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nationalgrid

Market Harborough 400/25kV Substation
Braybrooke Network Rail Connection Scheme

Flood Risk Assessment

SEPTEMBER 2017

Incorporating

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Braybrooke Network Rail Connection Scheme

Flood Risk Assessment

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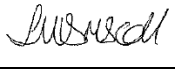
Checker	Lisa Driscoll	
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1 INTRODUCTION

1.1 Background to the Scheme

1.1.1 As part of Network Rail's (NR) programme of electrification of the Midland Mainline Railway, National Grid is required to provide a grid connection point to supply the railway with electricity. National Grid is, therefore, proposing to construct a new 400/25kV substation on land adjacent to the railway and the existing 400kV overhead lines between Market Harborough and the village of Braybrooke ('the Site').

1.1.2 The new substation will be a compact site designed around an existing pylon which will connect the substation to the overhead line. The arms of the tower will be modified to take the downleads (wires) that connect into the substation. The downleads will be held in place with anchor blocks in the substation rather than landing on gantries, to keep the visual impact as low as possible. The substation will also include two 400/25kV supergrid transformers, associated switchgear, amenities block, protection and control buildings. The switchgear equipment will be mounted on steel structures which are then mounted on pad concrete foundations. The largest foundation structure will be the concrete transformer bund and plinth. The overall substation compound and access road areas will require some re-profiling to level the surface suitable for transportation of the large transformers.

1.1.3 In order to access the substation for construction and ongoing maintenance purposes, a new, tarmac access road will be constructed from an existing junction with Kettering Road at Clack Hill. This will initially run eastwards on the line of an existing track before veering south west towards the railway. At this point, the new road will run parallel to the railway on its northern side towards the new substation.

1.1.4 As part of the operation of the proposed new substation, National Gird will also require the installation of an earthing system. The earthing system is required to provide protection to the equipment and personnel within the substation and the surrounding areas. An array network of copper tape and rods is required to be buried in the ground to keep the rise of voltage touch potential during an electrical fault condition within the industrial specified safety limits. The large size of the array network at this Site is needed to help dissipate the high currents experience during a fault condition, due to the proximity of the railway. The array network will need to be installed by excavating the ground to a depth of at least 1 metre, with the rods being driven to a greater depth. Once installed, the ground is reinstated to its previous use.

1.1.5 A landscape planting scheme has also been developed to help integrate the proposals into the landscape and provide visual screening.

1.1.6 The new substation, earthing system and most of the access road falls within Kettering Borough Council and is the subject of this planning application. The northern part of the access road falls within Harborough District so will be subject to a separate planning application to that Council around the same time.

1.2 Purpose of this Report

1.2.1 This report has been prepared for submission to Kettering Borough Council to provide detailed technical information for use during the application determination. It focusses upon those components of the proposals that fall within Kettering Borough.

1.2.2 The Environment Agency (EA) Flood Map for Planning (Ref. 1) identifies that the entire Site is in Flood Zone 1, low flood risk (land having a less than 1 in 1,000 (0.1%) annual probability of river flooding). However, the National Planning Policy Framework (NPPF) (Ref. 2) and the

associated Flood Risk and Coastal Change Planning Practice Guidance (PPG) (Ref. 3) require that a Flood Risk Assessment (FRA) be submitted with all forms of development of more than one hectare in Flood Zone 1.

1.2.3 Arcadis Consulting (UK) Limited has been commissioned by NG to prepare a FRA to support the planning application.

1.2.4 The remainder of this FRA is structured as follows: the assessment methodology is described, followed by an appraisal of the development proposals with respect to the NPPF and PPG for development and flood risk. The potential for flooding of the Site from a wide range of sources is then considered, followed by a more detailed assessment of surface water flood risk, with drainage design inputs. The report concludes with a summary and recommendations.

1.3 Scope of Works

1.3.1 The objective of this FRA is to provide a NPPF-compliant qualitative assessment of flood risk to the proposed substation, earthing system and associated access route as well as to assess the impact of the development proposal on flood risk to third party land.

1.3.2 To satisfy this objective, the following tasks have been undertaken:

- Collect and review EA and Lead Local Flood Authority (LLFA - Northamptonshire County Council flood maps and relevant strategic documents (including Strategic Flood Risk Assessments, Surface Water Management Plan and Local Flood Risk Management Strategy);
- Consult with the LLFA and utilities providers to gather baseline flood risk information, drainage asset data and flood history information as well as to confirm any flood risk management requirements;
- Consult with the EA to gather flood risk data linked to the River Jordan and review the data relative to the Site's local context and current climate change guidelines;
- Calculate existing (greenfield) rainfall runoff rates;
- Review the existing drainage and the proposed drainage strategy for the Site; and,
- Prepare a FRA report.

1.4 Terminology

1.4.1 Flood risk is a product of the likelihood and consequence of flooding. Throughout this report, flood events are defined according to their likelihood of occurrence. Floods are described according to an 'annual chance', meaning the likelihood of a flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year), has an annual exceedance probability (AEP) of 1%.

2 BACKGROUND

2.1 Site Description

2.1.1 The Site is located in Northamptonshire approximately 2.5km southeast of Market Harborough, centred at national grid reference (NGR) 475800 285700.

2.1.2 The Site occupies an area of approximately 10.16 hectares and consists of and is surrounded by greenfield land currently occupied by managed agricultural fields. The proposed substation compound is located adjacent to the Midland Mainline Railway and approximately 250m northeast of Harborough Road, 400m northeast of the River Jordan and 800m southwest of Desborough Road (A6), as illustrated on Figure 2.1 and Figure 2.2.

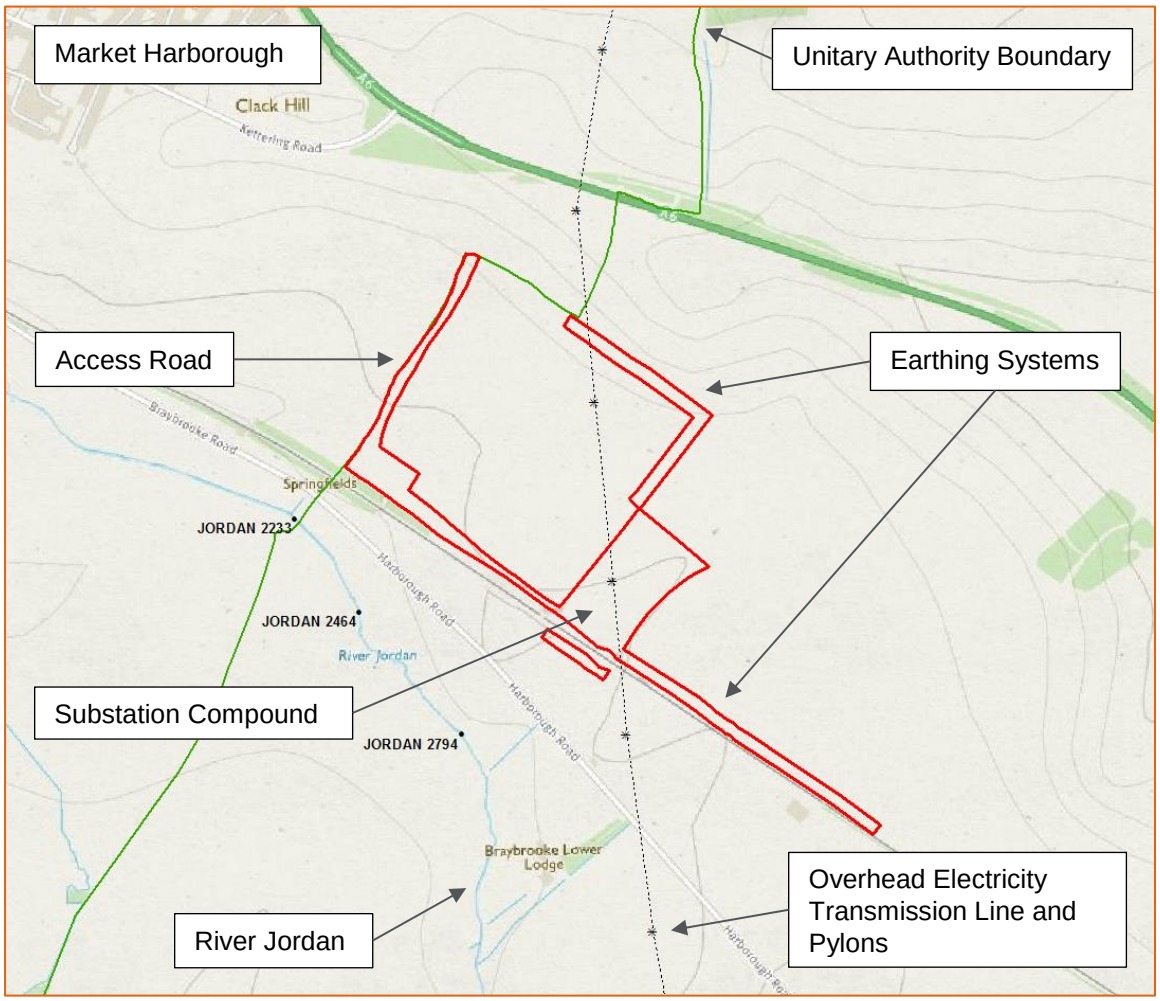

Figure 2.1 Location of the Site. Planning application boundary outlined in red. Contains Ordnance Survey data © Crown Copyright and database right 2017. All rights reserved.

