Network Data Standard

As Constructed Drawing Standard

These standards are to ensure As Constructed worksplans meet Energex requirements when returned to Network Data to allow all relevant systems are updated Accurately and in line with Service Level Agreements. External companies should not use these standards to construct non-Energex assets.

If this standard is a printed version, to ensure compliance, reference must be made to the Energex internet site www.energex.com.au to obtain the latest version.

Approver	Sharyn Scriven General Manager Grid Investment

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1 Overview

1.1 Purpose

The ENERGEX electrical network is made up of numerous sites where equipment is installed to supply, support and deliver electrical energy. The purpose of a worksplan is to describe a task and provide information on what GIS to graphically represent as ENERGEX's transmission and distribution electrical network.

This document provides the standards for data capture for construction projects, non-planned emergency work and work completed under a Peace PTJ or Ellipse work order. It is imperative that equivalent information be recorded by crews performing all work above including emergency and storm related works are forwarded to Network Data within the business KPI targets as listed in this document. Compliance with this standard is mandatory and subject to audit inspection and reporting.

1.2 Scope

This document describes ENERGEX's data requirements for changes to network assets as a result of field-based activities including additions/ updates/ modifications/ removals.

This details the type of field data that must be supplied from the construction activities and the format in which it is to be completed. This also provides details on ENERGEX's time requirements in submitting notification of Construction details to ENERGEX Network Data.

The document principally applies to the ENERGEX distribution network from construction activities such as residential estates, commercial/industrial developments and augmentation projects and includes sub transmission and transmission networks that exist outside of the substation fence. However, Appendices 1 – 3 describe special additional requirements pertaining to major substation, overhead and underground transmission works respectively. This standard does not apply for work carried out on non-ENERGEX assets, although it may be used as a guide. This standard is only to be used for works completed on the distribution network up to the point of the fence of a Relay Controlled Substation.

2 References

2.1 Energex controlled documents

Data Maintenance Tool Standard – 3061786
Integrity of Low Voltage Electricity Network Connectivity – 3066382
Network Attachment Point Record for the Electricity Network – 3064923

3 Definitions, acronyms, and abbreviations

For the purposes of this standard, the following definitions apply.

Term	Definition
4C	4 core
AC	Asbestos Cement – Duct material
Al	Aluminium – Conductor material
Align.	Alignment within footpath or roadway, normally relative to RP boundary but in some instances may be relative to face of kerb
BBCC	Broadband Communications Cable
BFK	Behind Face of Kerb
Cadastre	Map showing surveyed boundaries of properties and roadways
Cadastral Node	Junction or corner of survey boundaries where a survey peg would be placed
CBD	Central Business District
CFS	Combined Fuse Switch
CM, or Cons. mains	Consumer's Mains – consumer's main cables running from consumer's terminals to meter box/switchboard
Cu	Copper – Conductor material
EOB	Edge of Bitumen
Ex.	Existing
FC, or FRC	Fibrous Cement – duct material
FCO	Field Construction Officer
G	Gas
GIS	Geographic Information System – a computerised mapping system showing ENERGEX asset locations overlaid on cadastre
GSW	Ground Stay (Wrapped)
GT	Ground Transformer
HV	High Voltage
ID	Identification
JU	Joint Use
KBS	King Bolt Spacing
LV	Low Voltage
NFM	Network Facilities Management – a database of ENERGEX assets, which works in association with the GIS.

Term	Definition
NECF	National Energy Customer Framework
OH	Overhead
OHEW	Overhead Earth Wire
OV	Optus Vision
PC	Pilot Cable
PLY	Paper Lead Alloy – cable insulation and sheath type
PMT	Padmount Ground Transformer (Kiosk)
Prop.	Proposed
PT	Pole Transformer
PVC	Polyvinyl chloride – an insulating material used within cables, also a duct material
RL	Reduced Level – height relative to a datum
RMU	Ring Main Unit
RP	Real Property –a surveyed property lot, not a roadway.
RPEQ	Registered Professional Engineer, Queensland
SACS	Substation Automatic Control System
S, or Sew	Sewer
SL	Streetlight
SSW	Sidewalk Stay (Wrapped)
SW	Storm Water
T, or Tel.	Telstra
UG	Underground
W	Water
WGL	Work Group Leader
XLPE	Cross-linked polyethylene – an insulating material used within cables
YOM	Year of Manufacture

4 Purpose of As Constructed Notification/Worksplan

4.1 Reasons for Capturing Field Data from Construction Works

There are several reasons why it is necessary to capture field data during construction:

(i) There are limitations to what can be determined within the design office. Certain elements of the installation may be best left to the construction crew to determine on site, such as:

- determining precise locations of cable joints, dependent upon conditions below ground, actual cable lengths on drums, ease of cable pulling etc.
- determining suitable fittings, locations or methods where insufficient information is available to designer, e.g., existing cable types unknown, site not surveyed or accessible.
- determining whether certain existing network components need to be replaced. This is not always obvious from ground level or until equipment is disassembled.
- determining which side of a low voltage open point a customer service is to be connected to.
- determining what tap setting a distribution transformer is installed on.

(ii) During construction it is sometimes necessary to deviate from the original design, for reasons such as:

- unavailability of materials – substitution required.
- unforeseen problems, e.g., other underground services obstructing electricity allocation in footpath, blocked duct.
- original design in error or impractical.
- late change by another party e.g., developer.

4.2 Uses of As Constructed Information

The primary purpose of As Constructed drawings is to facilitate accurate recording of the electricity network. These records take various forms, such as:

- mains maps,
- schematic diagrams,
- computer databases (GIS/NFM and other systems)
- pit cards.

It is crucial that records are up-to-date and accurate, as these support functions such as:

- NECF
- switching and control of the network;
- fault location and repairs, possibly under emergency conditions;
- servicing inquiries through the DBYDS (Dial Before You Dig Service);
- planning and design of future works – extensions, augmentation works etc.;
- maintenance planning;
- outage management

The information is relatively easy to capture at the time of construction; it is much more difficult, or even impossible, to obtain later, particularly for underground components.

For example, it may be necessary to locate a cable joint that has developed a fault, interrupting supply to many consumers. If the joint location is well documented then the joint can be found with ease, allowing repairs to be performed without delay and minimising damage to the surface above.

As Constructed drawings also alert construction auditors and designers to any deliberate changes made by construction staff, so that these are not perceived as errors. They also alert testing and commissioning crews to any changes made to the original scheme. It is critical that feedback to design is provided to enable the learning/feedback process to continue.

As Constructed drawings also have **legal significance**. The constructor certifies how the network was actually installed. If any problems become apparent at a later stage, e.g., cable installed on an incorrect alignment or depth, then the problem can be traced to the responsible person.

5 Capturing Information

5.1 Responsibilities

5.1.1 Planning & Design/Short Cycle Officer

Staff completing designs shall provide comprehensive details of the network on a worksplan for the works to be completed from. The details provided shall include any relevant existing information as well as all proposed works. Where inaccurate information has been discovered in the field whilst completing the design, the preferred option to have this rectified is to notify DataHelp via datahelp@energex.com.au or phone (07) 3664 DATA (3664 3282) so that the records can be updated prior to the construction work(s) commencing, alternatively please incorporate the changes into the worksplan and provide detailed notes for the attention of Network Data.

5.1.2 Construction

All Construction staff are responsible for providing sufficient information for the construction work(s) in a format that allows Network Data to process within our corporate systems. For projects where a worksplan has been provided it is expected that staff will mark up any changes to the original design from construction and/or recording supplementary information such as dimensions. The actual network installed must be recorded on the worksplan. The mark-ups to the worksplan must be completed in legible handwriting in red pen. Supporting commissioning sheets must be attached to the worksplan and must be completed in full also in legible handwriting.

