Acceptable As-Laid Standards

A best practice guide to record assessment and quality checks

Information Management

Contents

1.0 Introduction 2

2.0 ICP/IDNO Agreement Framework and Obligations 2

3.0 Recording of Underground Assets 4

4.0 Use of Sight Lines 5

5.0 Triangulation 6

6.0 GPS Coordinates 7

7.0 As-laids drawn with Computer Aided Design (CAD) 8

8.0 Example of an Acceptable As-Laid 8

9.0 Example use of Continuous Dimensions 9

10.0 Examples of unacceptable As-laids 9

11.0 Conclusion 11

1.0 Introduction

Accurate records for all assets are vital for the safe, effective, and efficient operation of Northern Powergrid's electricity distribution network. It is also vital that anyone responsible for capturing and/or assessing any asset records understands the importance of the standards laid out by Northern Powergrid and OFGEM to allow the correct, accurate, and *timely* capture of NPG's digital assets on our GIS systems.

This guide will outline, with the use of examples, the appropriate standards for drawing as-laid cable records. The aim is to prevent rejection of submitted records by providing clear guidance on how to correctly take on site measurements and capture as-laids with an acceptable level of detail.

All NPG resource, its service providers, independent connection providers (ICP's) and independent distribution network operators (IDNO's) or anyone who is suitably trained to supply Northern Powergrid with site records should use this guide to ensure consistency and accuracy.

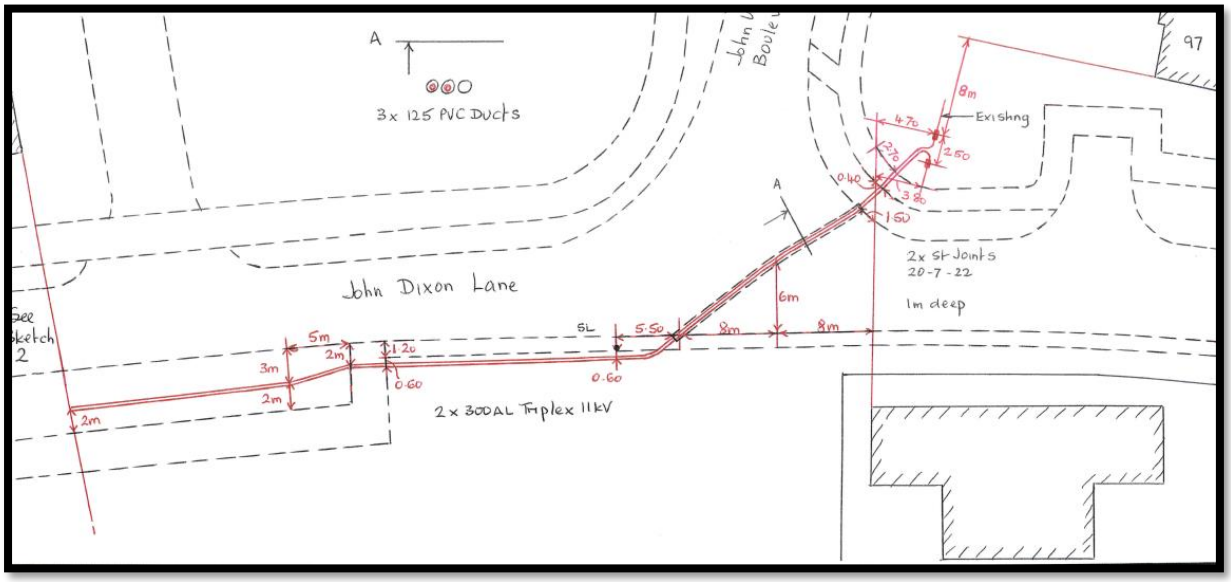

Figure 1. An example of detailed dimensions provided for an 11KV substation loop which includes dimensions from appropriate site lines to cable ends, changes in cable position, duct ends and joint positions.

2.0 ICP/IDNO Agreement Framework and Obligations

In all cases, ICP's/IDNO's *must* submit their as-laid records, to the specifications outlined in section 3 of this document, ***no later than 48 hours, or 2 working days, prior to the connection.*** Jointing records must be submitted no later than 48 hours *after* connection. If as-laid records are not submitted within the 48-hour window, the project engineer has the right to cancel the connection and the ICP/IDNO may be charged for abortive costs.

Upon submission of records, it is the ***project engineer's responsibility*** to check the connection call off to satisfy that all pre-requisite conditions have been met, all site records are of an acceptable standard as outlined in this document and raise any concerns with said records that are known following attendance to site.