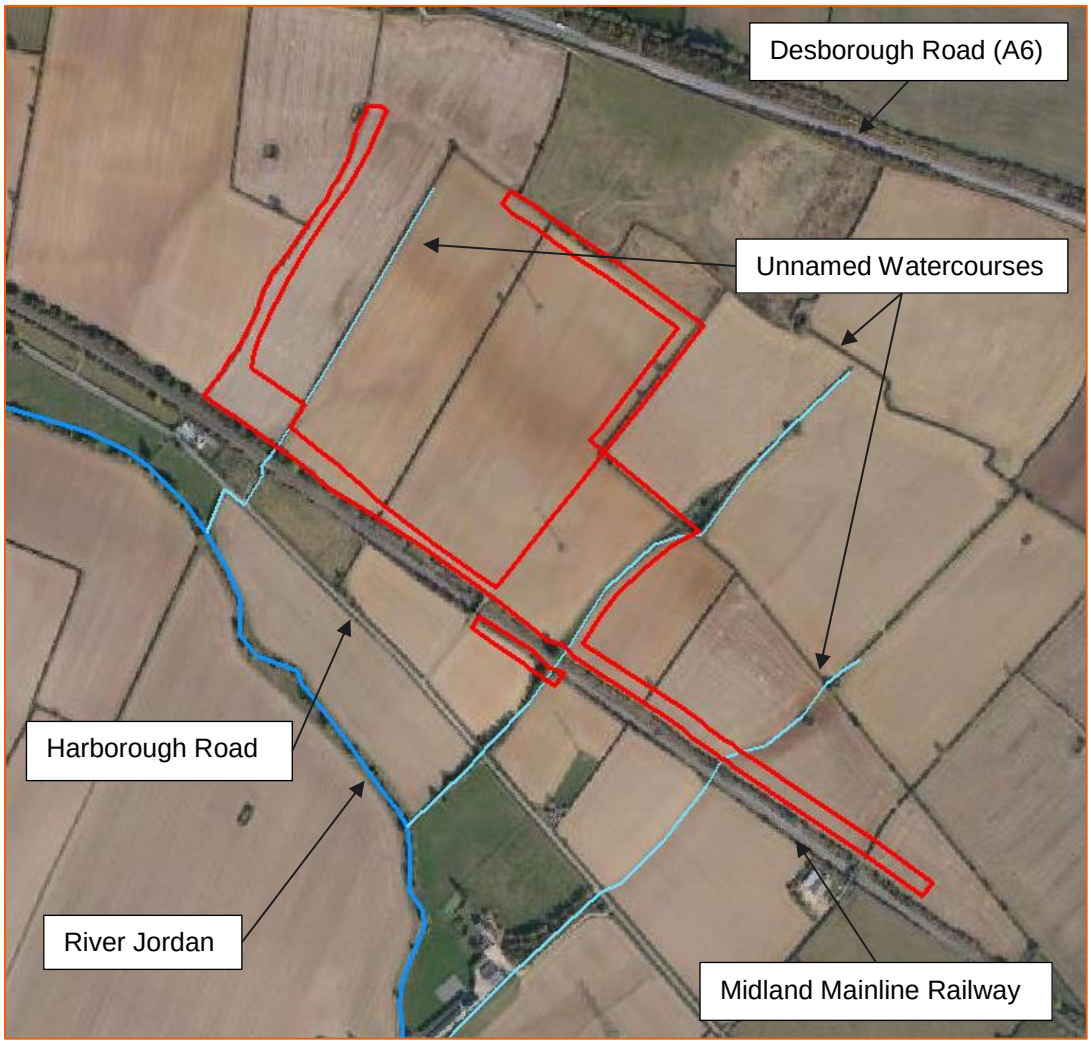

Figure 2.2 Existing Land Use. Planning application boundary outlined in red. Contains Ordnance Survey data © Crown Copyright and database right 2017. All rights reserved.

Topography

2.1.3 Topographical information for the Site has been drawn from EA Opensource Government License 2m LiDAR digital terrain mapping (DTM) datasets (Ref. 4), illustrated in Figure 2.3. The substation compound has ground levels between 91.7m above ordnance datum (mAOD) and 100.9mAOD, with a slope down towards the River Jordan and the unnamed watercourse to the south and east.

2.1.4 Ground levels within the footprint of the northern earthing system slope up as it extends north-eastwards from the substation compound, with elevation rising from 100.9mAOD to 111.6mAOD. As the system turns north-westwards, elevations continue to rise, from 111.6mAOD to 114.4mAOD. Ground levels within the footprint of the eastern earthing system are relatively flat, with elevations between 98.5mAOD and 105.3mAOD, with a slight up-slope as it extends south-eastwards from the substation compound, before dipping as it crosses a small valley approximately 250m east of the substation compound.

2.1.5 The proposed access road slopes down as it extends westwards from the substation compound, with elevation falling from 100.9mAOD to 89.6mAOD. The access road route then rises as it travels northwards towards Desborough Road to a maximum elevation of 101.7mAOD.

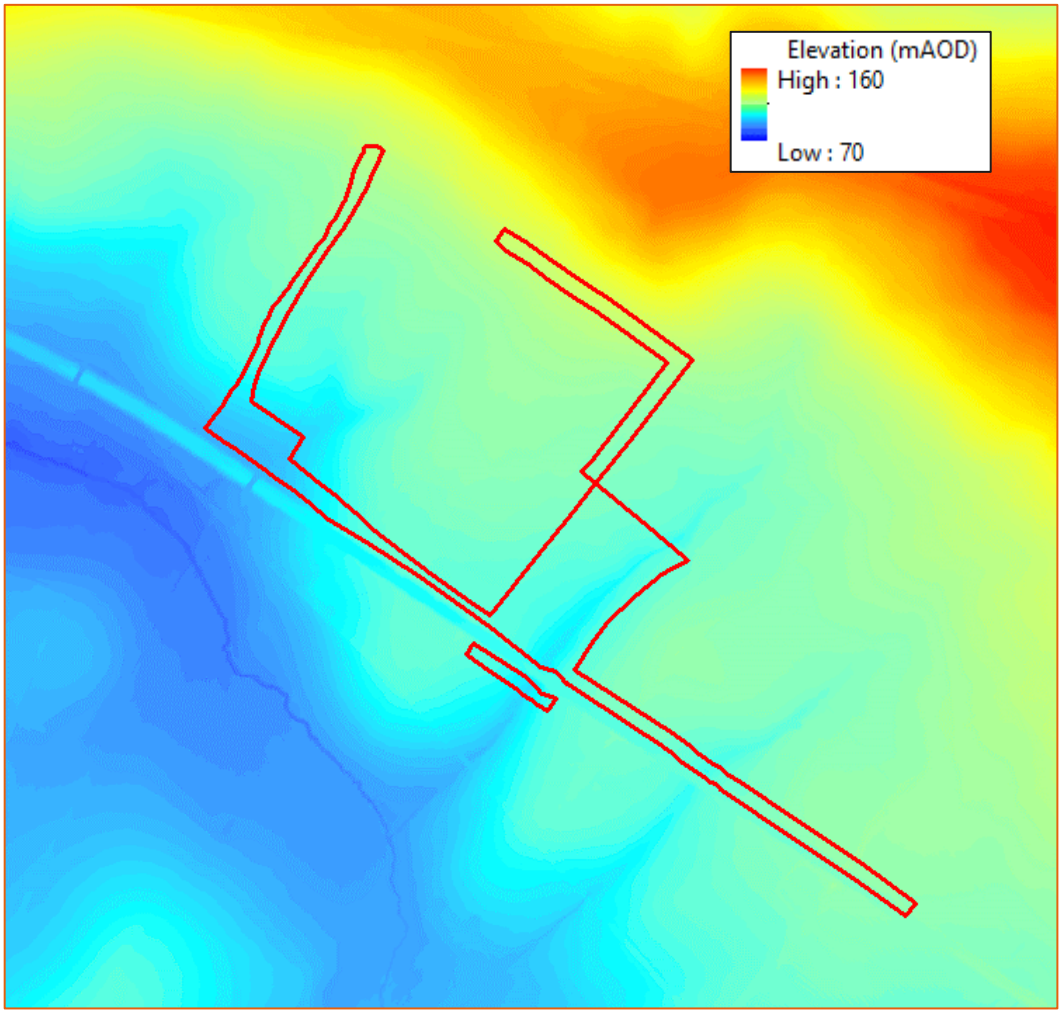

Figure 2.3 Site Topography. Planning application boundary outlined in red. Contains EA Opensource data © Crown Copyright and database right 2017. All rights reserved.

2.2 Catchment Description

2.2.1 The entire Site is located within the catchment of the River Jordan, an EA designated Main River and minor tributary of the River Welland. The River Jordan flows in a north-westerly direction, at its closest approximately 130m southwest of the Site and to this point drains a catchment of 12.6km^2. The local catchment of the River Jordan receives an average annual rainfall of 644mm (Ref. 5).

2.2.2 Three unnamed watercourses, tributaries of the River Jordan, flow in south-westerly directions through the Site, illustrated on Figure 2.2. The watercourses drain small (less than 1km^2) catchments.

2.2.3 The eastern watercourse bisects the proposed route of the eastern earthing system and flows south-westwards within a valleyed section. The watercourse is piped under the existing farm access track and culverted under the Midland Mainline Railway, conveying flows to the River Jordan. The watercourse accepts flows from the eastern section of the eastern earthing system.

2.2.4 The central watercourse, which flows along the eastern boundary of the substation compound, flows south-westwards within a valleyed section. The watercourse is piped under the existing farm access track and then culverted under the Midland Mainline Railway towards the River

Jordan. The watercourse accepts surface water runoff from the Site of the substation compound.

2.2.5 The western watercourse bisects the proposed access road and flows south-westwards alongside an existing hedge line. The watercourse is piped under the existing farm access track at the southern end of the field and is then culverted under the Midland Mainline Railway, the culverted section conveys flows to the River Jordan. The watercourse accepts surface water runoff from the western portion of the Site. Further description and photographs of these features are provided in the Outline Drainage Strategy report (Appendix A).

Geology and Soils

2.2.6 The entire Site is underlain by soils consisting of slowly permeable seasonally wet slightly acid but base-rich loamy clayey soils with impeded drainage (Ref. 6). There are no recorded superficial deposits over the Site.

2.2.7 Bedrock geology over the Site is divided between the Whitby Mudstone Formation – Mudstone, in the north (which includes the northern earthing system and the northern 100m of the access road) and the Dyrham Formation - Siltstone and Mudstone, interbedded, in the south (Ref. 7). The Dyrham Formation is designated as a Secondary (undifferentiated) aquifer (Ref. 8). Such aquifers are defined by rock layers or deposits with a wide range of water permeabilities and storage and with variable (minor to non-aquifer) characteristics.

2.3 Historical Flooding and Flood Defences

2.3.1 A search of the BHS Chronology of British Hydrological Events (CBHE) website (Ref. 9) was carried out. This website provides a public repository for hydrological facts. It attempts to provide as much material as possible so that the spatial extent of flood events and their relative severity can be assessed. During the website search, no records of flooding of the River Jordan were identified.

2.3.2 Consultation with the EA identified no records of flooding having affected the Site or in the local area.

2.3.3 The Kettering and Wellingborough Level 1 Strategic Flood Risk Assessment (SFRA) (Ref. 10) states that there is a long history of flooding in the Boroughs of Kettering and Wellingborough, dating back to the 1940s, with fluvial flooding identified as the main source and specifically the River Jordan, however there are no records of flooding in proximity to the Site. The Level 1 SFRA identifies three incidences of flooding from the River Jordan in Braybrooke, located approximately 1.5km upstream of the Site. These incidences relate to the blockage of culverts in the town, however these flood events did not extend to the Site.