For projects with multiple work groups all changes to the worksplan after the date of issue must be marked up in writing and provided to all of the work groups. If the changes are major, contact the designer and have the plan revised and re-issued to all work groups.

As Constructed drawings also have legal significance. The constructor certifies how the network was actually installed. If any problems become apparent at a later stage, e.g., cable installed on an incorrect alignment or depth, and then the problem can be traced to the responsible person.

Construction staff are encouraged to provide feedback to the designer when alterations to the worksplan are required as a result of an incorrect design, or a change based on improving the network. This feedback may by initiated by marking clear feedback about the design on the As Constructed Stamp (if applicable).

It is noted that in some locations the responsibility for completing the As Constructed Stamp may be the responsibility of the FCO/WGO/WGL, however all staff are responsible for contributing sufficient information to enable accurate capturing of constructions.

5.2 The timely return of As Constructed Records (Including Worksplan)

The timely entering of Network data is essential to ensure that operations and the safety of Staff, contractors and the public is maintained. As Constructed records (including required forms/worksplan) are to be received at Network Data within 10 business days of commissioning of any asset, the electrical completion of a project or the practical completion of a project stage or non-commissioned constructions. Don't delay As Constructed plans for civil backfill or old pole recoveries to be completed.

Field crews and contract resources have 10 business days to submit the As Constructed records to the POW Support Officer for submission to Network Data.

Field crews and contract resources have 10 business days to submit the As Constructed records to Network Data, Network Data then have 10 Business days to update the relevant systems to ensure all electrical network assets to be represented accurately in corporate information systems (e.g., NFM, GIS, Powerfactory, etc.) as soon as possible to reflect the energised state of the network regardless of whether the work was completed by internal or contract resources and regardless of voltage.

5.3 Staged Projects

For large projects that are constructed and commissioned in stages, "As Constructed" drawings shall be submitted for each stage. It is essential that network records be updated as soon as possible after the electrical completion.

For complex projects please contact Network Data for advice on project set up in Ellipse in relation to Network Data Work Order and POW requirements.

5.4 Marking Up

All alterations and notes made on the plan(s) submitted to Network Data must be marked up in red ink on an original sized copy of the construction plan. Reducing the paper size for an As Constructed Drawing is not permitted.

Worksplan often contain some redundancy, with information appearing on both the plan and within schedules. Mark-ups should be made to all occurrences of an item of information where alteration is necessary (including schematics).

5.5 Partial As Constructed Worksplans

1. **When only one work group has completed their work.**
   e.g. – A worksplan contains both UG and OH and just UG is completed – a UG partial As Constructed must be submitted. Please clearly mark the schedules and drawing(s) with the work that was completed/not completed (whichever is easier).

   OR

2. **Some of the work is completed and there will be a greater than a 10-business day delay in completing the rest of the worksplan.**

e.g. – Multi Page REPEX/CTG/CTS projects covering multiple work areas where the pages are completed independently – a Partial OH As Constructed for the completed sheets must be submitted. Only the completed sheets are required.

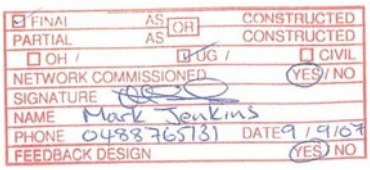
Just complete the sheets that you have worked on, no need for all sheets to be completed if the work is partially constructed, particularly as other work groups may have completed the other pages.

HV Apparatus Commissioning & Maintenance Sheet (Form 1175) may be submitted along with Partial As Constructed worksplans if changes have been made to any plant items e.g. – New Transformer installed.

5.6 Signing Off

Regardless of the stamp you are using ensure on the first page you complete the following in a legible manner.

- Your Name & Signature
- Phone Number
- Date Completed
- Partial/Final
- Network Commissioned option
- Feedback to Design indication



Every sheet of the worksplan shall be stamped either Partial As Constructed or Final As Constructed, signed and dated.

If works are staged, worksplans must be stamped Partial As Constructed and it should be indicated if works completed are overhead, underground or civil works. The worksplan should be marked up indicating which work is partial.

Attach all Commissioning sheets including the HV Apparatus Commissioning & Maintenance Sheet (Form 1175). A carbon Copy (yellow Copy) is acceptable provided all relevant details section on the top of the form is completed.

Please note that Form #2928 Transformer & RMU Commissioning Sheet is not required to be sent to Network Data and is to be provided to the WGL for checking.

5.7 P1/P2 Project As Constructed worksplans

Network Data recognise the importance of processing priority P1 & P2 projects within a reduced cycle time to normal As Constructed works. Please ensure P1/P2 As Constructed records are clearly marked.

The email address is - AsConNDS@energex.com.au
Email Subject line: P1 or P0 to be added to start of the subject line naming convention below

5.8 Email As Constructed worksplans

Network Data has transitioned to being electronic processing and no longer accepts paper copies of As Constructed worksplans. All records for construction must now be emailed to Network Data.

Scanned copies of the worksplan(s) and supporting commissioning sheets are to be attached to the email. Links to Master Projects or other electronic folder locations are not to be included.

The email address is - AsConNDS@energex.com.au

Email Subject line is to be named:
Hub Area, NDS WO#, Construction Project #, Final/Partial, mark-ups/No Mark-ups, Name of person signing off plans, Date of As Constructed, Contractor company if not Energex

Naming Convention for scanned files:
Construction Project #_OH UG CVL_Final/Partial As Cons_MarkUps_ X Sheets of X_Name of signing officer_Date of construction

5.9 Fast Track Designs

Construction work(s) completed from an A4 or A3 worksplan template still require the same minimum information as that of a detailed design.

Staff completing a design under the speedy sketch system need to ensure that the information provided is sufficient for Network Data to be able to complete the data capture. Please refer to the Minimum Data Specifications Table on the next page for examples.

5.10 Construction work(s) completed without detailed design

There are occasions where detailed designs are not being completed for construction works(s). For works completed in this way a detailed description of the work(s) in the form of an As Constructed needs to be completed. Sufficient details must be provided to Network Data as including wording “like for like replacement” on an EnerGISe map or Ellipse Work Order printout is not sufficient.

An EnerGISe map may be submitted as an As Construction plan provided the right amount of information is provided as per the table on the next page.

Energex has a series of Fast Track Design Templates on an A4/A3 size form that may be used to support the EnerGISe print to form an As Constructed worksplan. These forms include:

- 527 – Site Schedule - RMU Upgrade/Recover Worksheet
- 1576 – Worksplan A3 GIS
- 1580 – Replace Unserviceable Pole
- 1581 – Site Schedule – Pole Transformer Install/Upgrade/Recovery Worksheet
- 1583 – Site Schedule – Component Installation/Recovery for Crossarms/Ground Stays/Overhead
- 1584 – Underground Pole to Pillar
- 1587 – Cross Street Pole Installation Worksheet
- 1588 – Site Schedule Padmount Transformer – Upgrade/Recovery Worksheet
- 1589 – Ground Transformer Upgrade/Recovery Worksheet
- 1590 – Pole/Component – Installation/Recovery
- 1592 – Streetlight Pole replacement Worksheet

Please note: - These forms have been designed as a “Scoping” pre-construction focus and if used to support an As Constructed record some of the fields will not be required to be completed.

