NSP/002/007 – Code of Practice for Crossing Flood Defences with Cable Circuits

1. Purpose

The purpose of this document is to detail Northern Powergrid (the 'Company') requirements for the crossing of physical flood defences (the 'Defence') using underground cables. This document applies to Company staff, their contractors and others (the 'Installer'), installing network infrastructure to be adopted by the Company for connection to the Company's network.

This Code of Practice communicates the options available and the process that must be followed, when it has been reasonably justified by the Installer and agreed by the Company's Project Manager, that there is no other reasonable option but to cross a Defence.

The baseline installation requirements must be sought from the following key Company policy documents:

- NPS/002/003 – 'Technical Specification for Protection Tile, Protection Tape, Cable Ducting and Route Markers'
- NSP/002 – 'Policy for the Installation of Distribution Power Cables'
- NSP/002/001– 'Guidance documents for the Installation of Fibre Optic Underground Cables'
- NSP/002/005 – 'Code of Practice for Cable Locations in Trench Layouts'

This document supersedes the following documents, all copies of which should be destroyed.

Document Reference	Document Title	Version	Published Date
NSP/002/007	Code of Practice for Crossing Flood Defences with Cable Circuits	1.0	Sept 2017

2. Scope

This document applies to the installation of underground cables of any type (and any associated ancillaries e.g. oil pipes) at the point which they cross a Defence, where either the cable installation is on behalf of, or to be adopted by The Company, or where the Defence is owned by the Company. Defences may include but are not limited to; flood walls or flood banks built around or to protect substations, buildings, utility assets, areas of land or buildings/structures.

Deviation from normal Company policy (as listed in Section 1) and subsequent application of this document must be pre-approved by an appropriate member of the Company. This will normally be the Company's Project Manager, or in some cases a Policy & Standards Engineer.

2.1. Table of Contents

3. Requirements

3.1. General Requirements

3.1.1. Installation Principles

1. The crossing of any Defence shall not impact on the integrity of its design, either by reducing its mechanical/chemical strength or by creating an alternative path for water to bypass the Defence, intentional or otherwise.
2. It is accepted that the integrity of a Defence may be temporarily impacted during the construction phase; the risk shall be suitably assessed and managed at all times. This may include for example; weather forecast monitoring and conducting works during typically dry months. In addition; a means of temporarily reinstating the Defence should be designed and be made available at very short notice for use during the construction phase.
3. Installations may be underneath, through or over a Defence. The most suitable option will depend on the type/construction of Defence. For example; it will often be most appropriate to install a circuit underneath a flood wall rather than through it.
4. Any joints on a cable circuit in the proximity of a Defence crossing shall be positioned with enough distance from the Defence, that the joint can be replaced without having to pull in a new section of cable through the Defence crossing and without impacting on the Defence or the crossing in any way. Specific site conditions and the circuit's route must be taken into account when deciding upon a suitable distance.
5. When crossing a Defence using a ducted system, consideration shall be made for the migration of water through the duct system from remote points. Where possible, breaks in the duct run and duct-end seals (either local or remote to the Defence) shall be used to prevent this from occurring.

3.1.2. Installing Underneath Defences

1. Before any new ducts are installed, records should be consulted to confirm any locations of spare ducts already installed under the flood defence.
2. Where new ducts are to be installed, they will ideally be located at the midpoint between movement joints.
3. Installing underneath Defences is normally the most preferred solution as it provides suitable mechanical protection to the cable circuits and will normally have the least impact on the Defence.
4. Cables/ducts shall be installed with clear space around their circumference to allow for the sufficient coverage and adhesion of the surround material which shall be installed to fill all voids between; the cables/ducts, surrounding ground and the Defence. The size of the clear space will depend on the type of material being used and the installation method.
5. Cable/duct surround material shall:
    a. Be of a non-porous composition.
    b. Be of a composition that allows for the complete filling of the void.
    c. Be of a composition that will not migrate or deteriorate once installed.
    d. Be flexible enough to cope with the thermal expansion/contraction of the cable(s) or duct(s) without resulting in voids.