2.3.4 The North Northamptonshire Local Flood Risk Management Study (LFRMS) (Ref. 11) *Historic flooding in the Kettering Borough* map does not identify any historic incidences of groundwater flooding, sewer flooding or surface water flooding in proximity to the Site.

2.3.5 There are no formal flood defences installed in proximity to the Site.

2.4 Development Proposal

2.4.1 The development proposal is described in Section 1.1 and a plan illustrating the proposed development layout is provided in Appendix B.

3 ASSESSMENT METHODOLOGY

3.1.1 This assessment of flood risk has been undertaken using a desk study approach. The desk study has utilised existing published information and data, where available, and has been informed by consultation with relevant authorities. These data have been supplemented by a hydrological assessment to calculate the surface water runoff characteristics of the Site in its current form and in the development scenario. Options for the management of surface water runoff are also described, to feed into the production of a Drainage Design (Appendix A).

3.2 Data Collection

3.2.1 Information has been drawn from web-based and published sources, outlined below, as well as from a Flood Product 4 data pack supplied by the EA (Ref. 12), included in Appendix C.

3.2.2 Web-based sources:

- Flood Estimation Handbook (FEH) Web Service;
- EA What's In Your Backyard? Interactive Maps;
- EA Long Term Flood Risk Interactive Maps (Ref. 13)
- EA Flood Map for Planning;
- Cranfield Soil and AgriFood Institute, Soilscapes Viewer;
- British Geological Survey, Geology of Britain Viewer.

3.2.3 Published documents:

- Kettering and Wellingborough Level 1 SFRA;
- Northamptonshire County Council Preliminary Flood Risk Assessment (PFRA) (Ref. 14);
- North Northamptonshire LFRMS.

3.3 Surface Water Runoff Calculations

3.3.1 Surface Water runoff estimates have been taken from the Outline Drainage Strategy (Appendix A). The Site is greenfield and has area less than 50 hectares and the Institute of Hydrology 124 (IH124) method has been used to calculate the mean annual flow rate.

3.4 Flood Risk Assessment

3.4.1 Following appraisal of the available data, identified above, and in line with best practise, flood risk to the Site has been assessed from the sources listed below:

- Fluvial
- Surface Water
- Groundwater
- Artificial sources.

3.4.2 The Site is located remote from the coast with ground levels above 85mAOD. Therefore, there is no risk of flooding from coastal or tidal sources. Flooding from these sources has been excluded from the assessment.

3.4.3 The potential for the development proposal to impact on third party flood risk was also assessed and options for the management of surface water runoff from the Site were investigated.

4 NATIONAL PLANNING POLICY FRAMEWORK

4.1 Overview

4.1.1 The NPPF and accompanying PPG set out the Government's planning policy for England and advises on '*how to take account of and address the risk associated within flooding and coastal change in the planning process'.* The principal aim of the NPPF is to achieve sustainable development by accounting for flooding at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from areas where risks are highest. Where development is necessary in areas at risk of flooding, the NPPF aims to ensure it is safe, without increasing flood risk to third parties.

4.1.2 Early adoption of, and adherence to, the principles set out in the NPPF and its PPG, with respect to flood risk, ensures that detailed designs and plans for development take due account of flood risk and the need for appropriate mitigation, if required.

4.1.3 The approach is a staged one whereby:

- A Site is categorised within an EA Flood Zone. These Flood Zones refer to the probability of sea and river flooding only and ignore the presence of existing defences;
- The Sequential Test is applied;
- Where a development type cannot be relocated to an appropriate Flood Zone (as defined in Table 4.2 below), application of the Exception Test may be required.

4.2 The Sequential and Exception Tests

4.2.1 The NPPF identifies four Flood Zone classification, detailed in Table 4.1 below.

Table 4.1 Flood Zones (Source: NPPF PPG, Table 1)

Flood Zone	Definition
Zone 1 – Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Zone 2 – Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a – High Probability	Land having a greater than 1 in 100 annual probability of river flooding; or land having a greater than 1 in 200 annual probability of sea flooding.
Zone 3b – The Functional Floodplain	Land where water flows or is stored in times of flood.

4.2.2 The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate for the type of development proposed. The NPPF provides guidance on the compatibility of each land use classification in relation to each of the Flood Zones, as summarised in Table 4.2.

Table 4.2 Flood Risk Vulnerability and Flood Zone Compatibility (Source: NPPF PPG, Table 3).

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗
Key:	✓ Development is appropriate		✗ Development should not be permitted		

4.2.3 Where the Exception Test is triggered, this requires the development proposal to demonstrate wider sustainability benefits to the community that outweigh flood risk, and that the development will be safe for its lifetime, without increasing flood risk elsewhere, and where possible reduce flood risk overall.

4.3 EA Flood Zone Categorisation

4.3.1 The EA *Flood Map for Planning* (Figure 4.1) identifies the entire Site in Flood Zone 1.

Figure *4.1* EA Flood Map for Planning.

4.4 Sequential and Exception Tests

4.4.1 The NPPF PPG defines the proposed development type (grid and primary substations) as *'Essential Infrastructure'.* The entire Site is designated as Flood Zone 1 and therefore satisfies the requirements of the Sequential Test. The proposed development does not require assessment under the Exception Test.

4.5 Need for an FRA

4.5.1 The NPPF states that all development types are appropriate in Flood Zone 1. However, the Site exceeds one hectare in size and represents a change of development type to a more vulnerable class and should therefore be accompanied by a FRA.

5 POTENTIAL SOURCES OF FLOOD RISK

5.1.1 Under the NPPF, there is a requirement to assess all possible sources of flood risk. Those sources applicable to the proposed development are listed in Table 5.1.

Table 5.1 Sources of Flooding

Source of Flooding	Description
1.Flooding rivers (Fluvial)	Floodwater originating from a nearby watercourse when the amount of water exceeds the channel capacity of that watercourse.
2. Flooding from the land (Surface Water)	Flooding caused by intense rainfall exceeding the available infiltration and/or drainage capacity of the ground.
3. Flooding from groundwater	Flooding caused when groundwater levels rise above ground level following prolonged rainfall.
4. Flooding from reservoirs, canals and other artificial resources	Failure of infrastructure that retains or transmits water or controls its flow

5.2 Fluvial Flood Risk

5.2.1 The EA *Flood Map for Planning* (Figure 4.1) indicates the entire Site is located in Flood Zone 1.

5.2.2 Modelled flood levels for a range of flood event rarities have been supplied by the EA for three nodes on the River Jordan in proximity to the Site: JORDAN 2233, JORDAN 2464 and JORDAN 2794, illustrated on Figure 2.1. The model results, generated by the Welland catchment model (2016), are presented in Table 5.2 below. It should be noted that these data represent 'in-channel' conditions, and therefore may not represent water levels on the floodplain.

Table 5.2 River Jordan Modelled Flood Levels

River Node	Return Period – Maximum Water Levels (mAOD)								
	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr	100 yr +20% CC	1,000 yr	1,000 yr +20% CC
JORDAN 2233	83.04	83.17	83.26	83.34	83.44	83.48	83.57	83.85	83.94
JORDAN 2464	83.83	84.02	84.15	84.27	84.43	84.51	84.70	85.18	85.31
JORDAN 2794	85.72	85.89	86.01	86.09	86.18	86.23	86.35	86.67	86.77

5.2.3 Compared to the ground levels across the Site that range from 89.6mAOD to 114.4mAOD, the modelled flood levels indicate that no flooding from the River Jordan would affect the Site

during extreme events, including the 1,000 year plus climate change event. A substantial freeboard in this extreme event would also remain (minimum 3m).

5.2.4 The EA *Flood Map for Planning* does not illustrate flood risk from non-Main River sources (ordinary watercourses). Three unnamed tributaries of the River Jordan intersect the Site, however the watercourses drain very small catchments and are contained within channels which provide sufficient conveyance capacity for likely flood scenarios. There are no records of flooding from these sources. It is therefore considered that fluvial flood risk from these watercourses is low.

5.2.5 **Overall, it is considered that the Site is at a very low risk of fluvial flooding.**

5.3 Surface Water

5.3.1 In greenfield areas, surface water flooding is a potential risk during short, intense rainstorm events or longer duration storms, when the infiltration capacity of the underlying soils is exceeded and rainfall runs off the land to pond in lower lying flatter areas. Introducing impermeable surfacing into greenfield areas may increase surface water flood risk to third parties.

5.3.2 The Site is not currently served by any public surface water or combined sewers, therefore soil permeability and slopes govern existing runoff patterns. Rainfall that does not soak into the ground would flow overland towards the unnamed watercourses and the River Jordan.

5.3.3 The EA *Risk of Flooding from Surface Water* map (Figure 5.1) indicates that over 75% of the Site has a very low risk (less than 1 in 1,000 (0.1%) annual probability) of surface water flooding. However, the eastern section of the Site, in proximity to the central unnamed watercourse, is designated with high (greater than 1 in 30 (3.3%) annual probability) risk of surface water flooding. This high risk area is associated with the unnamed watercourse and overlaps, in part, with the proposed location of the substation compound and part of the access road.

5.3.4 The proposed design includes a retaining wall along the eastern boundary of the substation compound, which would manage the flow path and prevent any surface water pooling on the substation compound.

5.3.5 Where the Site is intersected by the western and eastern unnamed watercourses, there is a variable risk of surface water flooding, between high and low (land having between a 1in 100 (1%) and 1 in 1,000 (0.1%) annual probability of surface water flooding).

5.3.6 These areas of elevated surface water flood risk, combined with the increase in impermeable surfacing from the proposed development could result in an increase in surface water flood risk. However, a drainage strategy, outlined in Section 6, is proposed for the Site to manage any increases in surface water runoff and maintain runoff rates to existing, greenfield rates.