If, upon receipt of the ICP's records, Information Management deem them unsuitable, resulting in rejection, the project engineer will be informed, and it is their responsibility to acquire amended

records from the ICP. The ICP is then obligated, under the Electricity Asset Adoption and Network Access Framework Agreement, to amend the records and resubmit within a timescale similar to that of the DNO's own processes, even if the connection has already been completed.

As per the Competition in Connection: Code of Practice document (V1.5, 2019), Section 7.4 - Adoption:

- 7.4.1 - Once the Connection Works are energised, the DNO will adopt those network assets that are to form part of the DNO's Distribution System as per the design, under an Adoption Agreement.
- 7.4.2 - The ICP will provide the DNO all as-laid drawings and test certificates as specified by the DNO. This information should be no more onerous than the information provided by the DNO's own Connections' activities.
- 7.4.3 - The information may be provided electronically in a timescale similar to that of the DNO's own activities. Failure to provide the correct information in the timescale required will result in a referral to the NERS Accreditation Body for investigation.
- 7.4.4 - DNOs will update new asset records into their graphical information system (GIS).

Additionally, In accordance with Schedule 1 of the Electricity Adoption Agreement:

1. - The ICP hereby acknowledges and agrees that:

1.1 - the Asset Owner owns or immediately prior to their Adoption by the Distributor will own the Assets constructed or to be constructed by the ICP as set out in Appendix 1 to this Electricity Asset Adoption Agreement;

1.2 - the Asset Owner will grant to the Distributor such Consents as it may require in order to Maintain the Assets;

1.3 - the Works have been or will be completed and the Assets constructed by the ICP in accordance with the Approved Design, the Specification, the Regulations and the terms and conditions of the Electricity Asset Adoption and Network Access Framework Agreement;

1.4 - accurate drawings and all necessary documentation required to ensure the Distributor's compliance with its obligations under the Regulations, any other necessary documentation in respect of the Works and/or the Assets, as requested by the Distributor, will be provided by the ICP and that with effect from the date of making live all rights in and to the same transfer to the Distributor; and

1.5 - subject to clause 14 of the Electricity Asset Adoption and Network Access Framework Agreement, it is responsible for errors, omissions or discrepancies in drawings and written information provided by it to the Distributor. The ICP indemnifies the Distributor against any and all claims, costs, losses and expenses incurred by the Distributor in carrying out any alterations or undertaking any remedial work including the cost of re-exposure of the Works (including for recording purposes where necessary).

3.0 Recording of Underground Assets

All records submitted from all trained sources ***must*** contain the following data:

- A drawing of all installed cables (including service cables, auxiliary cables, and earth wires) and ducts relative to the geographic area, drawn to a size that is legible. The drawing ***must*** be on a ***scaled Ordnance Survey map background*** (or similar) and show the route of the cable and ducts along with the dimensions taken on site.
- All underground cables must be recorded on site using a suitable measuring device ***when the cable is exposed.***
- Measurements must be taken at regular intervals to an accuracy of +/- 0.10m (100mm).
- Measurements must be from existing features on the map background (e.g., building sightlines, kerbs, back edges, walls, field boundaries or new builds) within a development site and ***not*** street furniture (e.g., lamps, drains, kiosks).
- Dimensions that clearly mark the start and end positions of cables and duct runs.
- Dimensions that clearly mark the transition of road crossings, moving from footpaths/verges into roadways, and vice versa – any deviation of the cable from straight must be measured from fixed, suitable features.
- Intermediate measurements at approximately 10m intervals along the route unless it deviates from straight when more frequent measurements will be needed; ***all measurements must be taken from fixed ordnance survey features***.
- Continuous dimensions around a curve with distances from kerb / back edge or building.
- Cross sections showing the formation of cables when there are multiple cables in a trench, including any ducts.
- Any unusual situations (e.g., where cables cross, deviate, or transition under walls etc.).
- Cable protection details (e.g., tape / tiles), cable depths along the route and length of installed cable.
- Date of cable installation.
- Cable attribute data including cable type, cable size, conductor material, number of cores, number of phases, phase colour, operating voltage, insulation medium (EHV only), feeder identification (e.g., name and number).
- Duct attribute data including size, type, quantity, formation, cable position in duct, depth and protection and start and end positions. Where trenchless technology is used to install the cable / duct an underground profile drawing must be provided.

