORTHING
1	POLE	360666.75	6323226.53
2	EOP	360673.63	6323245.14
3	HV STJ	360675.51	6323247.39
4	EOP	360676.61	6323249.98



PHOTOS: 1

MAP: BU44

BK: CC14/0101

Ausgrid

FEEDER / DISTRIBUTOR S667 DIST #1

VOLTAGE: LV

MUNICIPALITY: LEICHHARDT SUBURB: ROZELLE

STREET: FURIOSA RD DATE: 07/05/15

CROSS STREET: NUX AVE PRJTRAK No: XCO 018 666

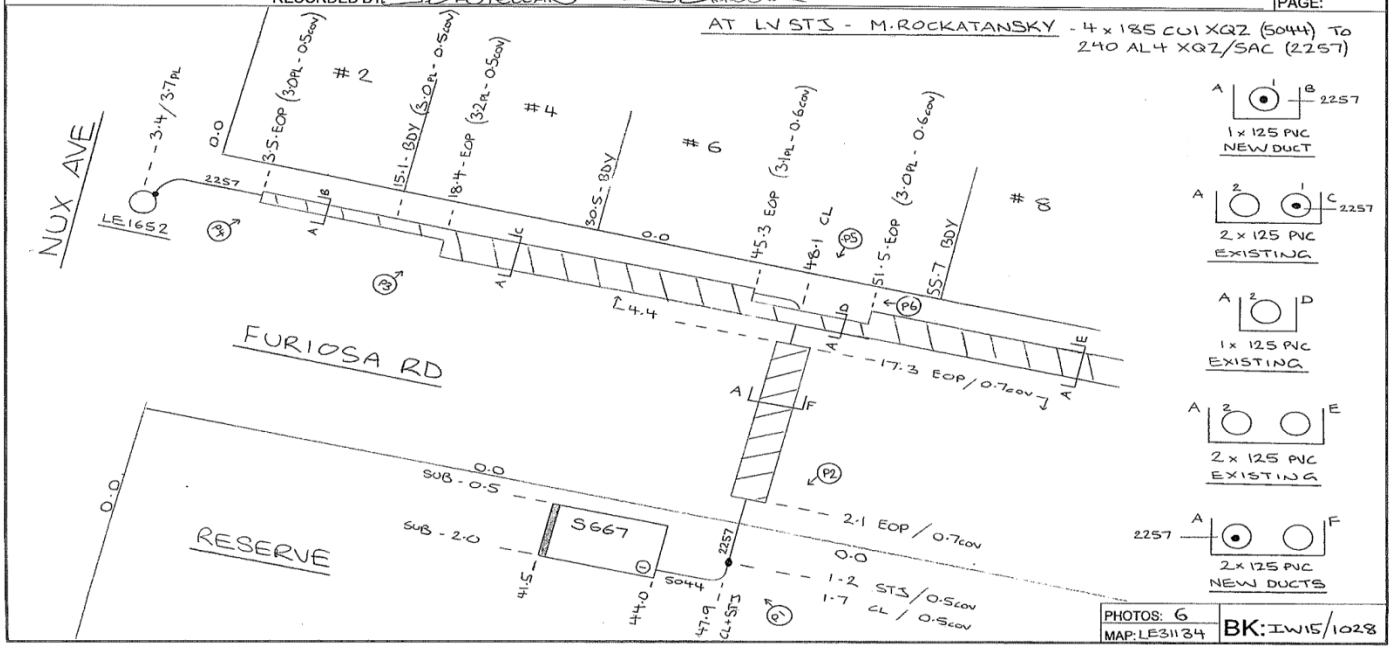
GANG: WILKEN SAP No: SC047 21

JOB DESCRIPTION: DUCT LAY FOR ROAD CROSSING + EXTEND EXISTING DUCT + PULL 1x 2257 FROM SUB TO UGOH + 1x COMMISSION JOINT FOR DIST #1 - S667

RECORDED BY: D CASTELLAN D Castellan

SIZE A4 QL B

PAGE:



PHOTOS: 6

MAP: LE31134

BK: IW15/1028

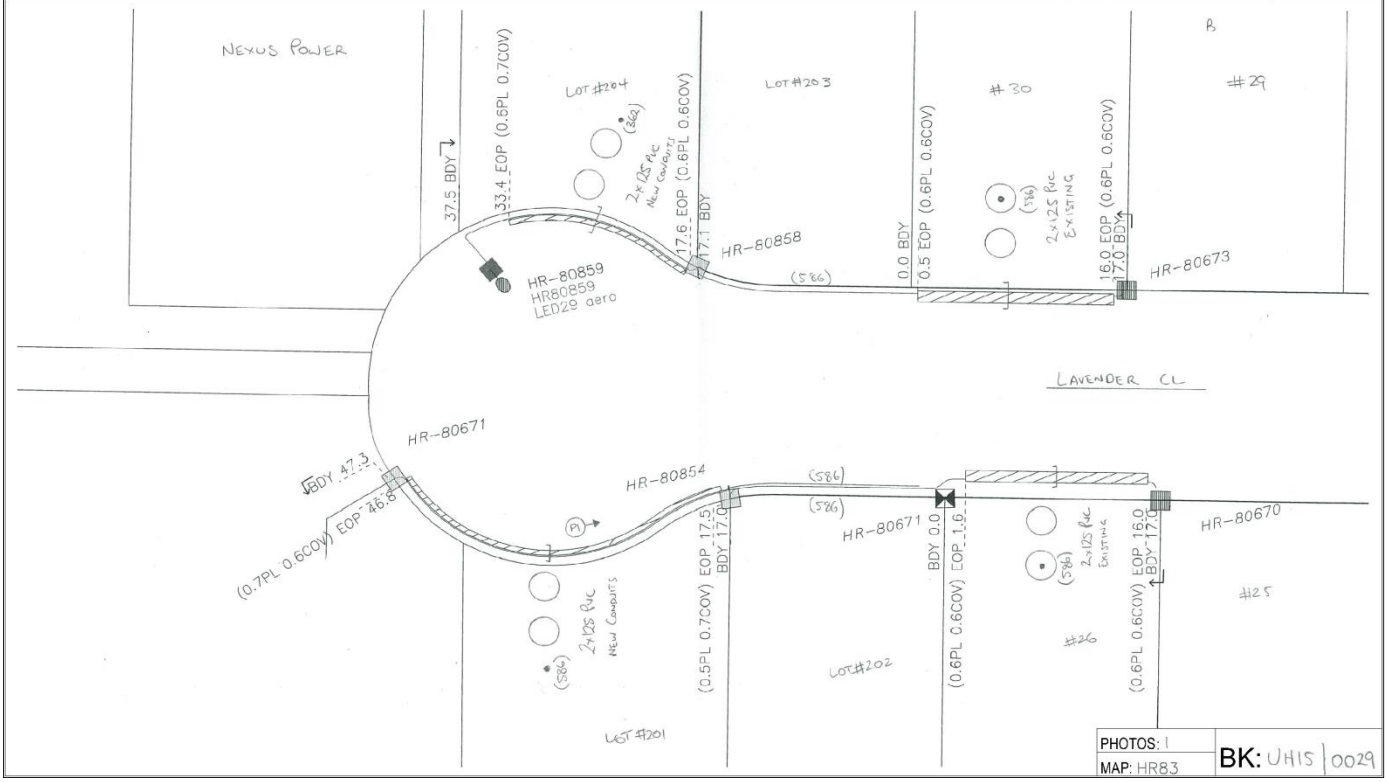
Ausgrid

FEEDER / DISTRIBUTOR:

VOLTAGE: LV +SL

MUNICIPALITY: MAITLAND SUBURB: GILLIESTON HEIGHTS
STREET: LAVENDER CL DATE: 5/12/14
CROSS STREET: AUBURN ST PRJTRAK No: XCJO14158
GANG: NEXUS POWER SAP No: SC05537
JOB DESCRIPTION: INSTALL 415V 240AL4 XDZ|SAC|APP1066/586) 240V 2.5 CU2.22|EARTH(362) AND NEW CONDUITS AS SHOWN. INSTALL NEW PILLARS HR-80858 HR-80671 AND HR-80854 PLUS SL STD HR-80859
RECORDED BY: Adam Jameson

SIZE A4 QL B
PAGE:



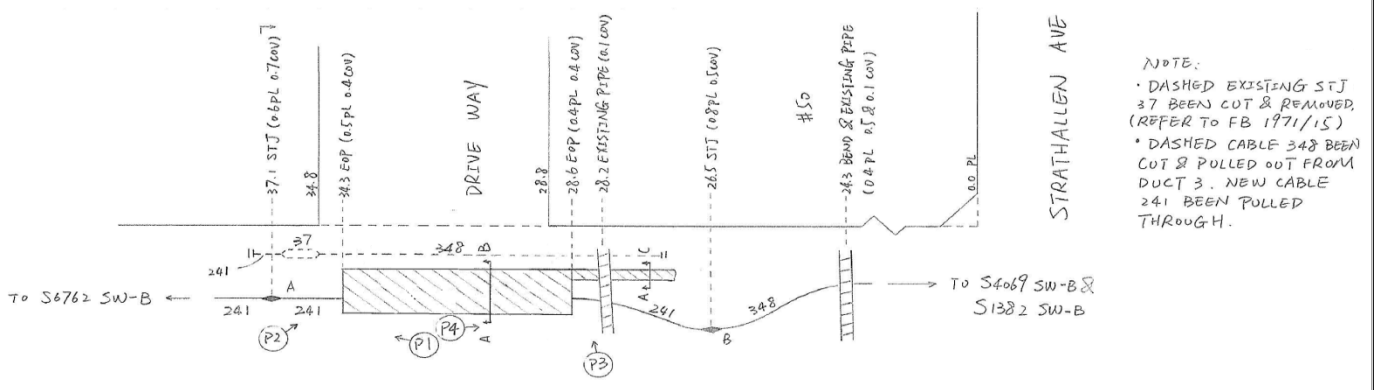
Ausgrid

FEEDER / DISTRIBUTOR: ZN 180 MOSMAN PA41

VOLTAGE: HV

MUNICIPALITY: WILLOUGHBY SUBURB: NORTHBRIDGE
STREET: BARINGA RD DATE: 20/02/14
CROSS STREET: STRATHALLEN AVE PRJTRAK No: HV FAULT
GANG: SAP No:
JOB DESCRIPTION: HV FAULT CABLE PULL & 2 X HV STJ 1 X EXISTING HV STJ REMOVED
RECORDED BY: SEAN ZHANG

SIZE A4 QL B
PAGE:



Annexure D – Photo Examples

Figure 64

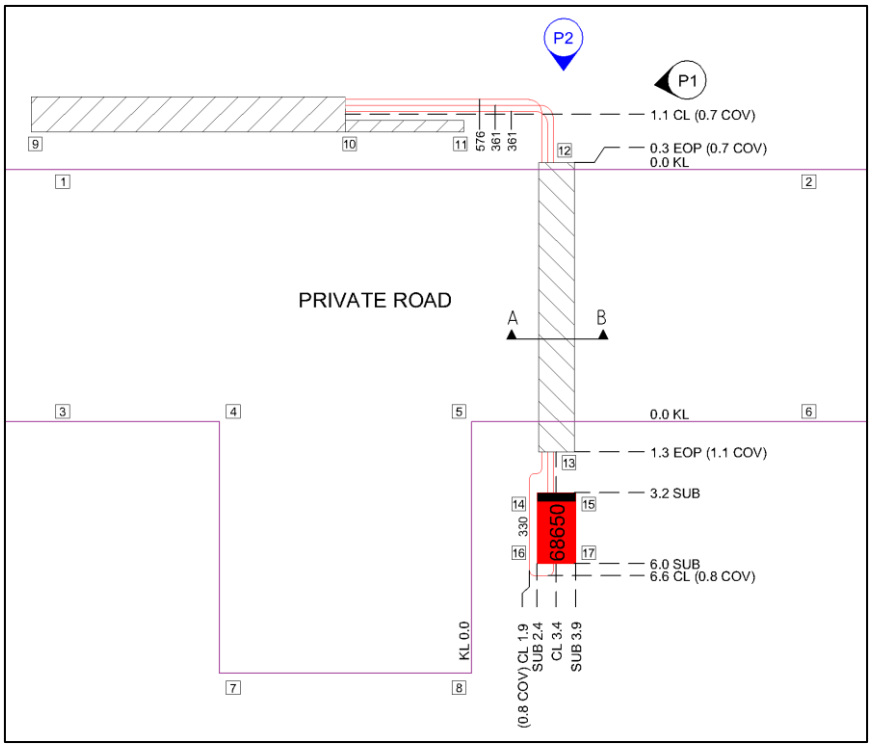


Figure 65

Figure 66

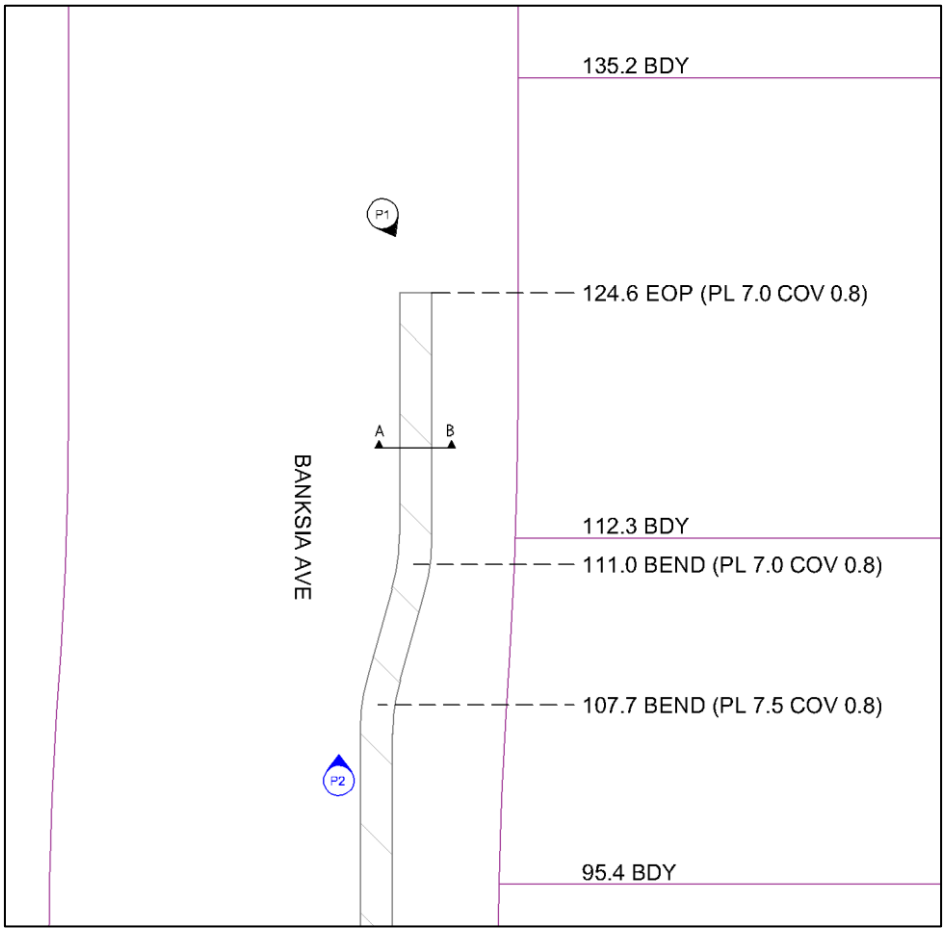


Figure 67

Figure 68

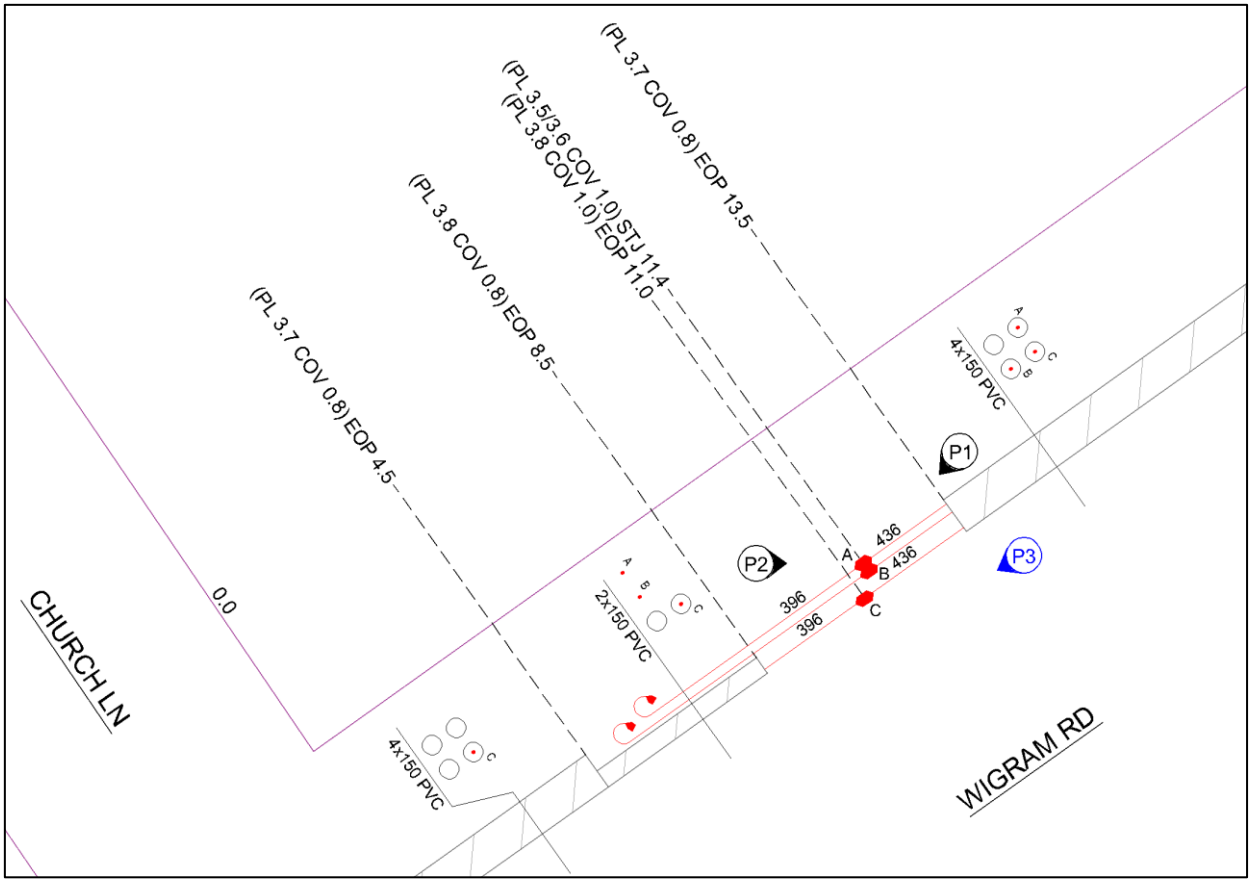


Figure 69

Figure 70

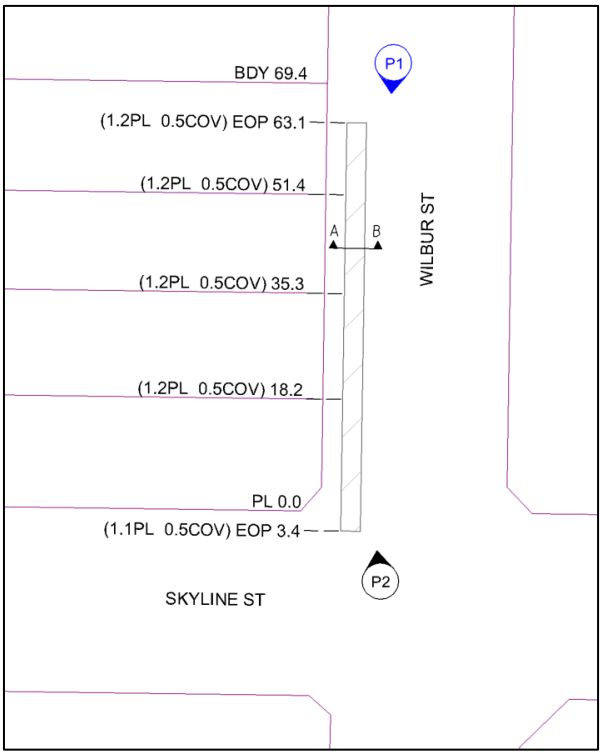


Figure 71

Figure 72