5.3.7 **Most of the Site has a very low risk of surface water flooding, however there are areas designated with medium to high risk, which coincide with the unnamed watercourses and surface water flow paths. A retaining wall along the eastern boundary of the substation compound would prevent surface water pooling on the substation compound, from the central unnamed watercourse, and a drainage strategy has been developed to manage increases in surface water runoff and subsequent flood risk.**

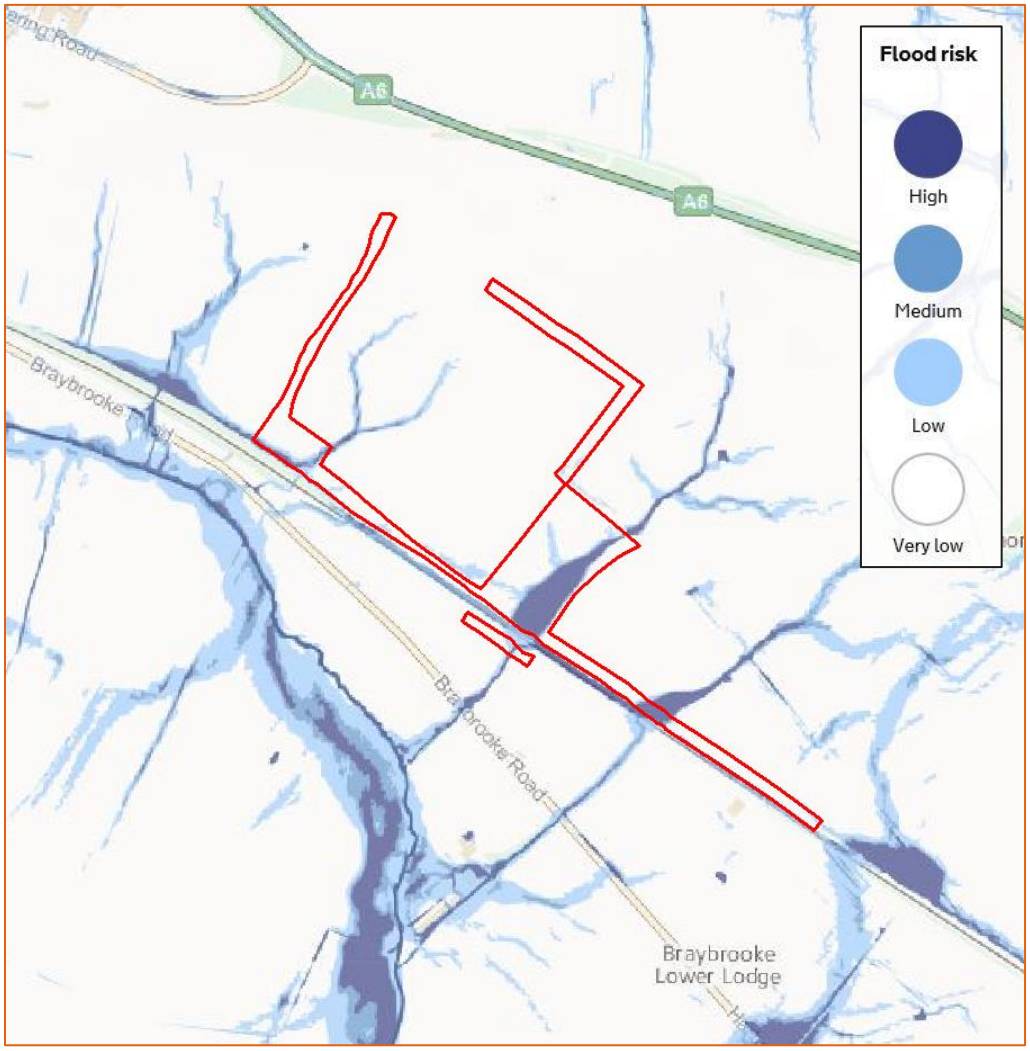

Figure 5.1 EA Flood Risk from Surface Water
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5.4 Groundwater

5.4.1 The *Kettering and Wellingborough Level 1 SFRA* states that the risk of groundwater flooding in the borough is generally low, but should be further assessed on a local, site-specific scale. The EA *Areas Susceptible to Groundwater Flooding* map identifies the Site as having a less than <25% susceptibility to groundwater flooding. In addition, there are no records of historical groundwater flooding in proximity to the Site.

5.4.2 Water levels in the underlying soils may have connectivity with the River Jordan or the unnamed watercourses, which could cause groundwater to rise to the surface if river levels were high for a prolonged period. However, the underlying soils have impeded drainage, which limits potential connectivity, and the bedrock geology only sustains a Secondary (undifferentiated) aquifer, which has limited potential for the storage and conveyance of groundwater.

5.4.3 **Overall, it is considered that the Site is at low risk of groundwater flooding.**

5.5 Artificial Sources

5.5.1 The *Kettering and Wellingborough Level 1 SFRA* identifies eight flood storage reservoirs and three former water supply reservoirs within the borough. However, the *EA Risk of Flooding from Reservoirs* map indicates that the Site is not located within the maximum extent of flooding should large reservoirs fail and release the water that they hold.

5.5.2 The Site is located more than 3km east of the Market Harborough Arm of the Leicester Line (Grand Union Canal), which is considered sufficiently remote from the waterbody so as not to pose a source of flood risk.

5.5.3 Consultation with Severn Trent Water has identified that there are no sewers in proximity to the Site. Anglian Water asset maps identify a main running along Desborough Road (A6) to the north of the Site, however, this asset is considered sufficiency remote from the Site so as not to pose a source of flood risk in the unlikely event of a burst.

5.5.4 **Overall, it is considered that the Site is at low risk of flooding from artificial sources.**

6 SURFACE WATER DRAINAGE ASSESSMENT

6.1 Planning Policy Requirements

6.1.1 Current flood risk and development planning policy specifies that surface water arising from a development should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the Site prior to the proposed development. Opportunities to reduce flood risk to the Site itself and elsewhere, taking climate change into account, should be investigated and this should be demonstrated as part of the FRA. Developers should seek opportunities to reduce the overall level of flood risk through appropriate application of Sustainable Drainage Systems (SuDS), which provide a means of restricting discharge rates and run-off volumes as well as improving water quality and providing wildlife and amenity value.

6.2 Existing Drainage

6.2.1 The Site is currently greenfield and not served by any installed public surface water or combined sewer networks. Existing runoff characteristics are therefore governed by slopes, soil type and the permeability of the overlying surfaces. During larger storms, excess runoff would drain in accordance with the topography of the Site, towards the unnamed watercourses and the River Jordan.

Runoff Rate Calculations

6.2.2 Surface water runoff rates have been calculated to inform the Outline Drainage Strategy (Appendix A). Surface water runoff has been estimated using the IH124 method. Flow rates have been calculated based on an average annual rainfall of 639mm and with standard percentage runoff values of around 0.49 (based on clay soil), but which varies depending on the location within the Site boundary. Using these standard values, the mean annual flood flow is estimated as 4.34l/s/ha. The proposed development should aim to maintain runoff rates from the Site at greenfield rates to ensure no change in flood risk to surrounding, third party areas.

6.3 Overview of the Proposed Drainage Strategy

6.3.1 The following section provides a summary of the Outline Drainage Strategy, prepared by Jacobs, for the proposed development, which is attached in Appendix A.

Objective

6.3.2 The primary objective of the drainage strategy is to manage any increases in surface water runoff volumes arising from the proposed development. The strategy aims to limit runoff rates to existing, greenfield, rates as well as manage any increases in surface water flood risk from the proposed development, to the Site and third parties. The drainage strategy also aims to prevent environmental pollution arising from the substation once it is in operation as well as considering potential future impacts of climate change on rainfall intensities and runoff volumes.

6.3.3 The drainage strategy has followed best practise outlined in CIRIA SuDS Manual (Ref. 15) and adheres to standards and guidance provided by the LLFA.

Surface Water Drainage

6.3.4 The three unnamed watercourses flowing through the Site provide suitable outfall points for discharge of runoff from the proposed development. However, the proposed development will increase impermeable land cover, and is therefore likely to increase surface water runoff rates and volumes, additional flow control, conveyance and attenuation is required.

6.3.5 The strategy primarily consists of filter drains to collect water and convey flows into the unnamed watercourses. The requirement for additional attenuation is provided via two attenuation ponds, located in the southwest corner of the Site, at the corner and to the north of the access road; and in the south-centre of the substation compound. The attenuation ponds will provide 435m^3 and 160m^3 of attenuation storage, respectively. The attenuation ponds link back to the unnamed watercourses via hydrobrakes, limiting discharge rates to 5l/s, which is taken as the approximate greenfield runoff rate.

6.3.6 Additional spillage and water treatment controls are also proposed for the substation compound, which will treat waters before connecting to the proposed drainage system.

6.3.7 These measures are considered sufficient to maintain greenfield runoff rates up to the 1 in 100 (1% AEP) rainfall event, inclusive of climate change allowance. As such, it is considered that there would be no increase in flood risk to the Site or third parties from the proposed development.

7 SUMMARY

7.1.1 Planning permission is being sought for the construction of a 400/25kV substation on land adjacent to the Midland Mainline railway and the existing 400kV overhead lines between Market Harborough and the village of Braybrooke. The proposed development also includes the creation of an earthing system and a new access road.

7.1.2 The entire Site is in Flood Zone 1, low flood risk, and the development proposal is classed in terms of flood risk vulnerability as '*Essential Infrastructure'*. The Site is therefore considered appropriate for this form of development.

7.1.3 The Site is larger than 1 hectare and represents a change in land use to a more vulnerable development type, therefore, in line with the NPPF PPG, an FRA has been prepared.

7.1.4 Flood risk from a wide variety of sources has been considered:

- The Site is in Flood Zone 1 and therefore has a **low risk of flooding from main rivers.**
- The Site is intersected by three small, unnamed watercourses, however there is no history of flooding from these waterbodies and they drain small catchments. **Overall, the risk of flooding from ordinary watercourses is concluded to be low.**
- The EA *Flood Risk from Surface Water* map indicates that most of the Site has a very low or low risk of flooding from surface water. However, where the Site is intersected by the unnamed watercourses, these areas are designated with high risk. **A retaining wall is proposed along the eastern boundary of the substation compound, which would prevent surface water pooling on the Site from the unnamed watercourse and a drainage strategy has been developed to manage any changes in surface water runoff from the proposed development.**
- There is no history of groundwater flooding at the Site and the proposed development includes no works likely to impact on aquifers. **Overall, the risk of flooding from groundwater is low.**
- The Site is located remote from the canal network, is not included in the EA *Flood Risk from Reservoirs* map and is not served by any existing sewer networks. **Overall, the risk of flooding from artificial sources, including sewers, is low.**
- The Site is located remote from the coast and at an elevation greater than 85mAOD. **The Site is not at risk of flooding from the sea or tidal sources.**

7.1.5 A drainage strategy has been developed, which aims to maintain runoff rates arising from the developed Site to the existing, greenfield rates. The strategy focuses on filter drains flowing into one of two attenuation ponds and then outfalling, via a hydrobrake, into the unnamed watercourses. Sufficient storage would be provided to maintain greenfield runoff rates up to the 1 in 100 year (1%) AEP rainfall event, including a 20% allowance for climate change. The drainage strategy also includes provision for additional treatment and storage of runoff from the substation compound to mitigate any potential for pollution arising from the proposal.