Minimum Data Specifications Table:

Short Cycle Work Category (categorised as work without detailed design completed)	Work type	Network Data Minimum Requirements(Inc. NDS Work Order)			Optional fast Track Design form to be sent to NDS
		GIS Map	Additional Information to be provided with/on the GIS Map	Mandatory Commissioning Sheets	
Replace Unserviceable Pole – SL/LV/11kV/33kV.	Planned work (e.g. like for like)./Emergency Replacements/ Damage to Energex Property	Optional	Pole Size, Sinking Depth, Foundation Type, Alignment to Kerb, Distance from old site to new (include Direction), Overhead Construction Information,	Nil	Form 1587
Replace/Upgrade Pole Transformer	Planned & Emergency work (e.g. transformer size for size, tank & minor changes to station including bridging, LV links, EDO arm).	Optional	EDO Assembly. EDO Fuse Size, Live Line Clamps, LV Configuration including Disc Link/Fuses, HV Configuration	Form 1175	Form 1581
Replace Air Break Switches	Planned & Emergency (e.g. like for like).	Optional	Nil	Nil	Form 1583
Component changes and Minor Network Alterations	Planned Minor works (at one site typically)/Emergency Replacements/ e.g. - cross arm or trident replacements, Changing of EDO arms or installation of LV fuses/DL's	Optional	Construction information e.g. – cross arm type, Fuse Type	Nil	Form 1590
Upgrade Air Break Switches	Planned & Emergency (e.g. replace with non-remotely controlled pole top mounted LBS).	Optional	Mid Pole/Top Pole Mounting confirmation by either supplying F1577 or marking up As Constructed Plans.	LBS Pre-Com Sheet F1577 (Must be completed however optional to send to NDS)	Form 1583
Replace Padmount Transformer	Planned & Emergency (e.g. like for like replacement, same configuration and site at current standards).	Optional	If any circuits changed or cables changed then LV Circuit Labels, HV Circuit Labels, cable information	Form 1175	Form 1588
Replace/Upgrade Ground Transformer / RMU	Planned & Emergency (e.g. like for like replacement, same configuration and site at current standards).	Optional	If any circuits changed or cables changed then LV Circuit Labels, HV Circuit Labels, cable information	Form 1175	Form 1589
Replace/Upgrade RMU	All	Optional	If any circuits changed or cables changed then LV Circuit Labels, HV Circuit Labels, cable information	Form 1175	Form 1589
Replace LV UG Link Pillars	All	Optional	If any circuits changed or cables changed then LV Circuit Labels and cable information, any joint information	Nil	Form 1584
Replace LV Pillar	All	Optional	Number of fuses, Configuration e.g. - 2 way, 3 way	Nil	Form 1584

5.10.1 Bulk Work completions for particular NAMP Lines with no Detailed Design

Network Data do receive As Constructed records where there has not been a detailed As Issued or As Constructed worksplan created. For certain work types such as bulk ABS replacements on existing poles the minimum information required is a printout of the HV Panel with the changes written on or a copy of the approved current project scope statement. Please contact Network Data prior to utilising this method of advice.

5.11 HV Apparatus Pre-Commissioning Sheets

HV Apparatus Pre-Commissioning sheets (Form 1175) must be sent to Network Data attached to the As Constructed worksplan. This form has been made as a triplicate book so that the original copy can be handed to switching crews if the energisation is completed by another crew, the yellow carbon copy is to be returned with the As Constructed Plans to POW Support to forward to Network Data and the pink carbon copy is to remain within the booklet. It is acceptable for the carbon copy to not be totally completed provided the complete all relevant details section on the top of the form is completed.

Please note that Form #2928 Transformer & RMU Commissioning Sheet is not required to be sent to Network Data and is to be provided to the WGL for checking.

The HV Apparatus Pre-Commissioning sheets should be sent to Network Data within 10 business days of commissioning date.

Loose HV Apparatus Pre-Commissioning sheets shall have the Ellipse Project number/Construction Work order number located on the form for easy identification.

5.12 Line Fault Indicators

Form 2224 (Installation, Removal, Replacement or Relocation of Line Fault Indicators – Data Sheet) must be forwarded to Network Data. The form must include the following data:
Site identification:

- Between key sites (for relocation and installation only)
- Location – street name and suburb
- Type of LFI being installed
- New address (where being relocated only)
- Printed name, signature, contact phone and date for responsible person completing job
- Form 2224 should be sent within 10 business days of installation to Network Data for Planet to be updated.

5.13 Network Attachment Points

The need to be able to identify the Supply Source for premises has never been more important. Collecting the upstream pole/pillar is critical for Network Data to know which side of the LV Open Point the service is connected to.

Each new or transferred overhead service needs to have an OH Service form completed and returned to POW Support for entry into Peace, this applies to all planned/non-planned work.

Paper Forms

- 8877 – Installation Connection Record Sheet
- 1024 – Overhead Services – Inspection/Maintenance Data Sheet
- 1019 – Overhead Services – Inspection/Maintenance Data Sheet

FFA Service Forms

- 13 – OH Service Replacement System Generated (Peace Jobs)
- 11 – Adds & Alts (Peace Jobs)
- 10 – New Connections (Peace Jobs)

Whilst it is the preference for the As Constructed Worksplans to be marked up with the services so that a visual representation can be followed this is not mandatory provided the Service form is completed.

5.14 LV Open Points

Notifications of changes to LV open points need to be supplied to DataHelp. For changes that are part of a worksplan, please red pen any alterations to the open point location or configuration and please mark the customer supply side of the open point for all services at that site.
For changes to the switch position or location that are part of switching/non worksplan construction work such as emergency work please ensure you notify DataHelp via email datahelp@energex.com.au or phone (07) 3664 DATA (3664 3282) of the change(s). Please include information for the customer supply side of the open point for all services at that site so that Network Attachment Points can be updated.

Changes that are of a temporary nature are still to follow the current abnormalities process and only at the point where the abnormality is removed, and the switch status remains are Network Data to be informed via the methods mentioned above.

5.15 Substation Ellipse/NFM Data Recording and Notification Advice

Form 1392 (Substation Ellipse/NFM Data Recording and Notification Advice) the original form must be returned to Network Data.

The form must include the following data:
Substation name:

- Name of responsible person submitting Form 1392, and date
- Operating Number, Commissioning Date, Cyclo Reading at Commissioning, Stores Code, ENERGEX Number, Serial Number, if it is scrapped or not, and any additional comments

Form 1392 should be sent within 10 business days of commissioning date to Network Data for updating via email to plantprocessing@energex.com.au

5.16 Information Not Relevant

Not all the information on the worksplan is relevant once construction is completed. Construction notes, resource estimation models etc. are not relevant to any network records and have no further value to ENERGEX. Consequently, changes to these elements need not be indicated on the drawing. Similarly precise details of recovered items are not relevant, just the fact that the items were recovered – a site ID must be provided. (Any factors likely to affect job charges are a possible exception.)

The exception to this is for assets that are decommissioned but remain installed e.g. – UG cable left direct buried in the ground. Sufficient details are required to ensure that the location of the asset can be determined and marked in corporate records for future use.

Changes to certain minor elements of the drawing may be too trivial to Note: e.g., details of conduit bend radius, clamps, lugs, conductor sleeves and terminations.

5.17 Information to be Captured

Appendix one on the following pages details the information to be noted for each segment of the worksplan. Examples are provided in the associated sketches. Note that these examples are illustrative only. Changes of the magnitude shown would not normally be necessary.
Minimum requirements are listed:

5.17.1 Speedy Sketches

- Worksplan sketch that includes site numbers
- Supporting scoping sheets e.g. – Form 1581 Pole Transformer Install/Upgrade/Recover Work Sheet
- Printout of HV WebView diagram for projects involving HV changes/additions
- Printout of Energise for LV open point changes – including NAP's for services from open points
- Label information including new/amended isolator/switch fuse numbers.