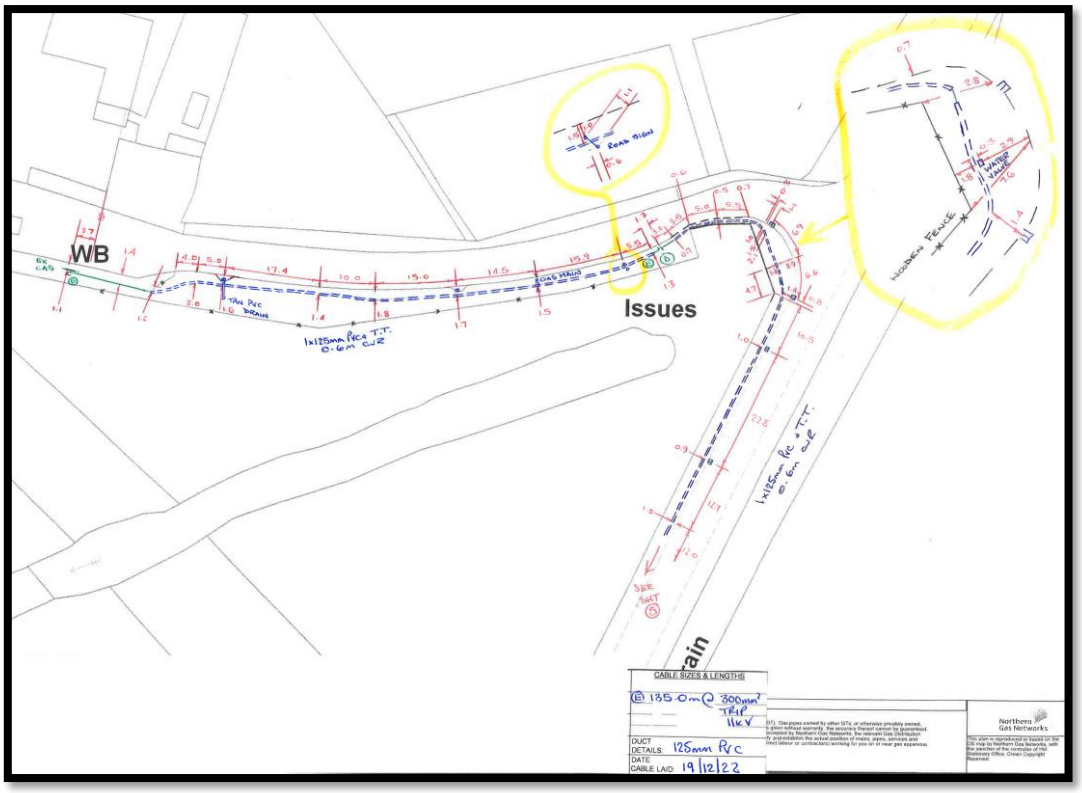

Figure 2. A typical hand-drawn as-laid cable record for an LV mains cable, with examples of standard dimensions taken from geographical features, running dimensions, and insets for increased detail.

4.0 Use of Sight Lines

Clear sight lines should be used as frequently as possible to allow accurate dimensions to be recorded. Only use sight lines taken from clearly defined 'permanent' geographical features such as:

- Buildings
- Fences
- Walls
- Straight kerb lines
- Any other clearly defined feature/boundary that is visible on a map sheet.

DO NOT USE:

- Streetlights
- Drains
- Kiosks
- Cabinets
- Poles/towers
- Temporary structures, e.g., generators, site cabins or temporary site supply kiosks.

The unacceptable features above are listed because they may not exist or be accurately represented on our map sheets due to legacy errors. These may be caused by lack of data or the poor resolution of map sheets in certain areas. Temporary structures such as site cabins for new developments are not static features on map sheets and as such are not acceptable to take dimensions from.

5.0 Triangulation

In the event of highly limited features available to take sight lines from, the triangulation technique may be used. This will allow Northern Powergrid to tie in any asset where other forms of measurement techniques are either unsuitable or impossible.