7.1.6 This FRA has demonstrated that the Site is considered appropriate for the development, relative to EA Flood Zone classifications, and has a low risk of flooding from rivers, groundwater and artificial sources. Areas of the Site are at risk from surface water flooding, however by following the Sequential approach in locating the various components of the proposed development components and by implementing the Drainage Strategy, it is considered there is no significant risk of flooding to the development.

7.1.7 It is also concluded that development of the Site would not increase third party flood risk.

8 REFERENCES

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Appendix A: Outline Drainage Strategy

Braybrooke NR Connection

National Grid

Outline Drainage Strategy

PDD-32519-REP-006 | 01

12th July 2017

32519

Document history and status

Revision	Date	Description	By	Review	Approved
00	28/06/17	First Issued	Jonathan Price	Dan Clark	Tom MacDonald
01	12/07/17	Removal of Culvert proposed	Jonathan Price	Dan Clark	Tom MacDonald

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments

Braybrooke NR Connection

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Client Name:	National Grid
Client No:	32519
Project Manager:	Tom MacDonald
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Contents

1. Introduction

1.1 Proposed Development

The National Grid (NG), as part of the Midland Main Line Electrification Scheme, will provide a grid supply point where the existing overhead line (OHL) route ZA crosses the rail track near the village of Braybrooke, Northamptonshire. See Figure 1 in Appendix A for the proposed development location.

National Grid project 32519 is to construct the new 400kV sub-station in a green field location, 2.5km south-east of Market Harborough, Northamptonshire, in conjunction with the development of a new 25kV Automatic Transformer Feeding Site (ATFS) trackside sub-station (Braybrooke) by Network Rail (the location, design and layout to be confirmed by Network Rail). The new National Grid sub-station, will contain two 80 MVA 400/25.5-0-25.5kV Super Grid Transformers (SGTs) connecting via cable to Network Rail's new Braybrooke ATFS transformer feeder station.

See drawing PDD-32519-LAY-011 to 014 in Appendix A for the proposed layout.

1.2 Site Location and Access

The proposed National Grid Market Harborough 400kV sub-station is located 2.5km south-east of Market Harborough, located between the Harborough Road (A6) and the mainline railway. The proposed route of the access road commences from Kettering Road in the north-west and follows field boundaries to the railway, then runs parallel to the railway to the proposed new 400kV sub-station and ATFS. See figures 2A & 2B for the access route and Figure 3 for the sub-station location.

1.3 Site Description

The proposed sub-station is to be constructed on (at present) open farm fields, there is a National Grid overhead transmission (OHL) route crossing the site, running north-south across the proposed sub-station with one transmission tower located at the site. The existing site slopes down from north to south which at some points is as steep as 22%.

See Drawing PDD-32519-LAY-001, in Appendix A for the proposed layout.

1.4 Purpose of Report

This report provides an overview of the existing surface water in the proposed site area and outlines proposals to ensure the development does not increase flood risk or effect water quality.

2. Desk Top Study

The nearest water course is the River Jordan, located approximately 100m south of the site. There are a number of small, localised land drains / ditches indicated on the maps in the vicinity of the site, with one to the south appearing to flow into the River Jordan. There are no surface water abstractions within 500m of the site.

The site and access road are in an area designated by the environment agency as Surface Water Safeguard Zone. These are areas in which the use of certain substances must be carefully managed to prevent pollution of raw water resources that are used to provide drinking water.

The below image shows the site is proposed to be within Flood Zone 1. Flood Zone 1 is land having a less than 1 in 1,000 annual probabilities of river or sea flooding.

Figure 2.1 : UK Governments Flood Map for planning (https://flood-map-for-planning.service.gov.uk/)

There are two existing surface flows within the site, these have been highlighted on the below;

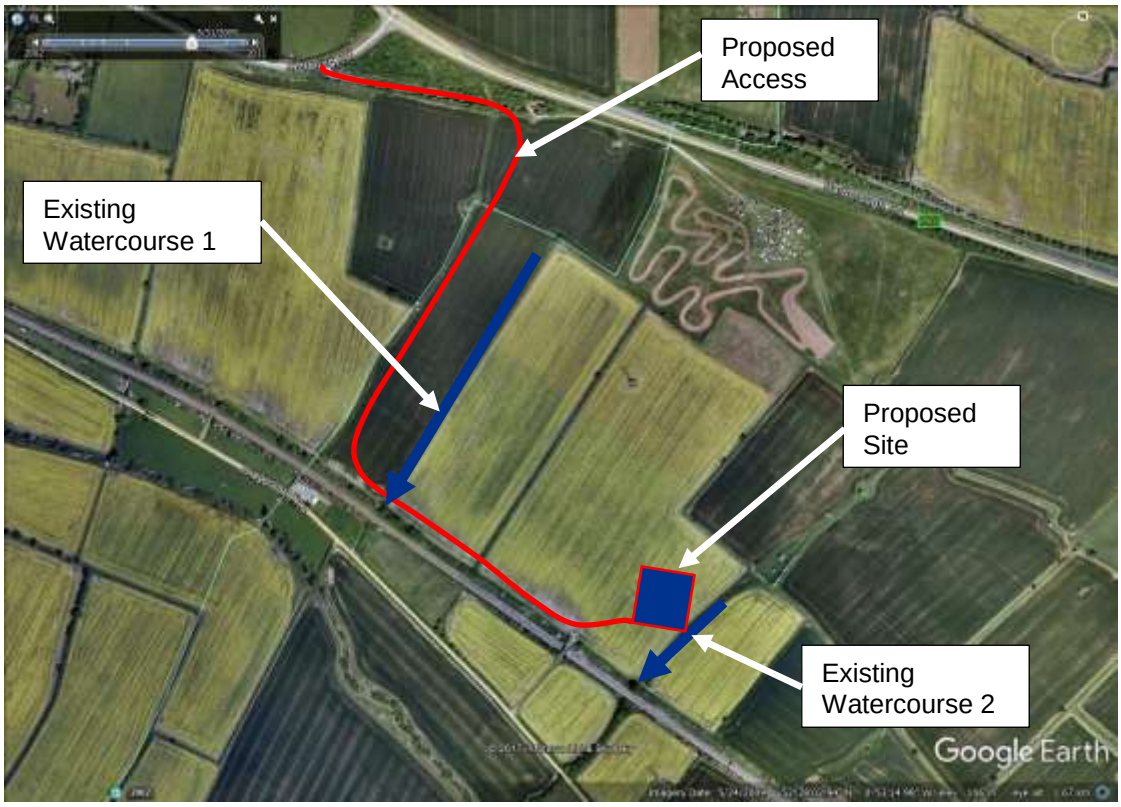


Figure 2.2 : Google Earth Image with existing watercourse and proposed access road and site highlighted

Both surface water flows are minor ditches and collected in culverts and conveyed under the railway towards the River Jordan. Existing surface water flood risk is shown on the below image;

Figure 2.3 : UK Governments Flood Map for planning, Flood Risk from Surface Water (https://flood-map-for-planning.service.gov.uk/)

Existing watercourse 1 appears on the surface water flood risk map, but there is an additional forked surface flow shown, the data may based on historic information prior to the current hedge and ditch arrangements. The

high risk flood area near the railway confirms reports of the corner of the one field been very boggy and coincides with a low point in the topography.

Existing watercourse 2 appears on the surface water flood risk map, and there is evidence of the culvert location and downstream flows into the River Jordon.

3. Existing Watercourses

3.1 Watercourse 1

Existing watercourse 1 follows the hedgeline from North to South on the western side. It is a minor ditch.

It is piped under the existing farm access track at the southern end of field near the boundary with the Network Rail land. There is an existing culvert under the railway conveying flows to the river Jordan.

At the culvert low point location there are also watercourse running parallel to railway line from the east and the west outfalling into the culvert.

Figure 3.1 : Existing Watercourse 1 looking north

Figure 3.2 : Existing Watercourse 1 piped under farm access track

Figure 3.3 : Existing watercourse 1 upstream end of railway culvert

Figure 3.4 : Existing watercourse running parallel to railway, connects with existing watercourse 1 at the railway culvert

3.2 Existing Watercourse 2

Existing watercourse 2 is within a valleyed section to the eastside of the proposed site field. It is conveyed under the farm access in a pipe before entering a culvert under the railway towards the river Jordan.

Figure 3.5 : Existing Watercourse 2 flowing right to left, piped under the existing farm access prior to been conveyed under the railway in a culvert (culvert headwall with metal barrier on top to left of photo)

Figure 3.6 : Existing Watercourse 2 looking North

Figure 3.7 : Existing Watercourse 2 culvert under railway

4. Policies, Standards and Guidance

Drainage is to be designed to Sewers for Adoption, and National Grids Generic Electricity Substation Design Manual for Civil, Structural and Building Engineering (TS2.10).

In addition, the design is to make use of the processes and design information in Design Manual for Roads and Bridges for drainage of the proposed access road.

All design is to be with consideration for relevant local standards and guidance for Local Lead Flood Authority (LLFA).

It is to follow best practice utilising CIIRIA SUDS Manual as a basis of design.

5. Proposed Access Road Drainage

5.1 Methodology

1) Develop greenfield peak runoff rate from http://www.uksuds.com/
2) Identify suitable watercourse outfalls from OS / Google Earth / http://magic.defra.gov.uk/
3) Liaise with highways on longitudinal profile
4) Once vertical and horizontal alignment are complete identify catchment areas and determine peak runoff
5) Complete drainage model in MicroDrainage or similar simulation software to size pipes and pond.

5.2 Design parameters

5.2.1 For FSR method the global parameters for this region are as follows:

- M5-60 Rainfall depth (mm) =20
- R ratio= 0.4
- SAAR (mm) = 639
- Return period = 2 years
- Soil type – 4
- Hydrological Region- 5

5.2.2 Unless otherwise specified, the surface runoff coefficients used will be as follows:

- Paved area -1
- Verges - 0.3
- Cutting - 0.3

5.2.3 Climate Change Allowances

Unless otherwise specified the climate change allowance shall be assumed as per the table shown below:

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 5.1 : Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline (Reference: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances)

It is proposed the drainage design of the pipes will use 20% CC with no flooding at the 1 in 5 year storm, except at sag points where the 1 in 10 year storm will be reviewed.

The pond will be design to 1 in 100 year storm and 20% Climate Change, but a 40% sensitivity check will be undertaken.