5.17.2 Workplan Designs

- Worksplan drawing that includes site numbers
- Supporting schedules as required
- Schematic Drawings – including Current & Proposed LV & HV network
- NAP information for services of an open point
- Label information

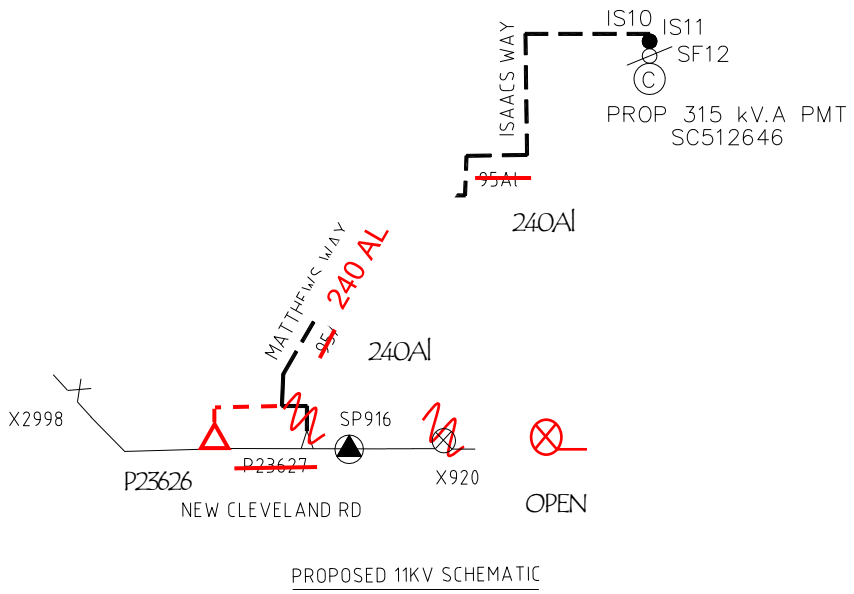
Appendix A – Worksplan Section – Detailed Explanation

A.1 Schematics

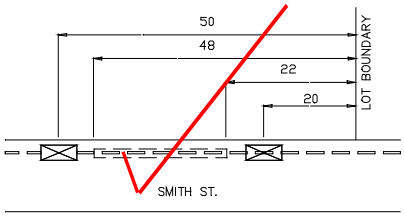
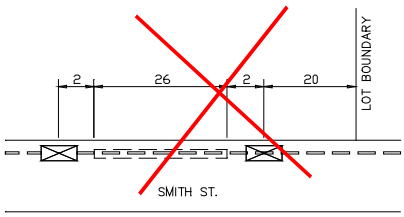
HV Geographic, HV System (Schematic) Diagram, LV Geographic, Streetlight, Pilot Cable

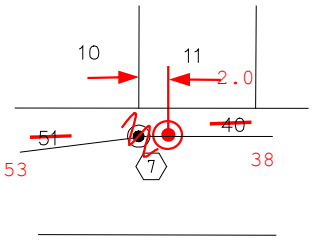
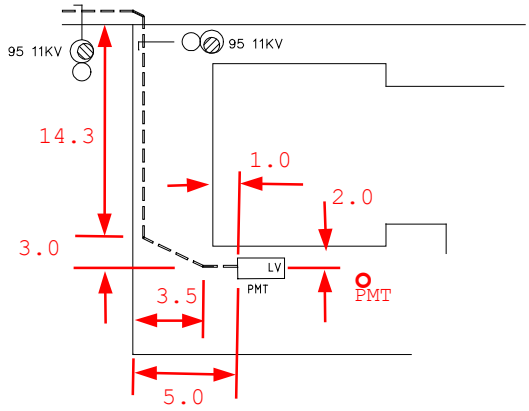
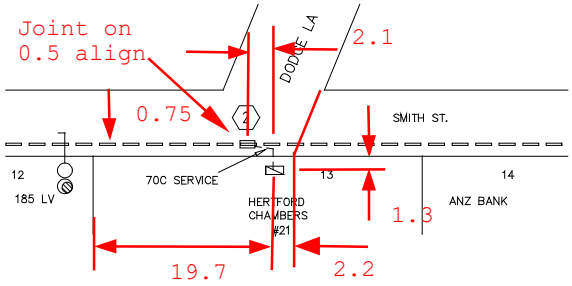
Element/Attribute	Comment
General	Schematics are a key part of the worksplan and must be 100% accurate with regard to connectivity, switching points and relationships within network.
Connectivity	Must accurately represent network configuration and connections.
Switching Points	Locations Open/Closed Status
Cable/Conductor Sizes	Show any changes. Use abbreviations, e.g., “240Al”. Mark up schedule to show full details e.g., “240 Al 4C XLPE LV”.
Feeder ID	Must be correct.
Phasing	Show phasing of OH mains where non-standard, i.e., where other than [N] ABC from footpath to carriageway (vertical and vertical delta constructions), or where all three phases are not present and energised.
Other	Work Site, if shown, is no longer relevant.

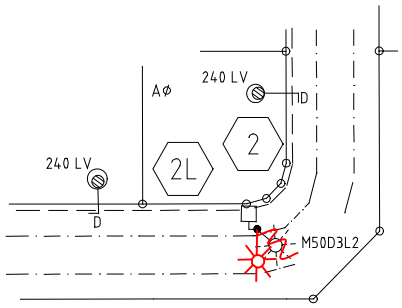
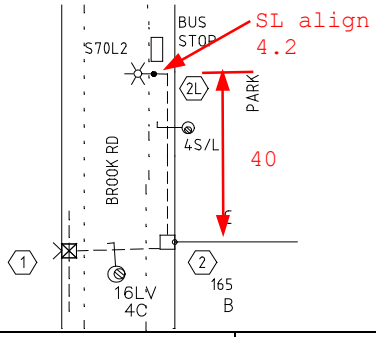
Example:
HV Schematic