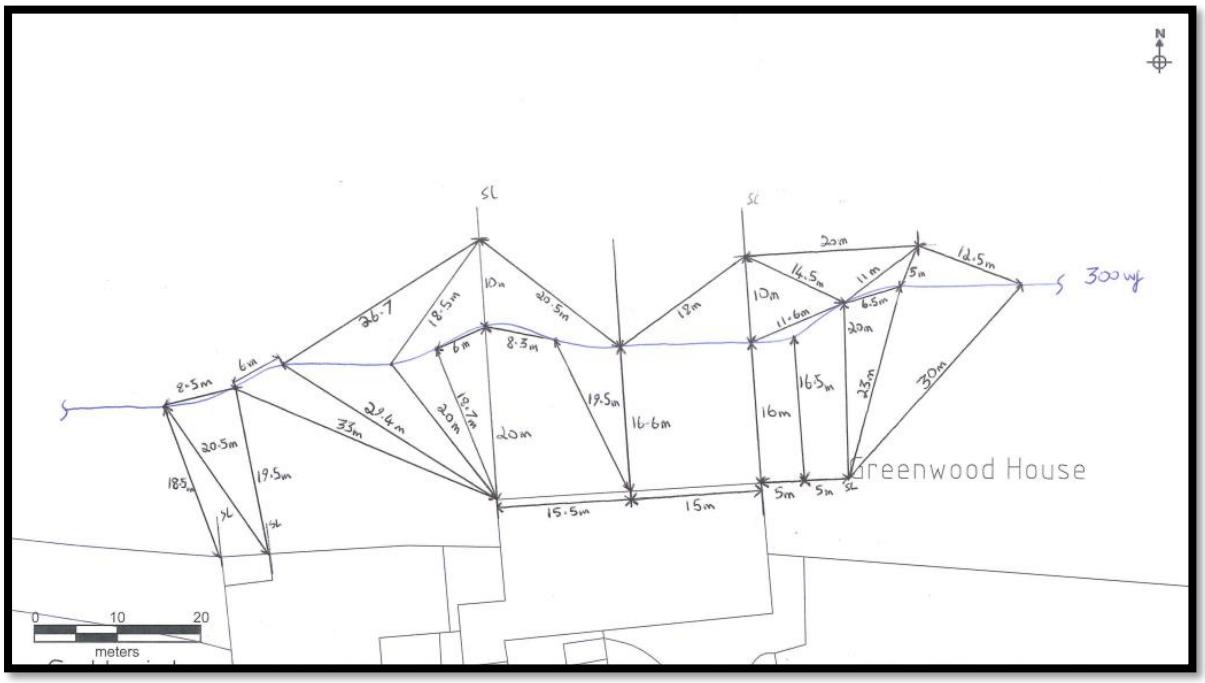

Figure 3. An example of triangulation used to accurately measure the position of a cable in an area with limited features.

Triangulation can be done using various equipment, but mostly requires any form of measuring tool and objects to use as a point of reference.

- Sight lines – there must be at least one permanent feature used as a sight line, from which all other points can be tied into, e.g., a building/fence.
- Tape measure/wheel – measuring tools.
- Points of reference – objects at hand or specifically acquired can be used to mark the ground, providing a point of reference with which to tie in the cable measurements, these include, but are not limited to:
    - Marker flags
    - Disc cones
    - Spray paint

Figure 4. Examples of items that could be useful in providing points of reference during triangulation.

6.0 GPS Coordinates

Currently, NPG will accept GPS records on a case-by-case basis. Each record must show:

- The X/Y coordinate pairs at 10m intervals for cables unless it deviates from straight where more frequent measurements become necessary.
- The X/Y coordinate pairs at all joint locations and cable terminations.
- The Ordnance survey Master Map background (showing highways, buildings, footpaths, and associated labelling as a minimum).
- Asset attribution.
- Cross sections.
- Dimensions to tie the cable in with any permanent ordnance feature that becomes available.
- Date of asset installation.
- Date of site visit.

Information Management will ***not*** accept any record containing coordinates from the 'What3words' geocode application. The resolution of this application is an area of ~3m^2, which is not suitable for accurate recording of assets. Any records submitted in this fashion will be immediately rejected.