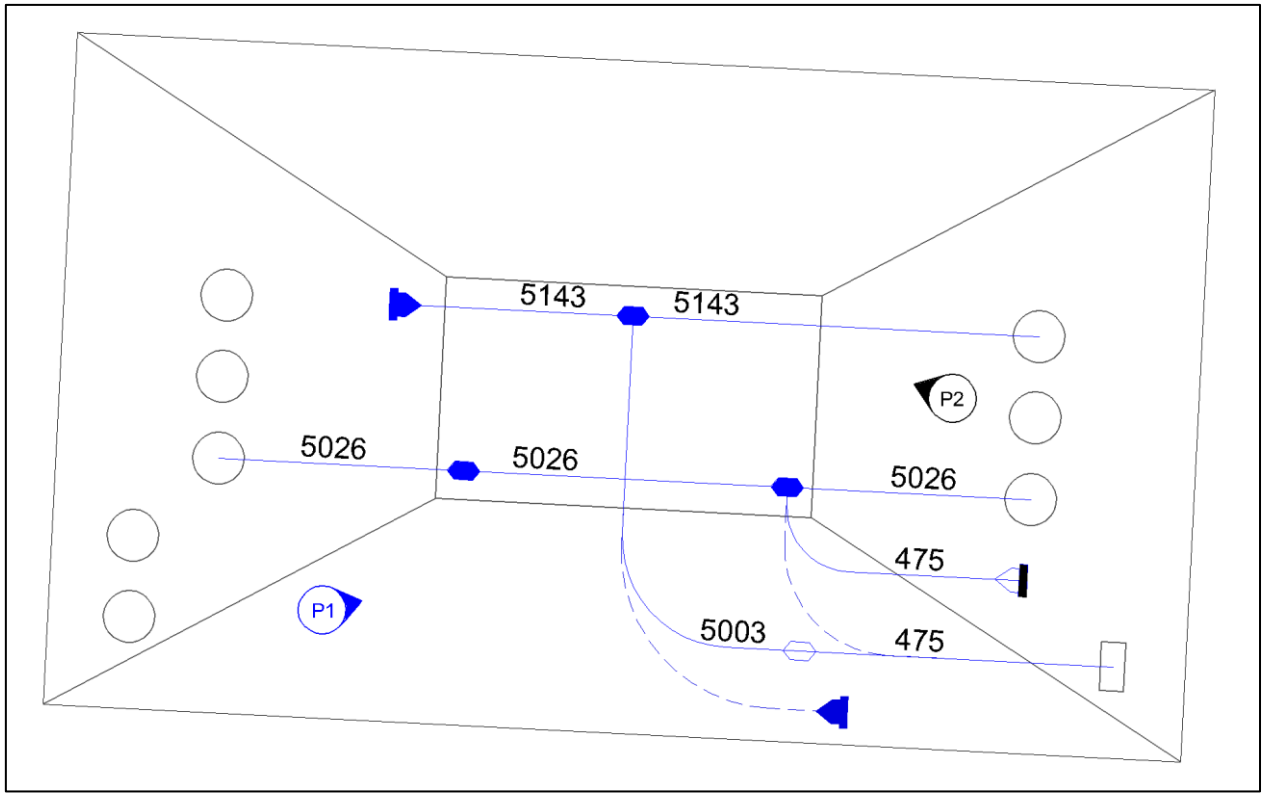


Figure 73

Figure 74

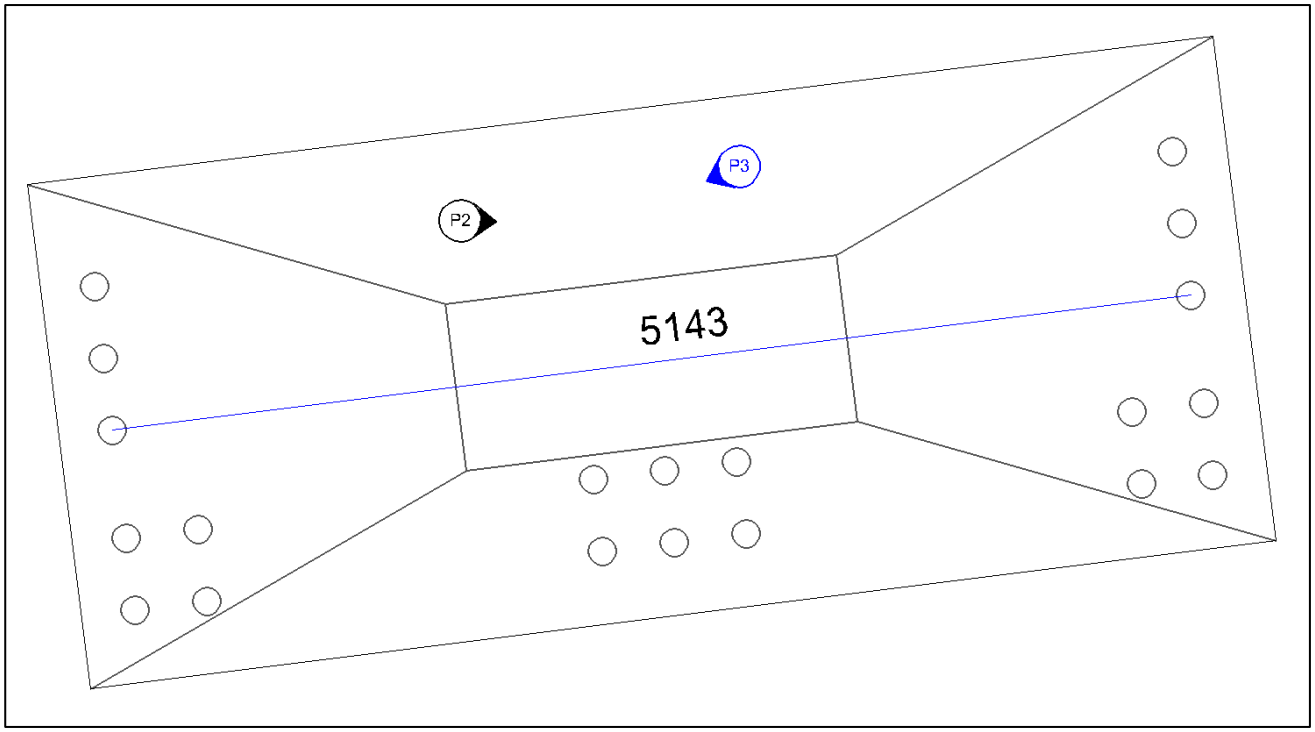


Figure 75

Figure 76

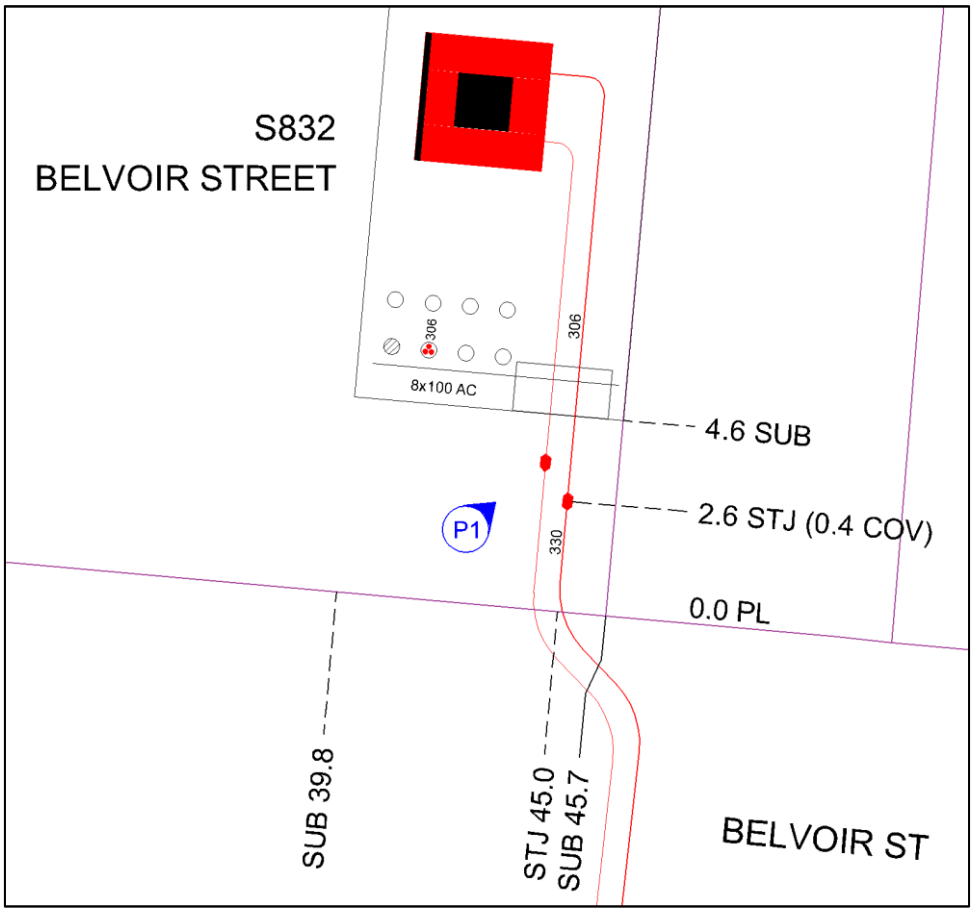


Figure 77

Annexure E – Metadata Procedure (Internal Process)

The WebGIS Field Book Upload tool is designed to capture metadata relating to the field recording and its associated images. All WebGIS applications are designed to run with Google Chrome web browser, and will not function correctly in the Internet Explorer web browser.

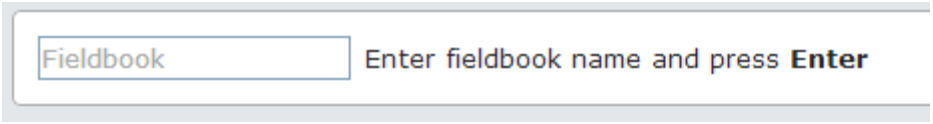
1. Open the WebGIS field book uploader

http://webgis.energy.com.au/fieldbook/ using the Chrome web browser.