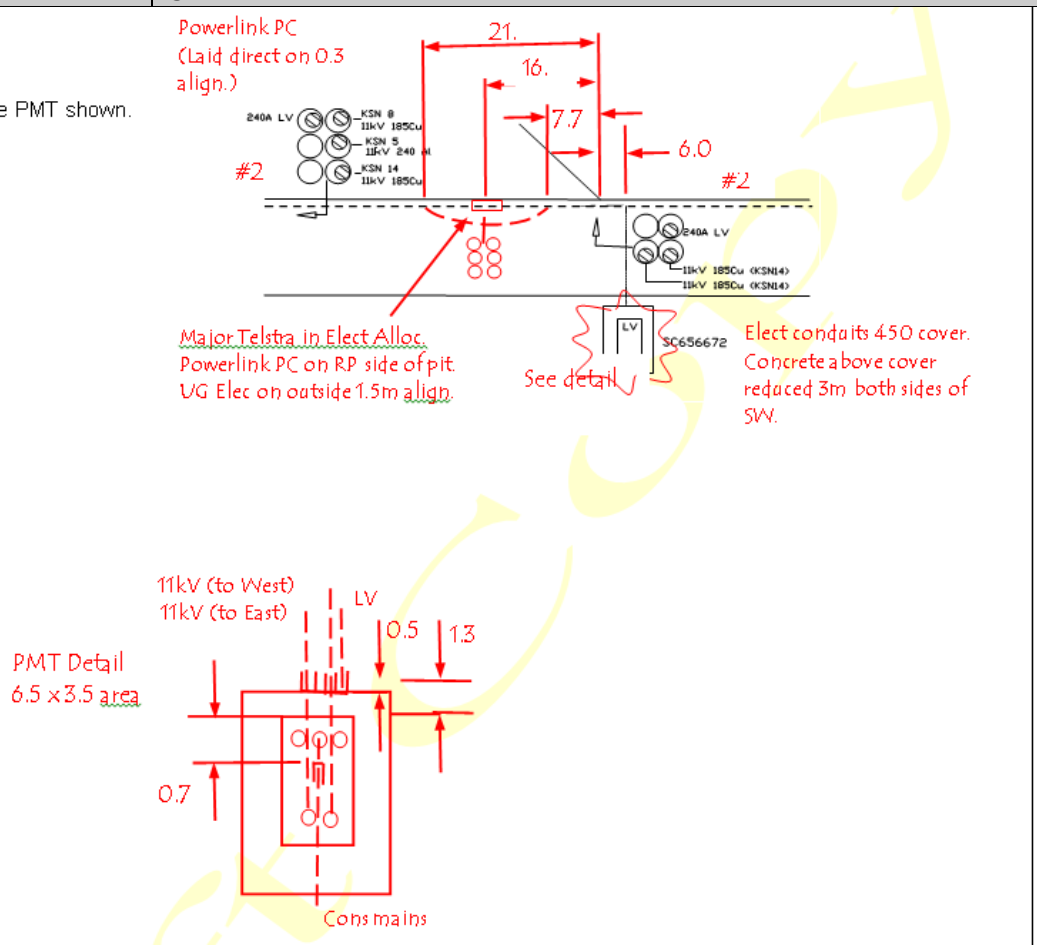
A.2 Plan and Details

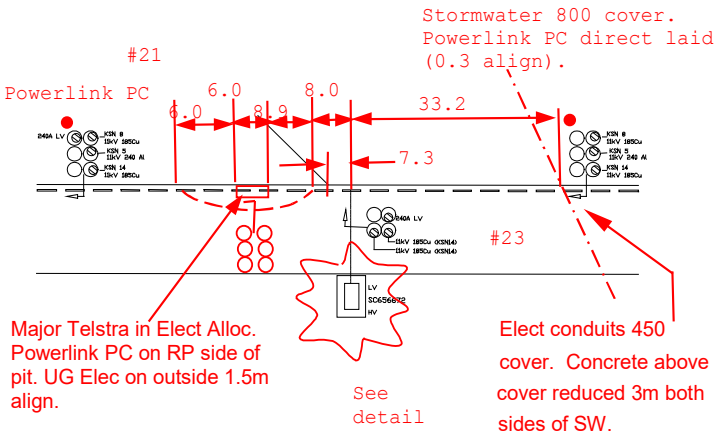
Element/Attribute	Comment
General	As the centrepiece of the worksplan, virtually all the information on the plan and associated details ('blow-ups') is of importance. This is the main section of the plan for showing dimensions and spatial relationships. Any changes made should be reflected in the drawing, schedules, schematics and labels.
Dimensioning	Reference from: cadastre (nodes/boundaries) if at all practicable – this is crucial for entry into GIS; side streets or projected side streets in CBD or urban areas where lot boundaries are difficult to determine because of building frontages on property alignment; other ENERGEX equipment sites, provided these can be referenced to cadastre. (Span lengths may be sufficient to fix pole positions, although dimensions relative to cadastre are preferred.) Use supplementary dimensions. Since reference points may alter with time, these helps confirm locations minimising expensive excavation and reinstatement. Show 'chainage' (dimensions along the length of the street) and 'alignment' (dimension from RP boundary, or face of kerb for private roads e.g., within a community title development). It is preferable for all dimensions within a group to be referenced to a single point, rather than have a large number of dimensions end-to-end. This minimises cumulative error in the measurements.
 	
	Measure to: Centre or centre-line of pole, pillar, pit lid, joint, disc, box, cable or duct group unless otherwise indicated. For larger items of equipment e.g., a PMT dimension to a centreline or edge. For depths, measure to crown (highest point) of cable or conduit group.

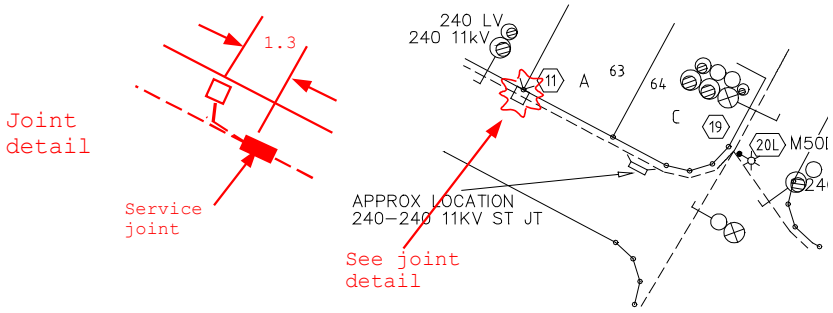
Element/Attribute	Comment
	Typical Accuracy: 0.2 m min. for underground. 0.2 m align, 1.0 m chainage min. for above ground. It is recognized that this degree of accuracy may not be achievable within some rural locations. Take particular care for underground assets below roads, driveways, or sealed footpaths. Where necessary draw Details ('blow-ups') with expanded scale to show dimensions in small area. If the Construction copy of the worksplan contains dimensions, alignments, or coordinates and these have not been altered, then there is no requirement to mark-up the As Constructed drawing.
Examples: Pole Dimension 	
Cable Dimension 	
Service Dimension 	

Element/Attribute	Comment
SL Pole Dimension 	
Streetlight or Equipment Orientation	This should be shown clearly and correctly.
Example: SL Orientation 	
Cadastre (lot and roadway boundaries)	Note: any changes in vicinity of network, including changes to lot nos. (This sometimes occurs within subdivisions where there are late changes to lot layout). Show council-approved street names where these are missing from plan. Show easement and GT or PMT road reserve dimensions accurately.
Pole or Equipment Location	Dimension alignments where non-standard. Dimension alignments relative to RP boundary or ENERGEX Plant wherever possible. Show Lot Nos. or RP Nos. (or Premise Nos. if other not known) in vicinity of assets. For distribution substations, show equipment positions relative to site boundaries or enclosure walls.
Site IDs	Any alterations to Site IDs must be shown on both the plan and the relevant schedule. Any sites added that are not on the plan should be given a site ID at Branch level. Also ensure correct spec ID is given and site is added to the schedule. Always give dimensions for these sites for accurate capture.