5.3 Greenfield Assessment

The site is small as such the individual catchments are below 50Ha. The flood estimation for small catchments (IH124) has been used to calculate the mean annual flood.

$$Qbar = 1.08 \times (0.01 \times AREA)^{0.89} \times SAAR^{1.17} \times SPR^{2.17} \text{ l/s}$$

(*For development sites of 50 ha or less, use 50 ha when applying the formula. Subsequently factor the resulting value by the ratio of the site area to 50 ha*.)

Qbar is the mean annual flood flow in l/s

AREA is the area of the catchment in ha.

SAAR is the standard average annual rainfall in mm

SPR is Standard Percentage Runoff coefficient for the SOIL category.

Due to the length of the site variable SAAR values have been used along the scheme length, for the worked example below a SAAR of 639 has been used along with a SPR of 0.47 (based on clay soil).

$$Qbar = 1.08 \times (0.01 \times 50)^{0.89} \times 639^{1.17} \times 0.47^{2.17} = 217 \text{ l/s}$$

Qbar = 4.34 l/s/ha.

6. Proposed Drainage

6.1 Catchment A – Ch. 0 to 330

It is proposed that gullies are to be provided at the location of low point at approximate chainage 22.7m. These gullies are proposed to be connected to the existing drainage along Kettering Road as the widening to the existing track is to be temporary during construction only.

Catchment area summary for this catchment is as follows:

Impermeable area (Ha)	Permeable area (Ha)	Total area (Ha)
0.02	0.00	0.02

6.2 Catchment B – Ch. 330 to 1360

Catchment area summary for this catchment is as follows:

Impermeable area (Ha)	Permeable area (Ha)	Total area (Ha)
0.68	0.04	0.73

Filter drains have been proposed in the verge to collect and convey the runoff.

The outfall is assumed to be located at the culvert at approximate chainage 1090m.

Flow attenuation is required in this catchment as the access track is a paved area. The flow is proposed to be limited to Greenfield discharge rate of 5 l/s up to 1 in 100 year return period.

1 m deep pond is proposed to be provided for attenuation at approximate chainage 800 m on the north side of the access track. Flow control has been proposed in form of hydro brake with a design flow of 5 l/s. The volume of storage in the pond is 435 m^3 (From MicroDrainage)

6.3 Catchment C – Ch. 1360 to 1515

The runoff from the compound of the substation is collected within the drainage system proposed along with the access track. The time of concentration is assumed to be 10 min for the site and a separate spillage control and treatment will be designed for the compound before connecting to the access road system.

Catchment area summary for this catchment is as follows:

Impermeable area (Ha)	Permeable area (Ha)	Total area (Ha)
0.31	0.01	0.32

Filter drains have been proposed in the verge to collect and convey the runoff.

Flow attenuation is required in this catchment as the access track is a paved area. The flow is proposed to be limited to Greenfield discharge rate of 5 l/s up to 1 in 100 year return period.

1 m deep pond is proposed to be provided for attenuation at approximate chainage 1300 m on the north side of the access track. Flow control has been proposed in form of hydro brake with a design flow of 5 l/s. The volume of storage in the pond is 160 m^3. (From Micro Drainage).

7. Culverts

The two existing piped crossings under the farm access will be assessed to see if they are capable for withstanding the loads of the proposed road and vehicles.

If they are not sufficient a large pipe diameter of 1.2m is to be provided to allow development of a sedimentation bed in the pipe to improve water quality and an allowance for freeboard.

As part of the electrification works Network Rail have confirmed they will be confirming the integrity of the existing culverts downstream of the site and making any repairs as necessary.

8. Maintenance

Drainage and as such its maintenance is key to maintaining the site and access roads, as effective drainage of rainwater from surfaces plays a major part in safety by removing surface water quickly, which can turn to ice in unfavourable weather conditions. In addition, a suitable drainage system will minimise damage to the structural foundations of the carriageway.

Gully emptying, road sweeping and other road maintenance tasks are important pollution prevention strategies for road runoff.

As part of the National Grids responsibility they will be required to maintain the following drainage apparatus;

- Edge collection system i.e. gullies, combined drainage kerbs or surface water channels
- Conveyance system i.e. pipes, manholes, catchpits or headwalls
- Attenuation Ponds
- Culverts
- Cut-off Ditches

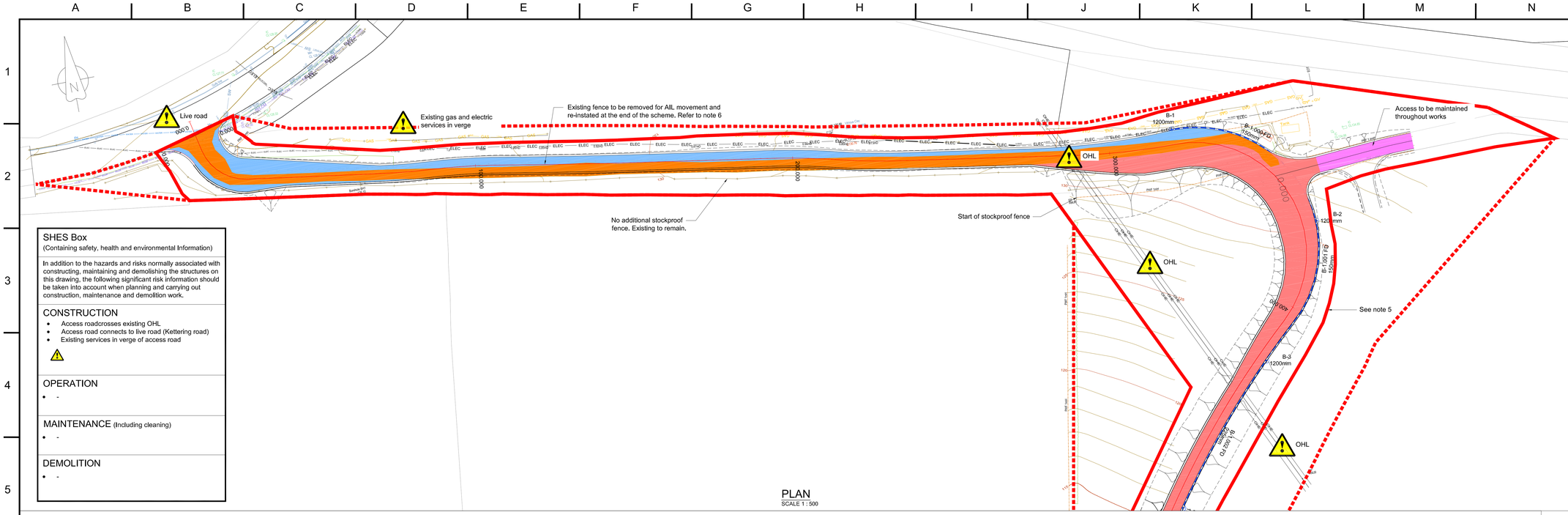
Existing and realigned watercourse will be the responsibility of the Local Lead Flood Authority (LLFA).

Maintenance activities should include but not limited to the following;

- Regular Maintenance
    - Remove litter (including leaf litter) and debris from surfaces, access chambers and inlets / outlets
    - Inspect edge collection surface, gullies, inlet/outlets, pipework, control systems, banksides for blockages, clogging, standing water and structural damage
    - Remove sediment from edge collection details, gullies, catchpits and sediment forebays
    - Cut the grass around attenuation pond
    - Control of vegetation within the pond, cutting aquatic plants and bank vegetation by at least 25% to ensure no pond capacity issues
    - Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)
    - Inspect water bodies for water quality issues
    - Check mechanical devices, hydrobrake and penstocks
- Occasional Maintenance
    - Remove or control tree roots, where they are encroaching underground apparatus, using recommended methods BS 3998:2010
    - At locations with high pollution loads, remove surface geotextile and replace and was or replace overlying filter medium
    - Clear pipework of blockages
    - Remove sediment form pond if capacity is reduced by 20%
- Inlets, outlets and flow control structures, these are particularly critical to the effectiveness of the system
- If sediment is trapped in accessible parts of the system, it can be removed easily as part of routine landscape maintenance work.

The effective and sympathetic Maintenance of the system should take account of the wildlife supported by the habitat provided.

Appendix A. Proposed Development



PLAN
SCALE 1 : 500

SHES Box
(Containing safety, health and environmental Information)

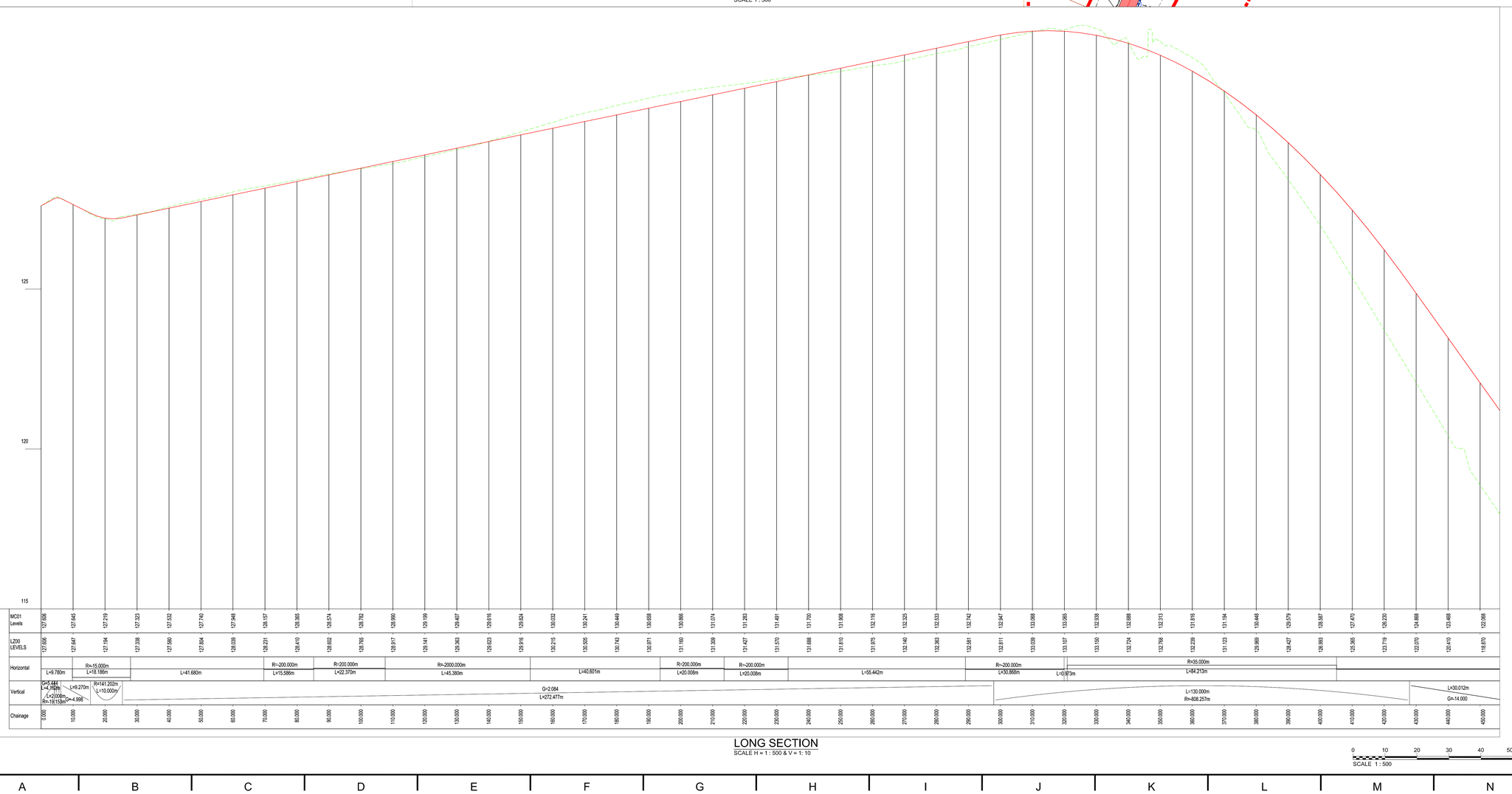
In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction, maintenance and demolition work.