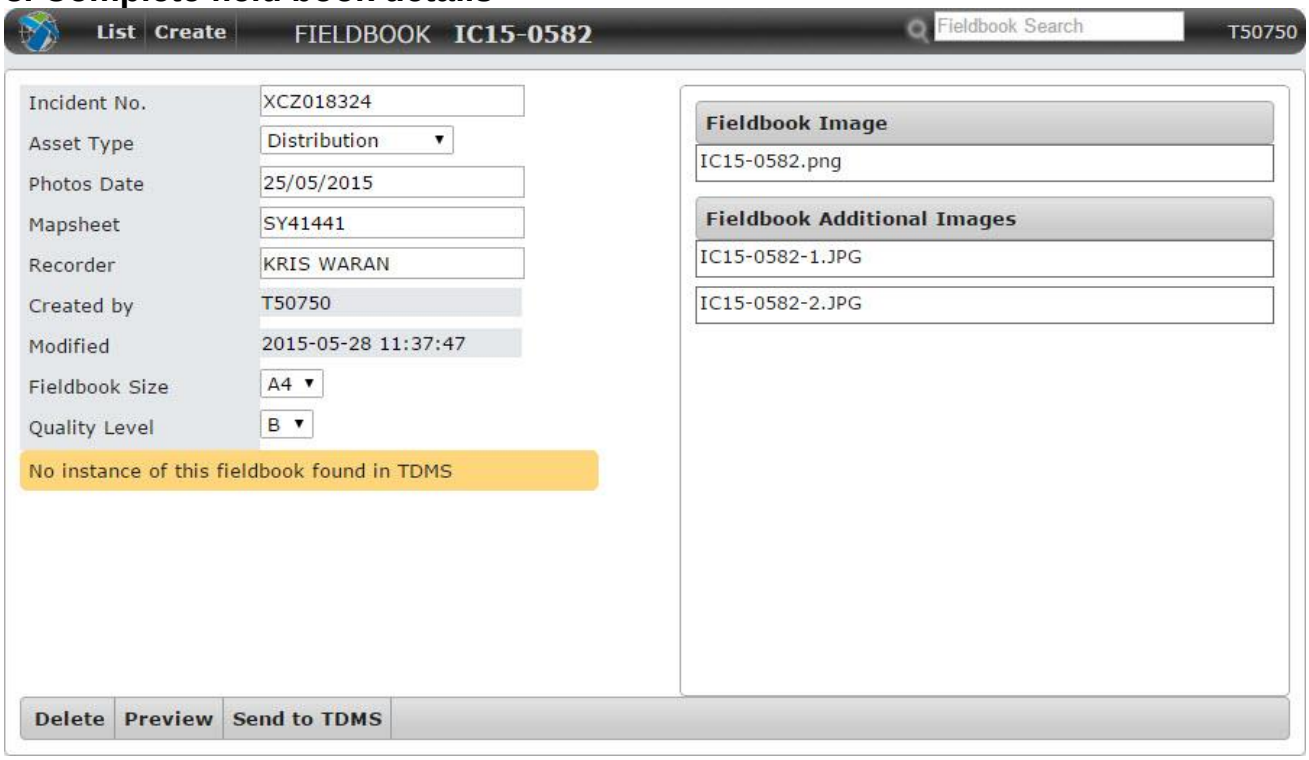
2. Create field book

Click Create

Enter field book name and press enter



3. Complete field book details



If the associated files have been placed in the correct folders they will be automatically loaded. If any expected files do not appear in the list, check the folder location and file names are correct.

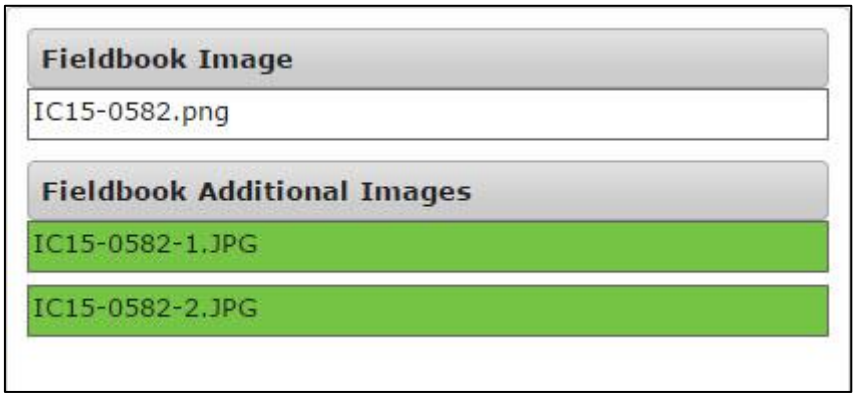
Complete the details about the field book.

4. Complete metadata for each image

Click on each image name to edit its metadata. The image will open in order for the orientation and description fields to be completed.

Hit **Next** to add data to next image or **Done** when finished.

The photo file names will highlight green once metadata has been added to each.



5. Preview the field book PDF

6. Upload to TDMS

Click **Send to TDMS** to complete the process.

Annexure F – Final Certification of As-builts (FCOA) Form

Company Form – Certification of As-builts (COA)

Contractor Request – Final COA (FCOA):

The included field recordings are submitted for approval and constitute final as-built information for all outstanding works for the specified project/stage:

Project name:	**Project number:**
Contract company:	
Field recorder name:	**Authorisation #:**
Date Completed: Click here to enter a date.	**Submission date:** Click here to enter a date.
Submitted document name(s):	
Associated PCOA receipt(s):	
Additional Comments:	

Ausgrid Receipt:

Field recordings received for all specified works	**Yes ☐**	**No ☐**
Field recordings compliant with NS100	**Yes ☐**	**No ☐**

Non Conformance (if applicable):

Description of expected works not represented in field recordings:
Description of noncompliant field recordings:

Assessor sign-off – Final COA (FCOA):

Certification of As-builts			**Yes ☐** **No ☐**
Name:	**Position:**	**Signed:**	**Date:** Click here to enter a date.