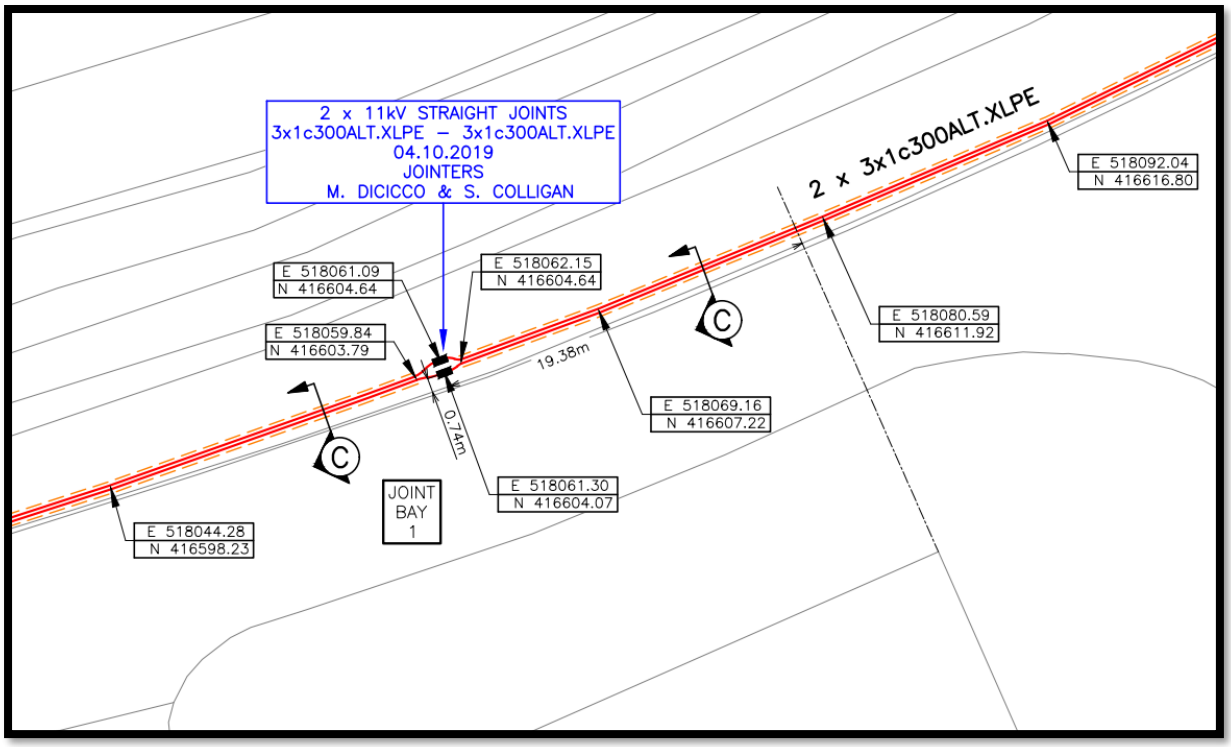

Figure 5. A GPS as laid that contains all specifications required – E/N coordinates, asset details, cross sections, dates, names of jointers and dimensions from ordnance survey features.

7.0 As-laids drawn with Computer Aided Design (CAD)

As shown in this document, many as-laids now come in drawn from a CAD system, rather than being hand drawn. These can be great for clarity as they allow for a level of versatility and quickness that hand-drawn records may lack. However, these benefits only apply when the records are drawn using the same techniques as a hand-drawn record.

Many CAD drawn as-laids are quickly rejected due to the abundance of dimensions taken either inconsistently, without sufficient reference to existing OS map/development plan features, or even from non-existent features (see section 10.0).

Where records have been rejected, these errors are likely derived from the fact the dimensions on the record are not physically taken while out on site. The cable is likely plotted using GPS coordinates which are then transposed onto the site plan in a CAD system to show the cable position. Dimensions are then added later to try and tie the cable position into the site plan. However, some of the features used for sight lines are either not appropriate, existing, or the dimensions themselves are simply plotted but not tied into any existing feature. Dimensions to cable deviations, cross sections (where applicable), and duct ends are also often missed out.

It is imperative that producers of as-laid records understand that any change in the position, number, condition, and configuration of cables within the cable trench and/or duct banks must be measured and detailed appropriately on corresponding cross sections.