CONSTRUCTION
- Access roadcrosses existing OHL
- Access road connects to live road (Kettering road)
- Existing services in verge of access road

OPERATION
- -

MAINTENANCE (Including cleaning)
- -

DEMOLITION
- -



LONG SECTION
SCALE H = 1 : 500 & V = 1: 10

SCALE 1 : 500

NOTES
1. This is a 4.3 drawing and is for development purposes only.
2. All dimensions are in m.
3. Alignment based on Electricity Substation Construction Civil, Structural and Building Engineering Design Handbook DH 10 Issue 4 section 2.11 and drawing NG-BS-TC01 Indicative Transport Configuration 97Te Transformer carried upon typical 5 Axle Bed 5 Axle Draw Bar Trailer Showing Minimum Turning Radii found at report Abnormal Indivisible Load Access Study - Transportation of a 97te Transformer to Proposed Braybrooke Substation Revision 1 dated 26/06/15.
4. Access for the farmer to be maintained at all times.
5. New stockproof fence to run along NG ownership / red line boundary.
6. AIL contractor to confirm any works required for delivery of transformer.

LEGEND
PLAN-
- Center line
- Carriageway line
- Verge line
- Embankment line
- Filter Drain
- Carrier Drain
- Catchpit / Flow Control
- Headwall
- Farm Access 75mm Gravel, 300mm Subbase
- Main Access 75mm Surface Course, 300mm Base
- Existing track
- Temporary widening on Existing track
- Construction Boundary
- Red line Boundary

PROFILE-
- Design line
- Existing ground

REFERENCE

PDD-32519-MOD-001	ROAD MODEL
PDD-32519-MOD-002	EARTHWORKS MODEL
PDD-32519-MOD-003	DRAINAGE MODEL

Rev	Description	Cnr'd	Chk'd	App'd	Date
02	Minor modifications	SSG	SMK	TM	28.06.2017
01	Revised road layout	SSG	SMK	TM	31.05.2017
00	First Issue	SSG	SMK	TM	18.05.2017

nationalgrid

Master Scheme No:	Sub-Scheme No:	Site:
32519	N/A	MARKET HARBOROUGH 400/25kV SUBSTATION

Scheme Name: BRAYBROOKE NR CONNECTION SCHEME

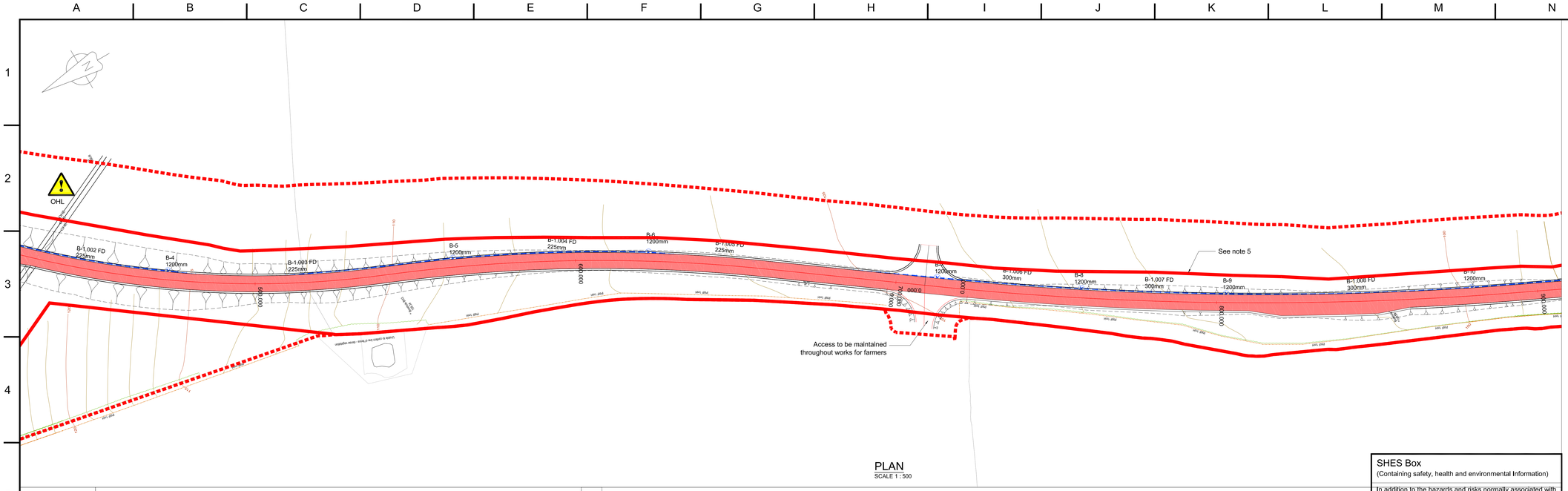
Document Title:
ROAD PLAN AND LONG SECTION
SHEET 1 OF 4
MARKET HARBOROUGH SUBSTATION

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
SSG	28.06.2017	SMK	28.06.2017	TM	28.06.2017

Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
ANDREA ROBERTSON	DWG	AS SHOWN	A0	1 OF 4	02

National Grid Drawing Number:
PDD-32519-LAY-011

Originator Drawing Number:
JAC/B3100023/32519-LAY-011



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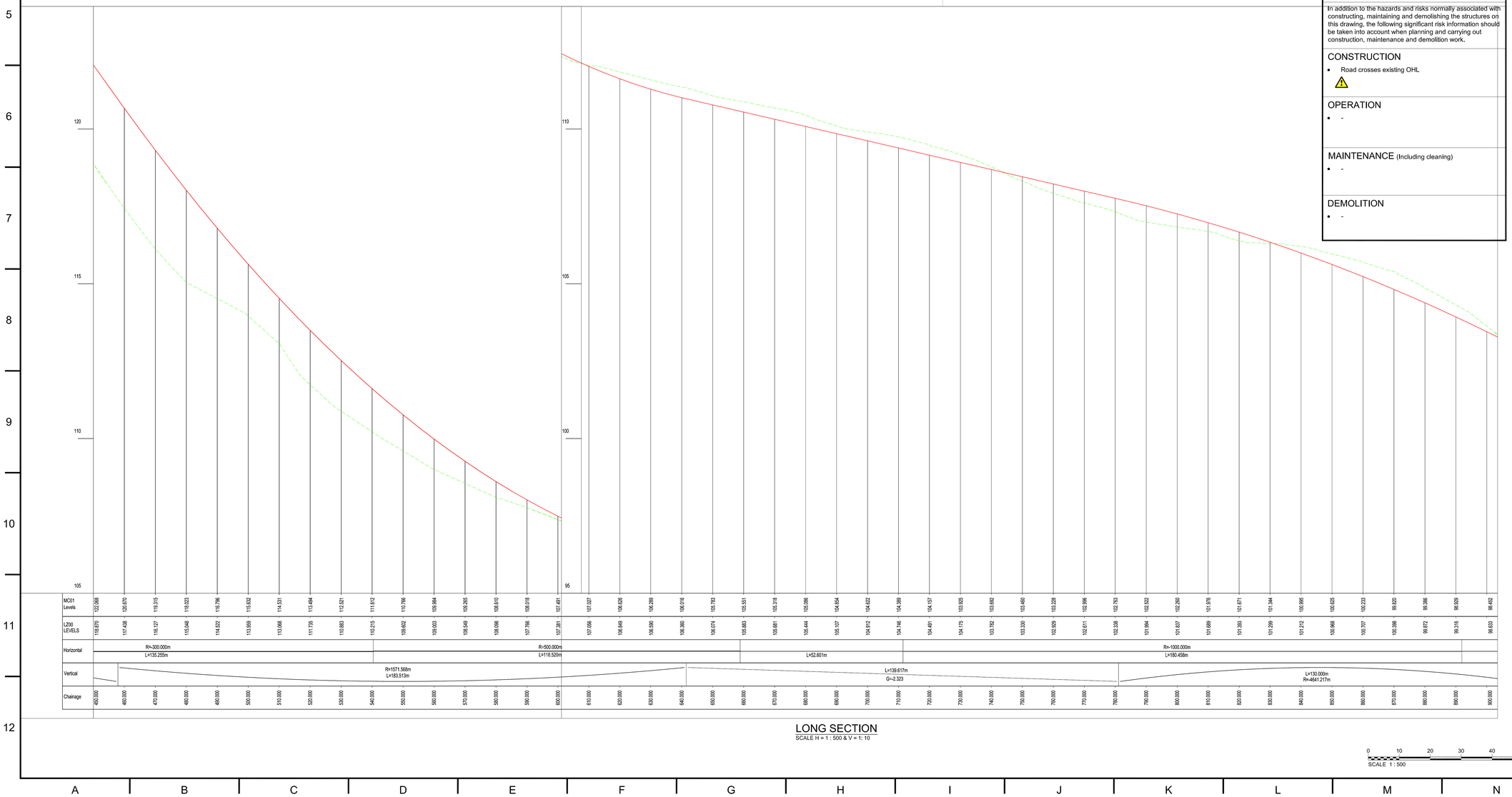

LONG SECTION
SCALE H = 1 : 500 & V = 1: 10

0 10 20 30 40 50 m
SCALE 1 : 500

SHES Box
(Containing safety, health and environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction, maintenance and demolition work.