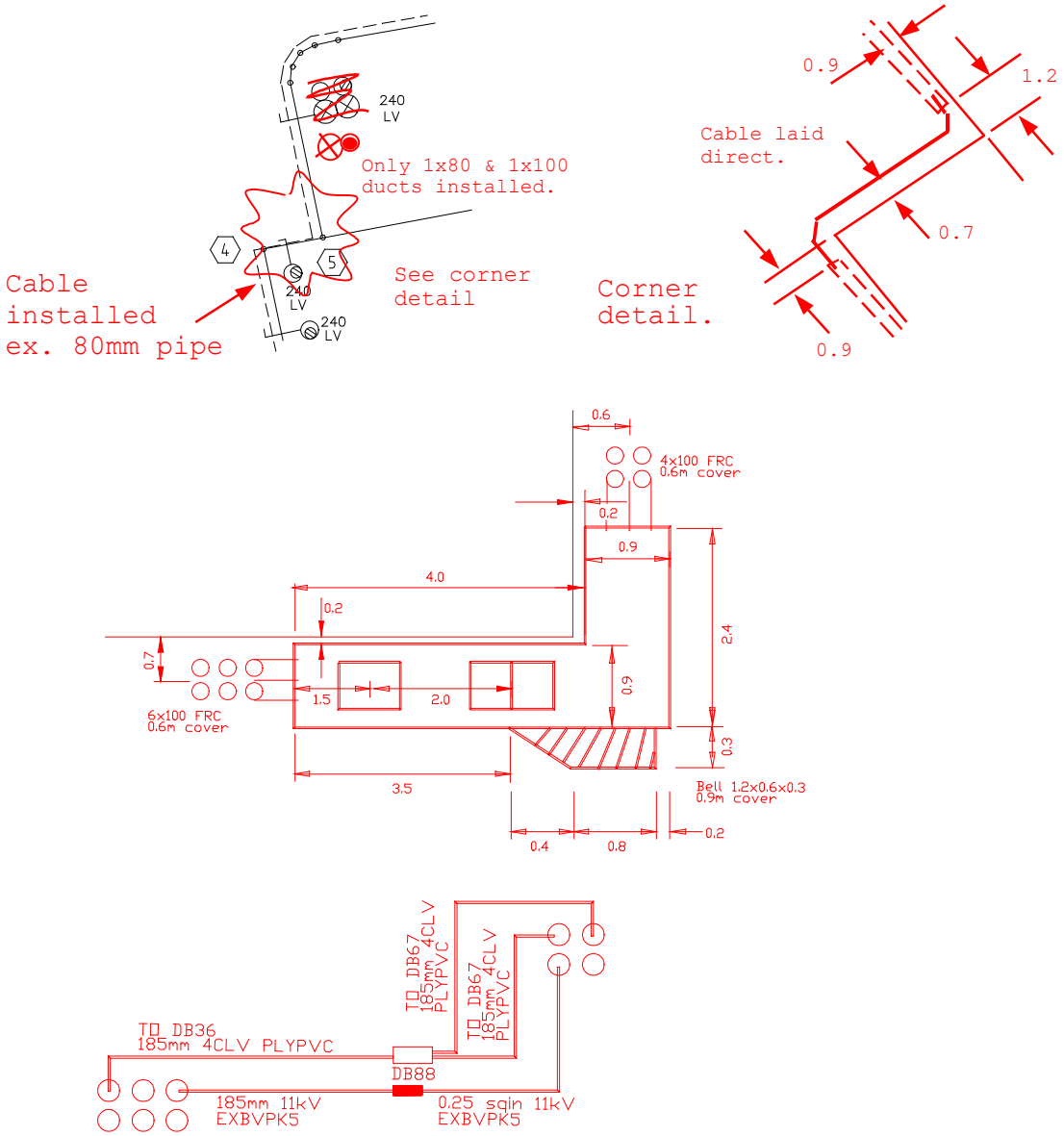
Element/Attribute	Comment
Underground Cables	Dimension ‘alignment’ wherever non-standard. Dimension alignments relative to RP boundary or ENERGEX Plant wherever possible. Dimension ‘chainage’ wherever bend in cable or significant change in depth, except if this occurs directly in line with an obvious cadastral node. Show cable depth if: less than standard cover, or more than 0.5 m deeper than standard. If cover is less than standard, indicate mechanical protection used. Indicate where mechanical protection is absent, e.g., for tunnel bored duct. Show any changes to cable type on both the plan and the schedule. Use abbreviations on plan, e.g., “240 LV”. Mark up schedule to show full details e.g., “240 Al 4C XLPE LV”. Cable voltage should be clear. Where there is more than one cable of the same voltage within the trench or in close proximity, clearly identify cables with: Destinations as per Labels, or Feeder ID (The former is preferred since feeders may be reconfigured.) It should be clear which cables within the group terminate in pillars or other equipment, from mark-ups to the plan, schematic, or labels. Abandoned cables should be clearly indicated – along with whether cut, capped or live-end joint (pothead) at end. There is no requirement to show consumer’s mains. Show any non-ENERGEX cables or optical fibres running in electricity ducts, e.g., Powerlink Pilot, Optus, traffic signal cable. Show any underground services in close proximity to cables if possible. Indicate reason for any short, sharp change in depth or alignment, e.g., sewer manhole, Telstra pit, stormwater pipe below. Show cables internal to distribution substation site with a detail if required.

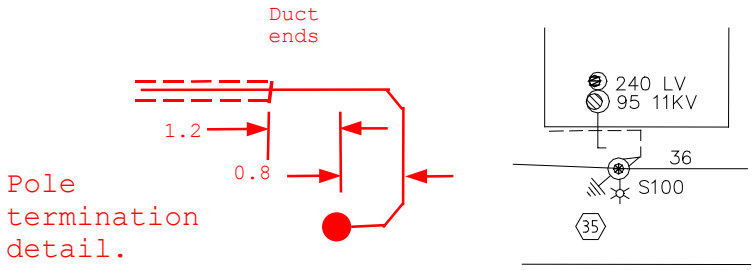
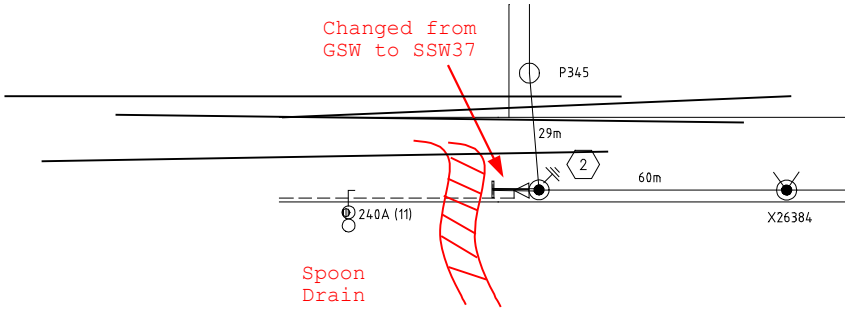
Element/Attribute	Comment
EXAMPLE **Cable Details** Note: Old style PMT shown.	

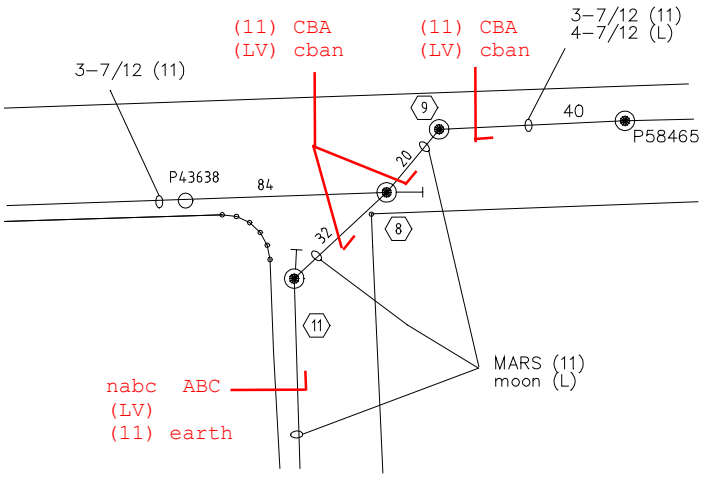
Element/Attribute	Comment
Cable Ducts (Conduit)	Show duct type, e.g., PVC, FC, square quad, ‘shamrock’ either on plan or in schedule. Show size (diameter) either on plan or in schedule. Empty high voltage conduits should be marked with an X through them. If a conduit does not get installed as per design, do not use an X to cross them out, put a line through non existing conduits and make a note of alterations made. Please also ensure this change gets made to the schedule. Show configuration e.g., 2 layers of 3 ducts. Show any changes in configuration, e.g., to skirt around an obstacle such as a large Telstra pit. Show occupancy (which ducts have which cables in them). Show ends of ducts. This includes locations where cables are direct buried, e.g., on sharp bends, crossing the footpath to a pole termination. Dimension ‘alignment’ wherever non-standard. Dimension alignments relative to RP boundary wherever possible. Dimension ‘chainage’ wherever bend in cable or significant change in depth, except if this occurs directly in line with an obvious cadastral node. Show conduit depth if: less than standard cover, or more than 0.5 m deeper than standard. If cover is less than standard, indicate mechanical protection used. Indicate where mechanical protection is absent, e.g., for tunnel bored duct. Show ducts internal to any distribution substation.
Example: Duct Details	