8.0 Example of an Acceptable As-Laid

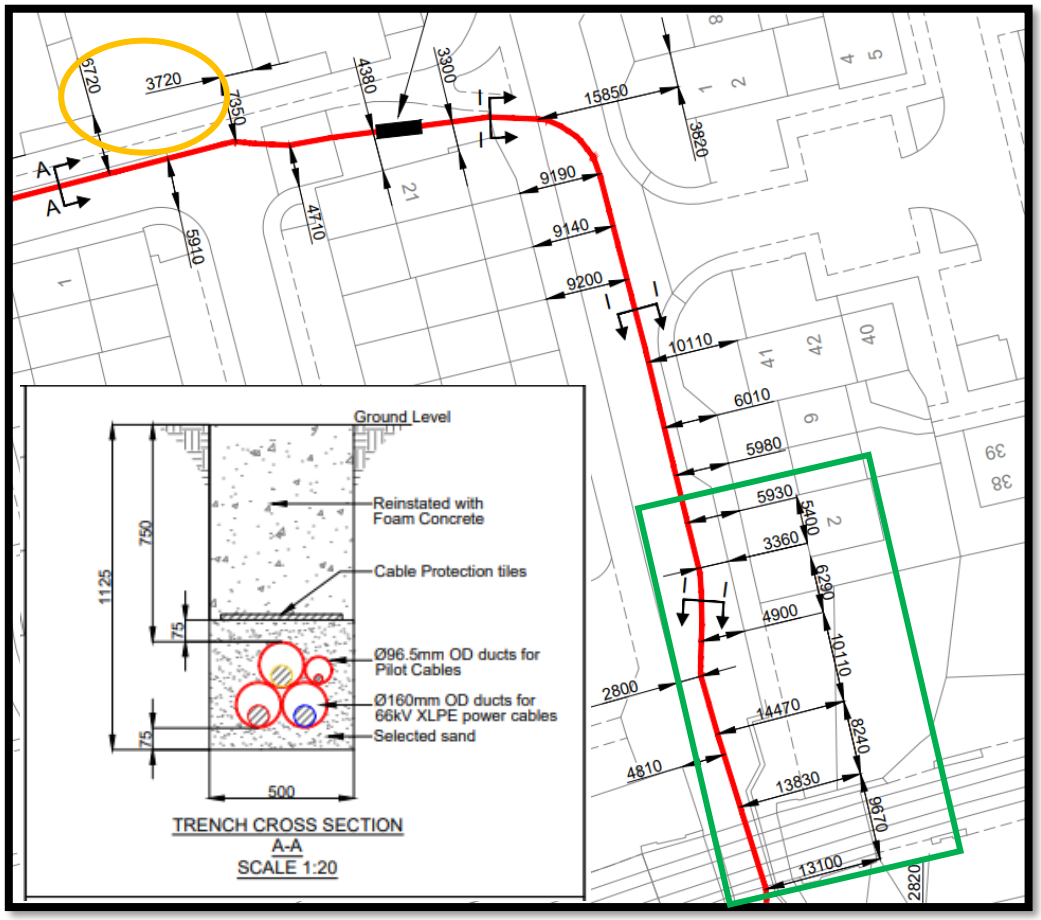

Figure 6. As-laid record for a 66KV XLPE cable drawn using CAD.

Each of the dimensions shown in figure 6 is taken using a sight line from an existing building, fence, straight kerb, or pathway; and are tied in with additionally dimensions where applicable (Circled in orange). Cross sections have also been provided where applicable, and the continuous dimensions used on the bottom-right (green box) have been tied in with dimensions from the opposite side of the cable.

Note: Please submit CAD drawings as PDF files as this is the format Information Management prefer to use.

9.0 Example use of Continuous Dimensions

There are instances where running dimensions may be required due to the lack of available features from which to take sight lines. These are predominantly in rural areas where suitable map features are highly limited.

The extended use of running dimensions is discouraged as, depending on the landscape and how they are drawn, they can decrease the accuracy of the records. However, if the landscape does not have any clearly defined features that are visible on the current OS map data, running dimensions may be acceptable.

Additionally, it should not be necessary to use running dimensions to measure the position of cables that are laid through sites with plenty of acceptable map features available.