Suitable materials include; puddle clay, bentonite/cement and foam concrete.

3.1.3. Installing Through Defences

1. Installing through a Defence will be dictated by the type of Defence, however;
    a. In the case of a solid wall type Defence; this will usually involve the creation of one or more holes through the Defence, into which the cables/ducts can be installed, and finally a suitable surround material will be installed to seal both the hole (and the duct ends).
    b. In the case of a flexible material type Defence (such as a clay flood bank); this will usually involve the excavation and reinstatement of a track through the flood wall, to the same specification as the existing Defence e.g. which will typically be a Bentonite/Cement or Puddle Clay core.
2. Installing cables direct (through a Defence) should always be considered as a first option, however if the risk can be managed through a suitable design a ducted installation is acceptable. The use of ducts thereby removing the need to further modify the Defence in order to repair or replace a section of cable.
3. Special care must be taken when considering this option as it will likely impact on the mechanical strength of the Defence as well as its ability to prevent the flow of water.

3.1.4. Installing Over Defences

1. Installing over Defences should be considered as a last resort due to the increased risk of access and interference due to the increased visibility and accessibility. However, in some situations it may be the most appropriate solution to prevent damage to the Defence. Examples may include; concrete bund or a flood wall within a substation where the risk of interference is lower, or for emergency/temporary works.
2. Cables shall be installed within suitable ducts or enclosures and provide suitable mechanical protection.
3. The cables/ducts shall be supported and restrained throughout their length wherever they are above ground.
4. Sealing of any ducts utilised to cross over the Defence should also be considered.

3.1.5. Where Ducts Cross Defences

1. The ducts at the Defence crossing shall be suitably water tight, to prevent water ingress into the dry-side.
2. Only a short, sealed section of duct(s) shall normally be installed, enough to facilitate the crossing, whilst not being too close that there is a risk of destabilising the Defence when digging down the ends of the ducts. The ducts shall not normally be connected to a run of ducts, in order to prevent to ingress of water from a remote point.
3. Duct ends will require the use of a suitable duct sealing system. At least one end of the ducts shall be suitably sealed to prevent the ingress of water. If only one end is sealed it shall be the dry-end, where the backfill is suitably compacted around the end of the seal in order to provide additional support to the seal.
4. Duct joins at the crossing should be avoided, if this is not possible; all duct joins and ends must be suitably water tight to prevent to ingress of water. This will normally require duct joins to be ring sealed, butt-welded or electro-fusion joined (the choice being duct type dependant).

5. Where sub-ducts or conduits are used (for example Fibre Optic installations) and it is not practical to split the ducts on one or both sides of the Defence;

    a. Each sub-duct that crosses a Defence shall be sealed at both ends. This will often be at the termination point and the next chamber along from the Defence.

    b. Consideration should be made for the positioning of chambers, for example a Fibre Optic chamber could be installed immediately on the dry-side of the Defence, allowing for a break in the duct and a suitable duct seal.

6. Once all ducts have been installed, both prior to and after the installation of the infill; the ducts should be inspected to ensure there are no cracks or weaknesses on any joins.

3.2. Specific Requirements for Company Defences

3.2.1. Installation of Ducts Under Existing Flood Walls

The types of flood walls typically covered by this section are those constructed from a concrete cast-in-situ wall, supported by a concrete cast-in-situ foundation slab that has a toe facing the wet-side of the wall (to provide cantilever support). Typical Company substation flood walls are constructed from a nominal 1200mm high concrete wall supported by a shallow concrete foundation with a toe on the outside of the wall. There are two methods discussed in this section; installing cables under the wall by undermining a small section of ground beneath the wall and installation cables under the wall by removing and replacing a small width of wall.

Installation by Undermining

The installation of ducts under Company flood walls by undermining shall be conducted in accordance with drawing *Y004X7721 – 'Underground Cable Installation – Installation of Cable Circuits Under Flood Walls – Installation of Ducts Under Existing Floodwall'*, shown in *Appendix 1 'Company Defence Crossing Drawings'*.