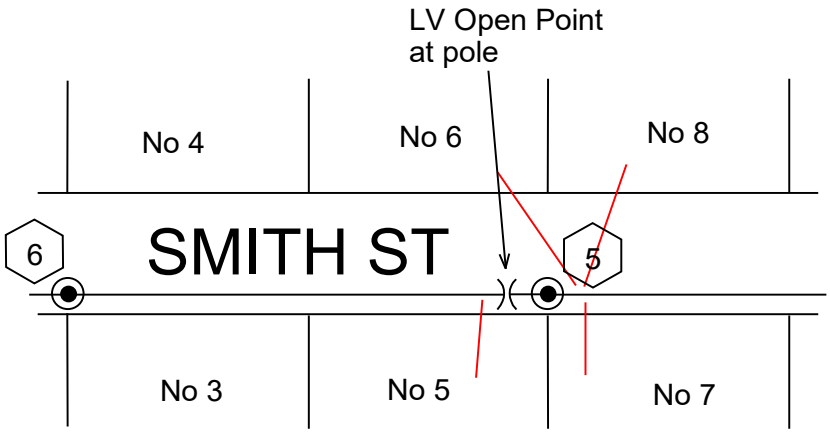
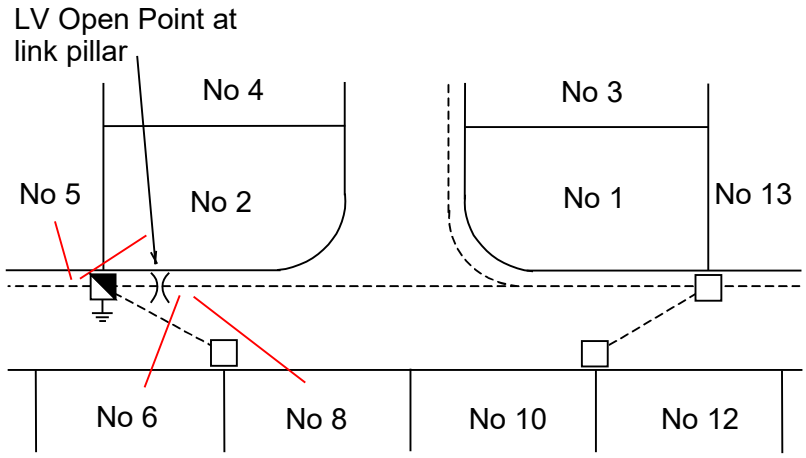
Element/Attribute	Comment
Cable Joints (Including service T-joints, cable end caps and live end joints)	Dimension 'alignment' of joints outside electricity allocation. Dimension alignments relative to RP boundary wherever possible. Dimension 'chainage', except where joint is directly in line with an obvious cadastral node. Service T-joints in residential areas need not be dimensioned if located within 1.0 m of lot (property dividing) boundary. However, the plan should clearly show the side of the boundary on which it is located. Show service pillars into which cable has T-jointed. Record all ECMs at joint locations. Show nearby Lot Nos. or premise Nos. to assist in locating the joint. Reference joints within a building e.g., substation cable basement, to building features so that they can be identified unambiguously, remembering that other joints may be added at a later time. Show details of joint types on plan or in schedule.
Example: Joint Details 	
Cable Pits	Dimension 'alignment' of pits outside electricity allocation. Dimension alignments relative to RP boundary wherever possible. Dimension 'chainage', except where pit is directly in line with an obvious cadastral node. Dimensions should generally refer to centre of pit lid. This assists in finding the entry when pit top has been covered over. For small streetlight pits and service pits, dimensions may be referenced to streetlight column. For new (or altered) large cable pits, show internal dimensions, bell mouth locations, positions and depths of incoming conduits, lid positions relative to edges. Show wall thickness, type of lid (single or double), vents and sumps. Where there are numerous cables or joints within a pit, show configuration as per pit card record. Show pit as though it were a box with the sides folded outward from the floor of the pit. Show cables as lines between incoming ducts. Show joints or disc. boxes on cables in relation to physical layout.

Element/Attribute	Comment
Example: Joint Pit Details	
Pole Terminations	Draw a small, dimensioned sketch for all ‘non-standard’ pole terminations, showing the direction of approach to the pole and the offset. A ‘standard’ termination shall be one where: the cable crosses the footpath at right angles to the RP alignment, the cable is offset from the pole centre by 0.3 m, the cable runs on the same side of the pole as the cable attachment, ducts end within 1.0 m of the pole chainage.



Element/Attribute	Comment
Example: Pole Termination Details  Note: Pole position fixing not shown.	
Overhead Conductors (and aerial pole stays)	Show any changes to configuration on plan. Show any changes to conductor type or span length on plan and in schedule.
Ground Stays	Record stay anchor positions relative to pole. If a sidewalk stay is substituted for a standard ground stay, or vice versa, this needs to be noted. Indicate where stays are within private property.
Example Ground Stay Details  	
Earths	Indicate sites that are earthed (poles, pillars etc.) both on the plan and in the relevant schedule. Note any changes to whether common or separate HV and LV earthing is used. It is NOT necessary to show details of actual electrode (earth rod) locations and connecting cables.
Phasing of OH Mains	Show phasing where non-standard, i.e., where other than [N] ABC from footpath to carriageway (vertical and vertical delta constructions excepted), or where not all three phases are present and energised. Show one span each side of the transposition point, tee-off, underground cable termination or transformer.

Element/Attribute	Comment
Example: Overhead Phasing Details  	
LV Service Phasing	Service phasing to premises shall be noted correctly on the plan, or on the Overhead Service Schedule for overhead-supplied lots. There is no requirement to capture details of street light phase connections.
LV NAPs (Network Attachment Points)	LV open points must designate the side of the open point that supplies a premise. This is important for the NAP database to be maintained effectively. Supply sources to premises are obvious in most cases, but at an open point it is indeterminate which side of the pole/pillar a premise is supplied from and therefore must be illustrated at time of connection as per the examples below.

Element/Attribute	Comment
Example: LV NAP Details  O/H NAPs  U/G NAPs	
Pilot Cables & Optical Fibres	Show any junctions – pillars, UG joints or junction boxes on poles. Indicate presence of any optical fibres within cables or overhead earth wires.
Other	Minor notes, e.g., regarding contractor responsibilities or consumer's mains, need not be marked up. Similarly minor changes to cadastre, kerbing etc. unrelated to the electrical network may be disregarded.

A.3 Equipment Schedule

Element/Attribute	Comment
Cable Joint or Termination Type	Record the type of joint (e.g., parallel branch joint, transition joint) using correct spec id.
Pillars	Note any changes to pillar type, e.g., From loop to link pillar, or fused services to CFS unit. and record spec id for new pillar.
Equipment Ratings	Note any changes to major plant type or equipment ratings. Ensure numbers and sizes of fuses are recorded accurately.
Earthing	Indicate sites that are earthed (poles, pillars etc.) on the plan and in the schedule. Note any changes to whether common or separate HV and LV earthing is used.

A.4 UG Cable Schedule

Element/Attribute	Comment
Cable Type	Record no. of cores, conductor material, core size, insulation material, screening, stranded/solid (if possible).
Other	There is no requirement to correct length measurements in schedule.

A.5 Civil Works Schedule

Element/Attribute	Comment
Conduits	Note conduit type and numbers in schedule and on plan.
Other	Details of trenching, reinstatement, bends or actual conduit lengths are not required.