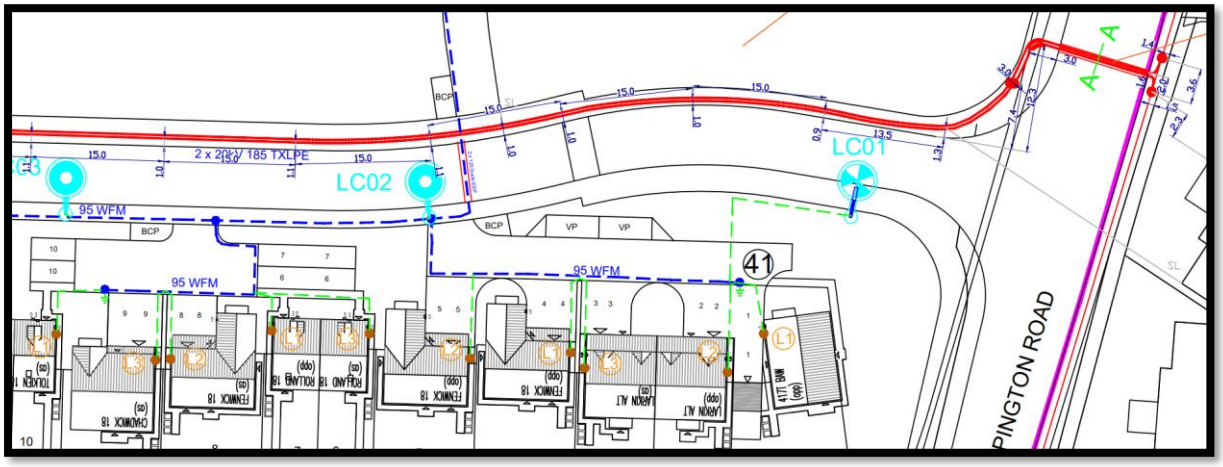

Figure 7. An as-laid for a new development using only running dimensions. Sight lines from buildings were used but they were applied incorrectly.

10.0 Examples of unacceptable As-laids

As-laids that do not meet the standards outlined in this document may be rejected. This negatively impacts both NPG and those supplying the records as additional effort is required to highlight error and re-supply information. Using the as-laid from figure 7 as an example, the following images were presented to the records provider to allow for the correction of the as-laid:

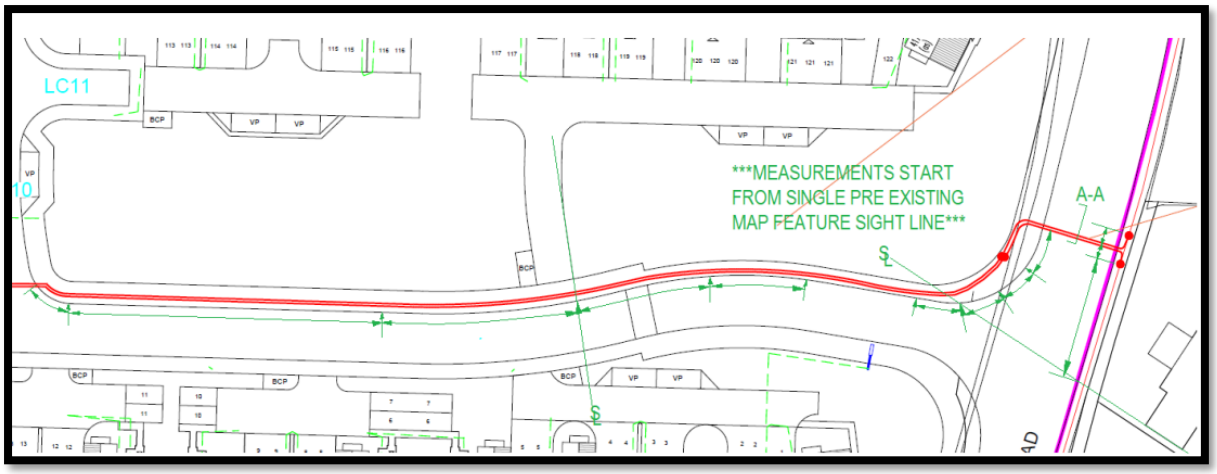

Figure 8. A subsequent drawing provided after the initial as-laid from figure 5 was rejected. The example shows (in green) how the record was amended with appropriate sight lines and corrected dimensions from the available sight lines.

Some elements of this as laid were then corrected and became acceptable (circled in green).