Note; the trench layout in the above drawing (Section A-A) is based on a typical 33, 66 or 132kV cable trench with single-core power and metallic auxiliary cables, as per drawing *Y004X7718 – 'Underground Cable Installation – Trench Layouts for Standard Installations – 33 / 66 / 132kV', as shown in NSP/002/005 'Code of Practice for Cable Locations in Trench Layouts'*. However, this design is also suitable for most single or double circuit crossings at any voltage, provided a suitable space is provided around each duct to allow the foam concrete to fill all voids.

Installation by Wall Removal/Replacement

The installation of ducts under Company flood walls by the process of removing and replacing a small width of wall shall be conducted in accordance with drawing *Y004X7722 – 'Underground Cable Installation – Installation of Cable Circuits Under Flood Walls – Removal of Floodwall Section and Reinstatement',* shown in *Appendix 1 'Company Defence Crossing Drawings'*.

3.3. Specific Requirements for Third Party Defences

1. The owner and/or responsible party shall be identified by the Installer for every Defence prior to the commencement of any design or works.

2. Where the owner and/or responsible party for a Defence is a large organisation; the Installer shall follow their relevant policies and procedures, including any licensing requirements. These organisations will typically include; The Environment Agency, local Councils, The Canal & River Trust, local Drainage Boards etc.

3. Where the owner and/or responsible party for a Defence is a private individual or small organisation with no policies or procedures of their own, the Installer shall provide additional support and knowledge to ensure a suitable design and installation in accordance with Section 3.1. This will

typically involve following the most appropriate policy from the Company or another large organisation.

4. References

4.1. External Documentation

Reference	Title
ENA TS 09-02	Specification for the supply, delivery & installation of power cables with operating voltages in the range 33kV to 400kV and associated auxiliary cables.
ESQCR	The Electricity Safety, Quality and Continuity Regulations 2002

4.2. Internal Documentation

Reference	Title
NPS/002/003	Technical Specification for Protection Tile, Protection Tape, Cable Ducting and Route Markers
NSP/002	Policy for the Installation of Distribution Power Cables
NSP/002/001	Guidance Document for the Installation of Fibre Optic Underground Cables
NSP/002/005	Code of Practice for Cable Locations in Trench Layouts

4.3. Amendments from Previous Version

Reference	Description
3.1.2	Referencing reviewing records to locate any spare ducts already installed
3.1.2	Referencing location of new ducts in relation to movement joints

5. Definitions

Reference	Title
Company	Northern Powergrid.
Defence	A physical structure for the purposes of controlling or blocking the passage of water.
Installer	Any persons installing assets that cross a Defence, where the circuit is to be adopted by the Company or the Defence is owned by the Company.

6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Liz Beat	Governance Administrator	06/03/2024

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period.

Standard CDS review of 3 years	Non Standard Review Period & Reason	
Yes	Period: n/a	Reason: n/a
Should this document be displayed on the Northern Powergrid external website?	Yes	