A.6 Overhead Pole Schedule

Element/Attribute	Comment
Pole	Record any changes to pole type (timber, concrete) or size (length/strength) for new poles. Record pole spec id, pole foundation and sinking depths if different from plan.
Alignment	Record any changes to alignment for new poles. Reference to RP boundary if practicable, otherwise to kerb face, EOB or edge of running lane.
Stay	Record any changes to stay types or sizes.
Earthing	Indicate sites that are earthed (poles, pillars etc.) both on the plan and in the schedule. Note any changes to whether common or separate HV and LV earthing is used.
Pole-mounted Plant	Show any changes to type or rating of pole-mounted plant.
Pole-top Constructions	Record any changes (e.g., 11TDS/NMOS).
Other	It is not necessary to mark-up changes to: KBS.

A.7 Overhead Conductor Schedule

Element/Attribute	Comment
Conductor Type	Show changes to conductor type in the schedule and on the plan.
Other	Actual conductor lengths, tensions and sags need not be recorded.

A.8 Streetlight Schedule

Element/Attribute	Comment
Type and Size	Record any changes to type or size of column, luminaire or outreach. If more than one luminaire on pole, specify which is affected, i.e. North, South, East, West.
Alignment	Record any changes to alignment. Reference to RP boundary if practicable, otherwise to other ENERGEX plant.
Mounting Height	Record any changes to mounting height.
Control	Note any changes to switching control of streetlights.

A.9 Labels

Element/Attribute	Comment
Text	Any changes to label text must be noted.
Other	Changes to label materials or dimensions are not relevant.

A.10 Title Block

Element/Attribute	Comment
Revisions	Show any changes likely to affect network records or project costing/charges.

Appendix B – Underground Transmission Works Overview

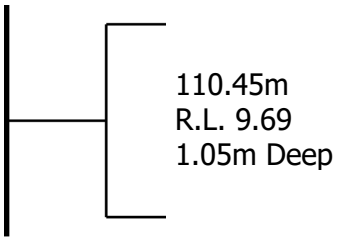
Accurate records are particularly vital for transmission cables so that:

(a) Cable dig-ins can be avoided,
(b) Repairs can be affected with minimal delay, and
(c) Circuit impedance and rating can be calculated to a high degree of precision.

A copy of the 'As Constructed' drawing may be cut into strips and pasted into a field book for the feeder. Basic details of the new cable are also entered into the ENERGEX GIS/NFM system on computer.

The following recording requirements are in addition to those for distribution projects:

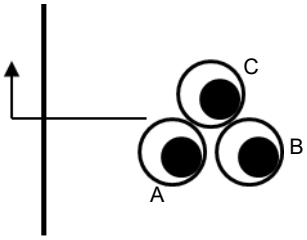
Show length, alignment, depth, and RL (reduced level) of each cable at intervals (typically 30 m) along the route. This is illustrated below. The length is of importance for determining circuit impedance. The RL is determined by reference to the survey of the original ground levels. In this way cable depths can be determined even if surface levels are altered at a later time.



This indicates that at chainage 110.45, the crown of the cable is at R.L. 9.69 and was 1.05m below the natural surface at the time of recording.

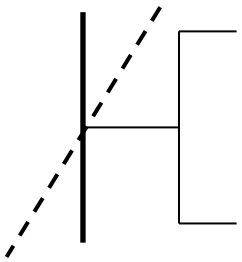
Lengths are recorded relative to the substation RP boundary. Lengths within the substation property shall be shown as negative values. Lengths of cables on poles shall be noted.1.

1. RLs are not required for cables within a substation yard.
2. Show the laying configuration e.g., flat or trefoil arrangement. Many transmission cables are single core types. Locations where the laying arrangement changes, or phase transpositions occur shall be noted.



This indicates three cables installed in conduits in a trefoil arrangement. The arrow indicates the direction of view.

3. Record the cable manufacturer, drum number, and year of manufacture. For joints, record manufacturer and style of joint.
4. Record the location of other cables, heat sources or underground services that may run adjacent to or across the cable route. Minor obstructions, e.g., 25mm dia. water services, need not be recorded.



This indicates that a water pipe crosses the cable at chainage 110.45, and that the pipe crown is at R.L. 9.69 and is 1.05m deep.

Figure 1: Example of water pipe crossing cable

Recognised mapping and survey abbreviations may be used, e.g., “SW” for storm water.

5. Note how the metallic sheaths of the cables are connected to each other and earth (e.g., single point, mid-point or cross bonding arrangement).
6. Note soil type along the route (e.g., clay, sand) and thermal resistivity and whether this information is based upon inspection and measurement or assumed.
7. Note any specialised backfill or mechanical protection used, e.g., lean mix concrete.

The scales used should be of sufficient size so that the drawing does not appear unduly cluttered with dimensions and notations.

Clearly mark on As Constructed Plan the As Issued Plan number assigned to works as they are different so Network Data can cross reference these plans.

Underground Cable Certification

For all projects involving installation of ENERGEX underground cable, an additional certification shall be affixed to the As Constructed plan concerning the depth and alignment of the cables. This may take either of two forms:

General underground cable certification
The cables detailed on this drawing have been checked using the cable locator described below and are, as far as can be determined, on the correct alignments and at the correct depths below the finished surface level.

Make: _____ Model: _____ Serial No. _____

Date cables located: _____Signed: _____Date: _____

Name: _____Organisation: _____

PLEASE PRINT

Contact Phone: _____

No Changes

For projects where there have been no changes to finished surface level, then the following certification may be used:

I have witnessed the installation of all conduits/cables for this project and confirm that these are installed on the correct alignment and depth (after the establishment of final surface levels).

Date(s) conduits inspected: _____Signed: _____Date: _____

Name: _____Organisation: _____

PLEASE PRINT

Contact Phone: _____

Appendix C – Overhead Transmission Works Overview

There are very few changes made during construction in this area. The original design is more detailed and there are fewer external variables to deal with than for a distribution project.

Nevertheless, it is possible to have changes to materials, foundations, or other elements of the line. ALL changes shall be noted on the 'As Constructed' plan so that records may be updated.

It is not necessary to resurvey the line following construction in order to record actual sags/tensions.

The following recording requirements are in addition to those for distribution projects:

- Dimensions shall be accurate to within 0.5m min
- Two locations shall be recorded for ground stays
- the point at which the stay enters the ground
- the centre of the anchor (mass concrete or log)

Locations of gradient control rings for earths on concrete and steel poles shall be recorded.

Overhead earth wires shall be shown on the plan in the same manner as other overhead conductors. The schedules shall also indicate where an earth wire is present.

Clearly mark on As Constructed Plan the As Issued Plan number assigned to works as they are different so Network Data can cross reference these plans.

Appendix D – Substation Works Overview

Major substation ('SS' sites with CB switchgear) construction documentation typically comprises:
Civil drawings
Layout drawings
Circuitry drawings
Panel fabrication drawings
Equipment Schedules
Multicore cable schedules
SACS database
Works Order describing work to be performed

ALL changes made during construction (apart from minor notes concerning construction responsibilities or resource estimation models) shall be recorded. Where information appears in several places in the suite of drawings, all references shall be updated.

This enables the design office to produce an 'As Constructed' amendment of the drawings which is re-issued to crews performing testing and commissioning works. These drawings are also lodged with the Plan Library and constitute the substation records.

For complicated mark-ups, in order to minimise confusion, a green pen or highlighter may be used to show elements that have been recovered and a red pen to show elements that have been added.

Cables within substations, whether at transmission or distribution voltage, are also the subject of detailed drawings held by Plan Library. Following any changes to cabling internal to a substation, these drawing shall be updated. The drawings shall show all cables drawn to scale with key dimensions indicated.