Submit request form to gis@ausgrid.com.au

Annexure G – Preliminary Certification of As-builts (PCOA) Form

Company Form – Certification of As-builts (COA)

Contractor Request – Preliminary COA (PCOA):

The included field recordings are submitted for approval and constitute as-built information for all works constructed to date:

Project name:	**Project number:**
Contract company:	
Field recorder name:	**Authorisation #:**
Proposed date of milestone inspection: Click here to enter a date.	**Submission date:** Click here to enter a date.
Submitted document name(s):	
Scope of current works:	

Ausgrid Receipt:

Field recordings received for all specified works	**Yes ☐**	**No ☐**
Field recordings compliant with NS100	**Yes ☐**	**No ☐**

Non Conformance (if applicable):

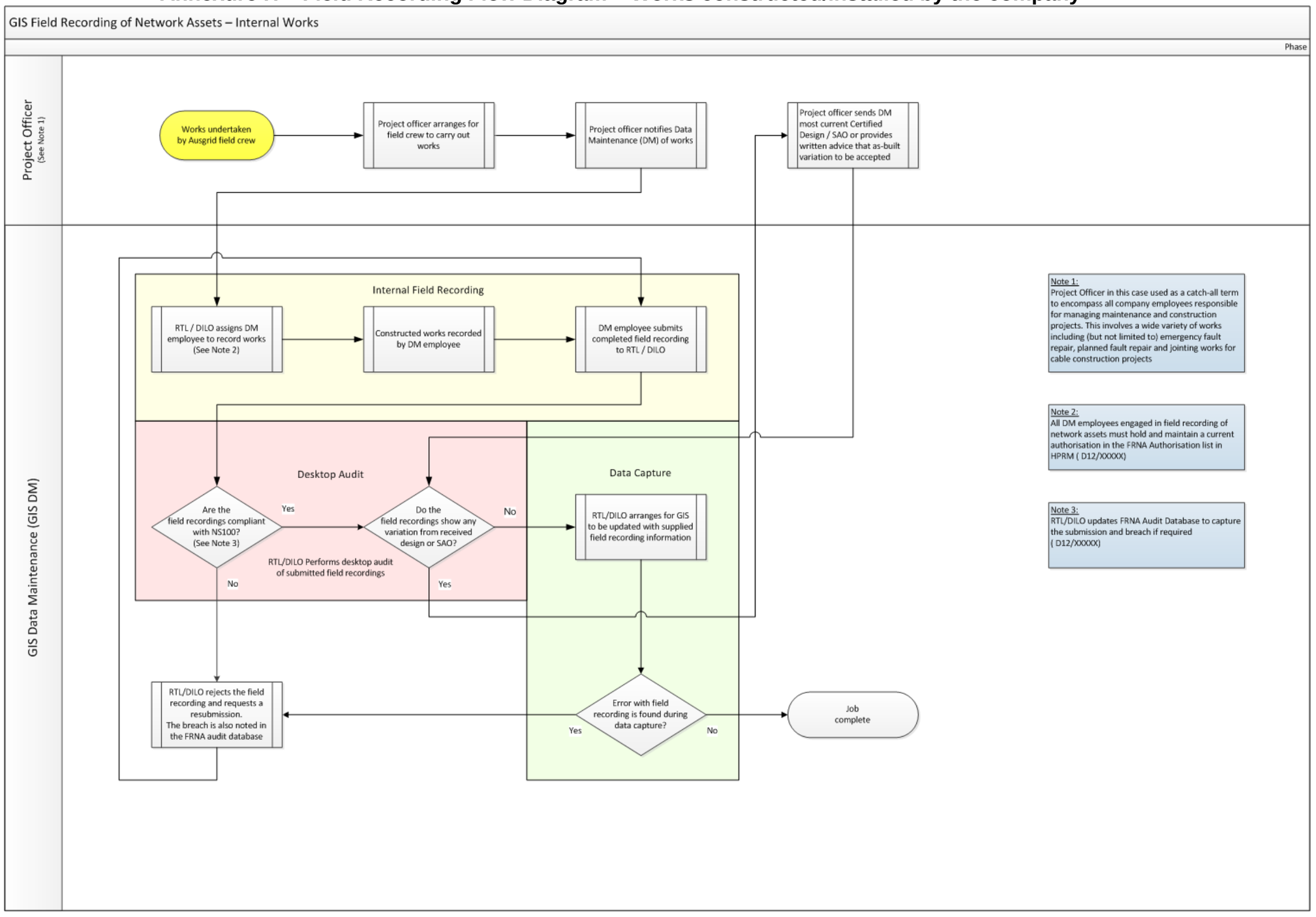
Description of expected works not represented in field recordings:
Description of noncompliant field recordings:

Assessor sign-off – Preliminary COA (PCOA):

Certification of As-builts			**Yes ☐**	**No ☐**
Name:	**Position:**	**Signed:**	**Date:** Click here to enter a date.	