		Date
David Johnson	Specification and Design Engineer	25/03/2024

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

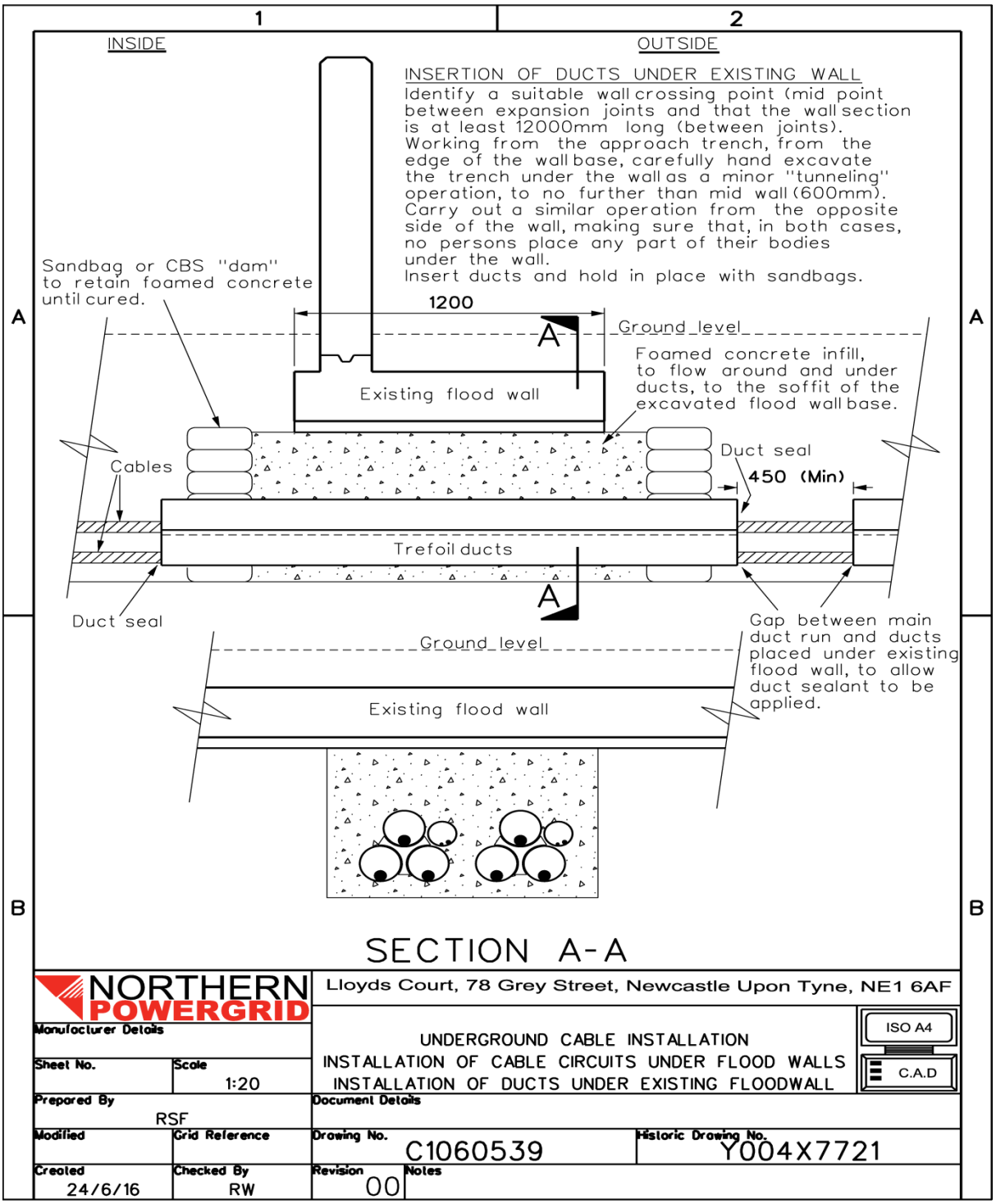
		Date
Ben Wilson	Specification and Design Engineer	25/03/2024