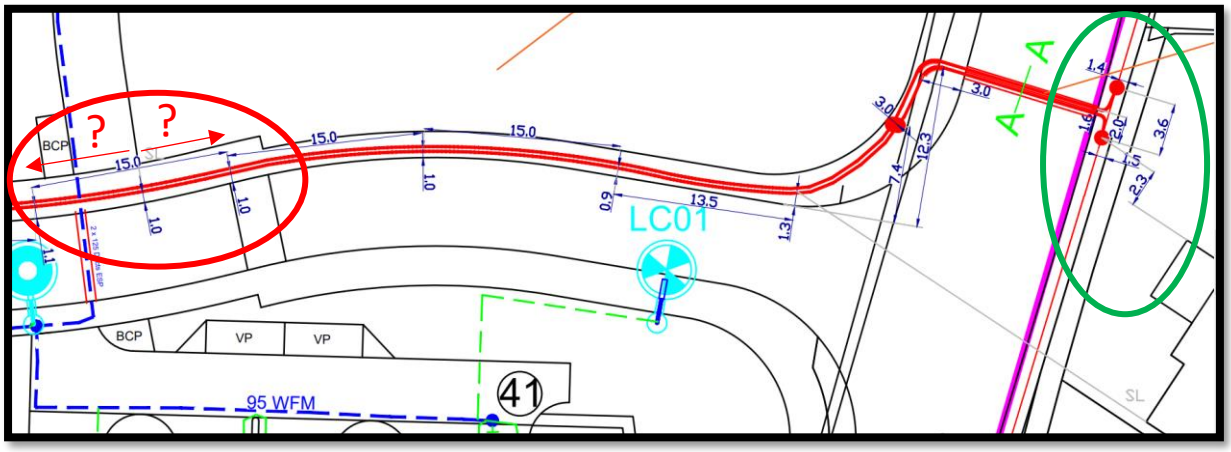

Figure 9. Inconsistent amendments to the as-laid results in further rejection.

Other elements remained unacceptable, even after sight lines have been applied as the measurements are not updated to achieve the required standard (circled in red).

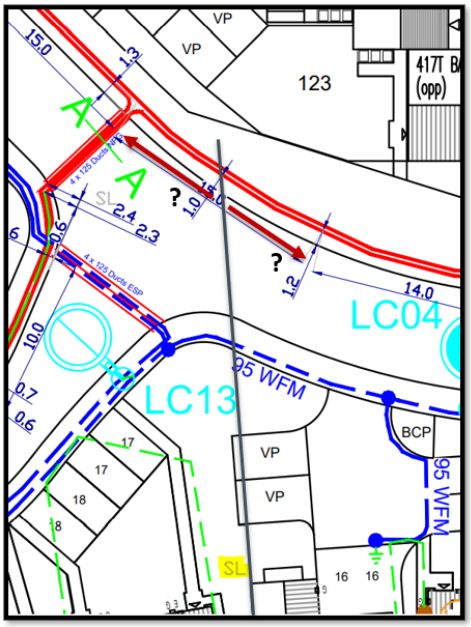

Figure 10. Correction requires dimensions to be updated

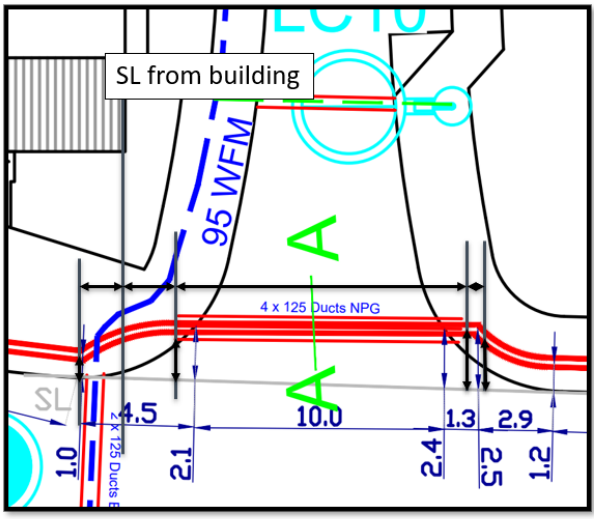

Figure 11. Dimensions to start/end of ducts and cable points taken from an additional sight line in order to make this acceptable.

11.0 Conclusion

This document seeks to aid in the consistent production, and timely submission, of acceptable cable as-laids and to significantly reduce/prevent rejection. If cable record rejection levels decrease, then so too will the amount of time spent by respective resources in amending said records.

It is vitally important that all individuals responsible for producing as-laid records for Northern Powergrid have:

1. A clear understanding of the quality standards set by Northern Powergrid.
2. A clear understanding of their obligations associated with record submission/re-submission laid out by the Electricity Asset Adoption and Network Access Framework Agreement.
3. Received appropriate training on the correct techniques to facilitate such.

To summarise:

- Accurate records for all assets are vital for the safe and efficient operation of Northern Powergrid's electricity distribution network.
- All parties who are appropriately trained to provide site records should use this guide to obtain/maintain a uniform standard of asset recording those results in consistently accurate records.
- As-laid records can be submitted any point between asset installation and the 48-hour window prior to the connection. Jointing records must be submitted no later than 48 hours after the connection.
- ICP's are obligated to submit records, and re-submit amended records, in a timely manner in accordance with the DNO's own processes.
- Asset records from site must be provided on a suitable OS map background.
- Submitted as-laids that fail to meet the desired specifications will be rejected by Northern Powergrid.
- By avoiding the errors outlined in this document workloads for all parties can be reduced, as submitted records are increasingly likely to be accepted and additional rework not required.