Submit request form to gis@ausgrid.com.au

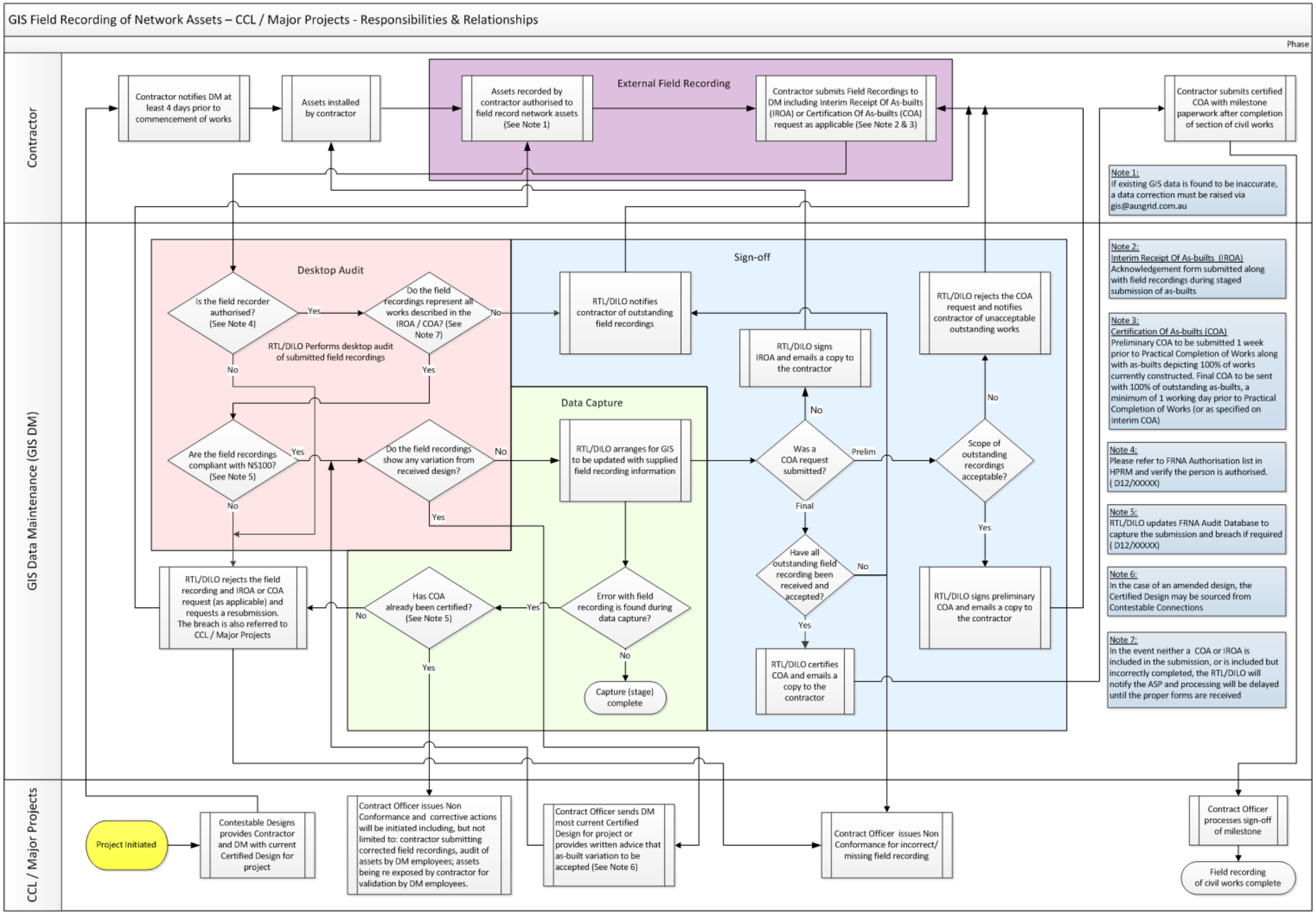
Annexure H – Field Recording Flow Diagram – Works constructed/installed by the company



Annexure I – Field Recording Flow Diagram – Works constructed/installed by ASP

Pending

Annexure J – Field Recording Flow Diagram – Works constructed/installed by CCL and Major Projects



Annexure K - Non Compliance Escalation Path for ASP/1 and Contractors

Stage	Issue	Action/Escalation
Initial Site Meeting **(Company & Contractor)** **or** **(Company, ASP3 & ASP1)**	Field Recorder not nominated by contractor / ASP/1	1. PO / ASP CO advises contractor / ASP/1 of authorised Field Recorders. 2. If ASP/1 is unable to source a Field Recorder, ASP CO will contact Data Maintenance Manager to discuss if the company can undertake field recordings for a charge. Note: this contingency is not applicable to company contractors 3. If no field recording resources are available the PO / ASP CO will delay the start of the project.
Assets Under Construction	Field Recordings not recorded to NS100 Field Recording of Network Assets standard or incomplete	1. GIS RTL / SDC will contact contractor / ASP/1 and remind them of field recording standards. 2. GIS RTL or GIS SDC will discuss with PO / ASP CO if field recordings are not provided in acceptable timeframe. 3. If it is determined that assets have been installed without a valid field recording, GIS RTL or GIS SDC will discuss with Data Maintenance Manager. 4. The Data Maintenance Manager will discuss possible courses of action with the relevant portfolio manager to obtain suitable field recordings, including up to re-excavation of ground. 5. Data Maintenance Manager will discuss with the relevant portfolio manager if a project delay/cancellation is recommended. 6. Where agreement is not able to be reached the matter will be escalated to the respective branch managers.
Request to Commission **Or** **Final Payment Request**		

Annexure L – Overhead As-built Verification Box

AS BUILT VERIFICATION

THIS DRAWING IS THE AS BUILT COPY. ALL AMENDMENTS TO THE DESIGN, IF ANY, ARE SHOWN IN RED PEN ON THIS DRAWING.

PRINT NAME: ..... DATE: .....

SIGNED: .....

AS BUILT DRAWING APPROVED BY DESIGNER. INCLUDING ANY AMENDMENTS.

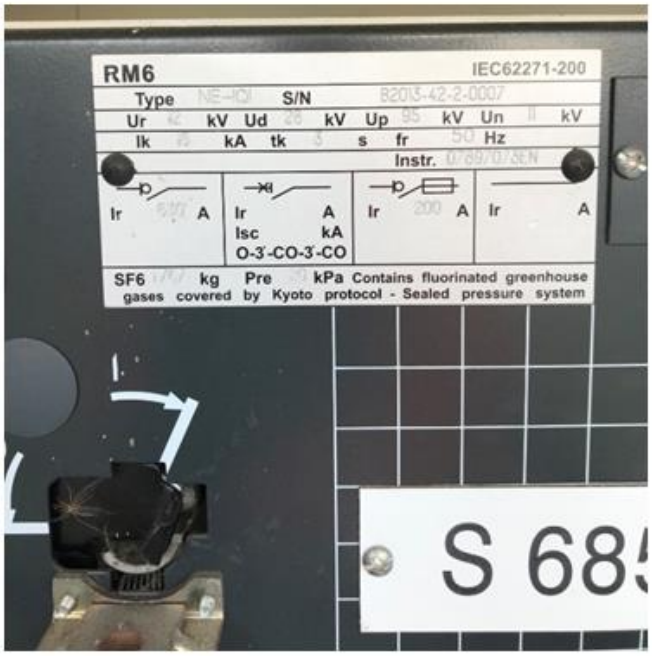
PRINT NAME: ..... DATE: .....

SIGNED: .....

Annexure M – Examples of Required Substation – HV Switchgear Photographs

Substation overview (including number)

HV Switchgear overview



HV Switchgear nameplate

Annexure N – Examples of Required Substation - Transformer Photographs

Transformer details

Transformer serial number

Transformer name plate

Annexure O – Examples of Required Substation – LV Switchgear Photographs

LV Switchgear overview

LV Switchgear name plate

LV Distribution Management and Control

LV Switchgear detail