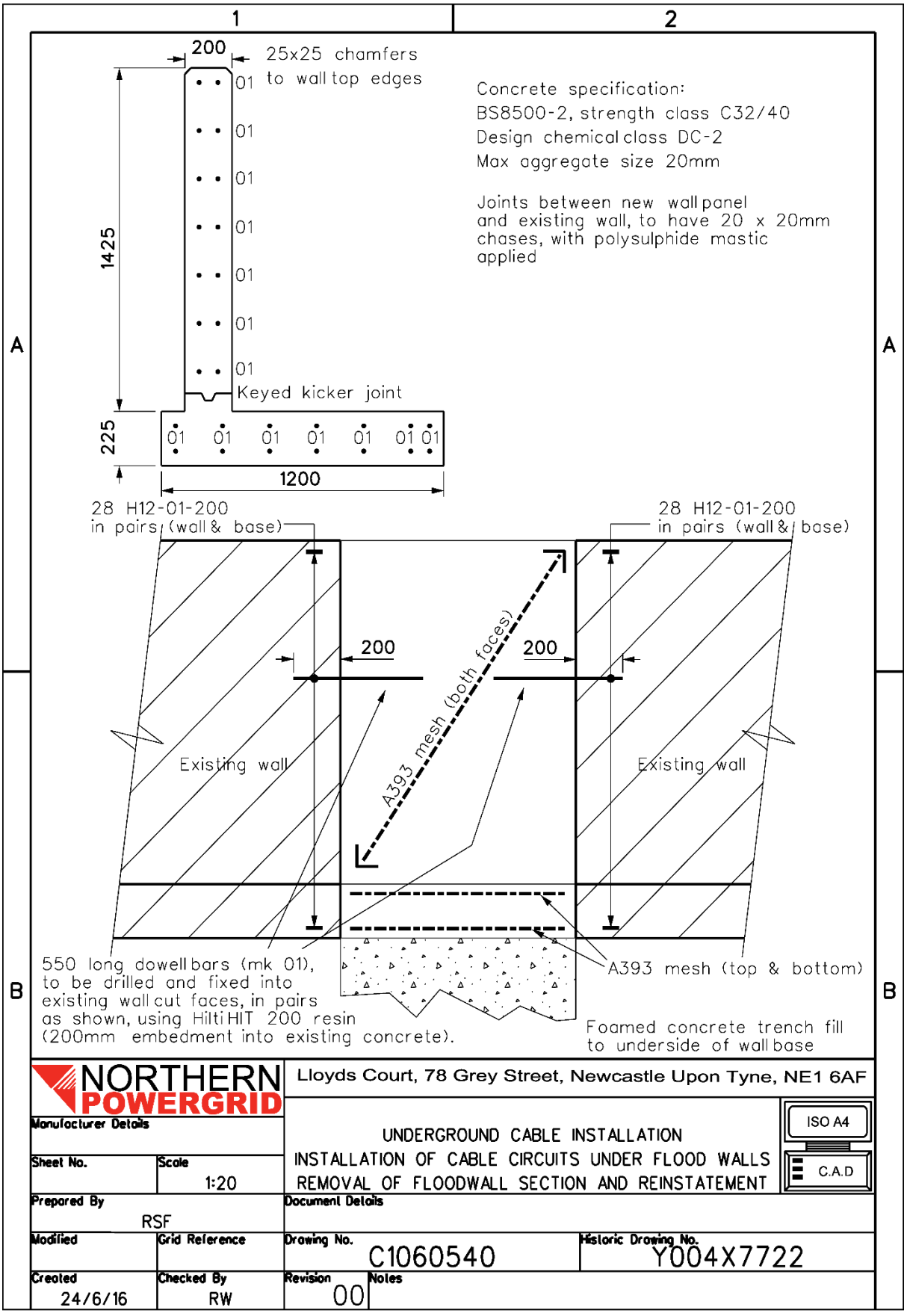
6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
David Sillito	Head of Major Projects	21/03/2024

Appendix 1 – Company Defence Crossing Drawings




1
2
A
B
200
25x25 chamfers to wall top edges
01
1425
225
1200
Keyed kicker joint
Concrete specification:
BS8500-2, strength class C32/40
Design chemical class DC-2
Max aggregate size 20mm
Joints between new wall panel and existing wall, to have 20 x 20mm chases, with polysulphide mastic applied
28 H12-01-200 in pairs (wall & base)
28 H12-01-200 in pairs (wall & base)
200
200
A393 mesh (both faces)
Existing wall
Existing wall
550 long dowell bars (mk 01), to be drilled and fixed into existing wall cut faces, in pairs as shown, using Hilti HIT 200 resin (200mm embedment into existing concrete).
A393 mesh (top & bottom)
Foamed concrete trench fill to underside of wall base
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details
UNDERGROUND CABLE INSTALLATION
INSTALLATION OF CABLE CIRCUITS UNDER FLOOD WALLS
REMOVAL OF FLOODWALL SECTION AND REINSTATEMENT
ISO A4
C.A.D
Sheet No.
Scale 1:20
Prepared By RSF
Document Details
Modified
Grid Reference
Drawing No. C1060540
Historic Drawing No. Y004X7722
Created 24/6/16
Checked By RW
Revision 00
Notes