CONSTRUCTION
- Road crosses existing OHL

OPERATION
- -

MAINTENANCE (Including cleaning)
- -

DEMOLITION
- -

NOTES
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LEGEND
PLAN-
- Center line
- Carriageway line
- Verge line
- Embankment line
- Filter Drain
- Carrier Drain
- Catchpit / Flow Control
- Headwall
- Farm Access 75mm Gravel, 300mm Subbase
- Main Access 75mm Surface Course, 300mm Base
- Existing track
- Temporary widening on Existing track
- Construction Boundary
- Red line Boundary

PROFILE-
- Design line
- Existing ground

REFERENCE

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Master Scheme No:	Sub-Scheme No:	Site:
32519	N/A	MARKET HARBOROUGH 400/25kV SUBSTATION

Scheme Name: BRAYBROOKE NR CONNECTION SCHEME

Document Title:
ROAD PLAN AND LONG SECTION
SHEET 2 OF 4
MARKET HARBOROUGH SUBSTATION

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
SSG	28.06.2017	SMK	28.06.2017	TM	28.06.2017

Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
ANDREA ROBERTSON	DWG	AS SHOWN	A0	2 OF 4	02

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PDD-32519-LAY-012

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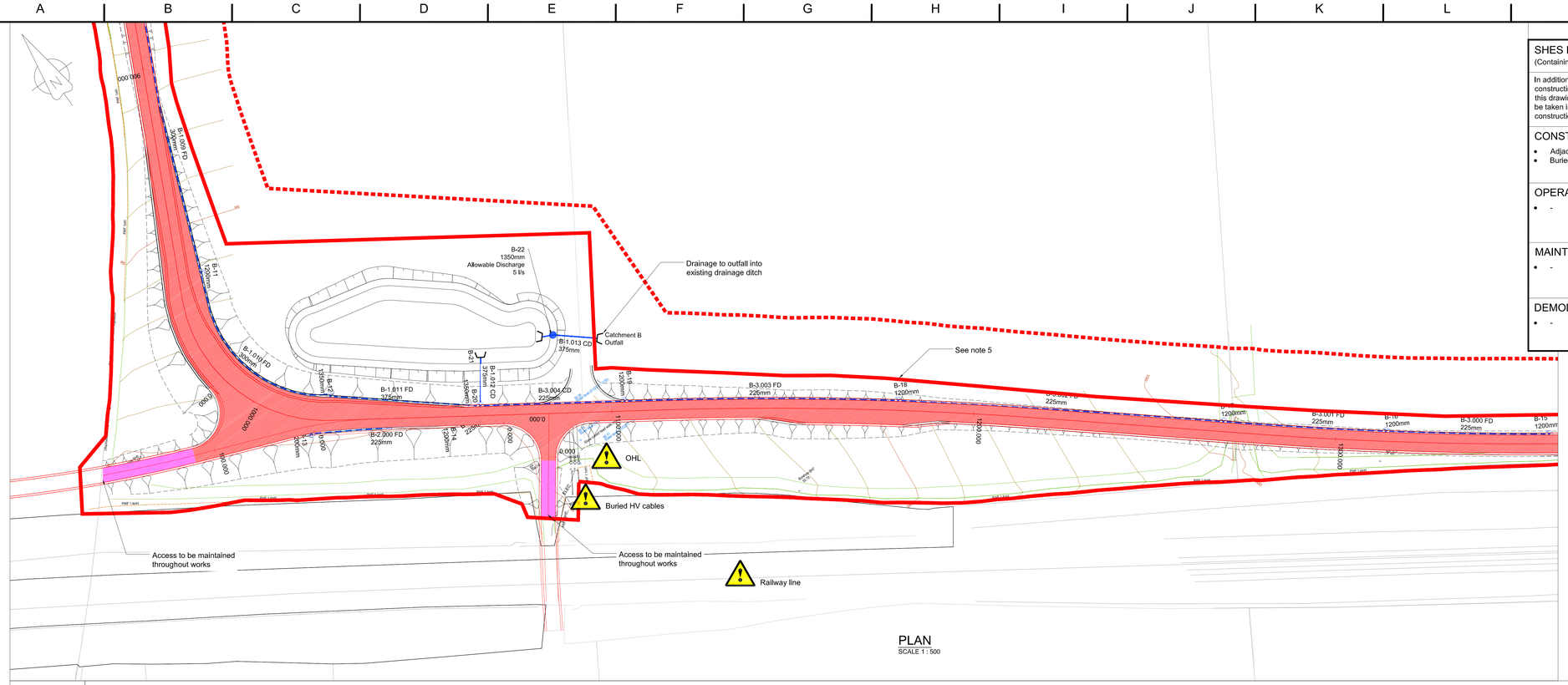
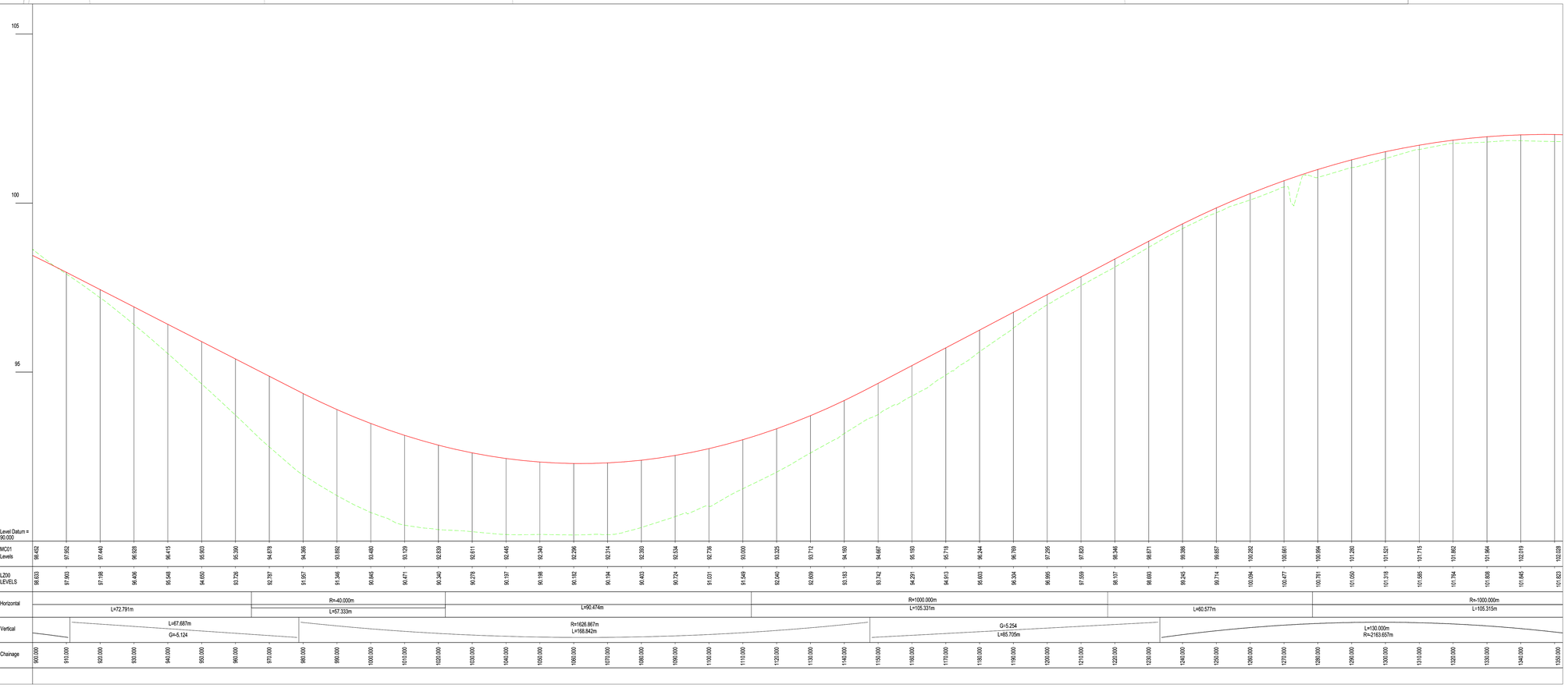




0 10 20 30 40 50 m
SCALE 1 : 500

SHES Box
(Containing safety, health and environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction, maintenance and demolition work.

CONSTRUCTION
- Adjacent OHL
- Buried HV cables ⚠

OPERATION
- -

MAINTENANCE (Including cleaning)
- -

DEMOLITION
- -

NOTES
1. This is a 4.3 drawing and is for development purposes only.
2. All dimensions are in m.
3. Alignment based on Electricity Substation Construction Civil, Structural and Building Engineering Design Handbook DH 10 Issue 4 section 2.11 and drawing NG-BS-TC01 Indicative Transport Configuration 97Te Transformer carried upon typical 5 Axel Bed 5 Axel Draw Bar Trailer Showing Minimum Turning Radii found at report Abnormal Indivisible Load Access Study - Transportation of a 97te Transformer to Proposed Braybrooke Substation Revision 1 dated 26/06/15
4. Access for the farmer to be maintained at all times.
5. New stockproof fence to run along NG ownership / red line boundary.

LEGEND
PLAN-
- Center line
- Carriageway line
- Verge line
- Embankment line
- Filter Drain
- Carrier Drain
- Catchpit / Flow Control
- Headwall
- Farm Access 75mm Gravel, 300mm Subbase
- Main Access 75mm Surface Course, 300mm Base
- Existing track
- Temporary widening on Existing track
- Construction Boundary
- Red line Boundary

PROFILE-
- Design line
- Existing ground

REFERENCE

PDD-32519-MOD-001	ROAD MODEL
PDD-32519-MOD-002	EARTHWORKS MODEL
PDD-32519-MOD-003	DRAINAGE MODEL

Rev	Description	Cre'd	Chk'd	App'd	Date
02	Minor modifications	SSG	SMK	TM	28.06.2017
01	Revised road layout	SSG	SMK	TM	31.05.2017
00	First issue	SSG	SMK	TM	18.05.2017

nationalgrid

Master Scheme No:	Sub-Scheme No:	Site:
32519	N/A	MARKET HARBOROUGH 400/25kV SUBSTATION

Scheme Name: BRAYBROOKE NR CONNECTION SCHEME

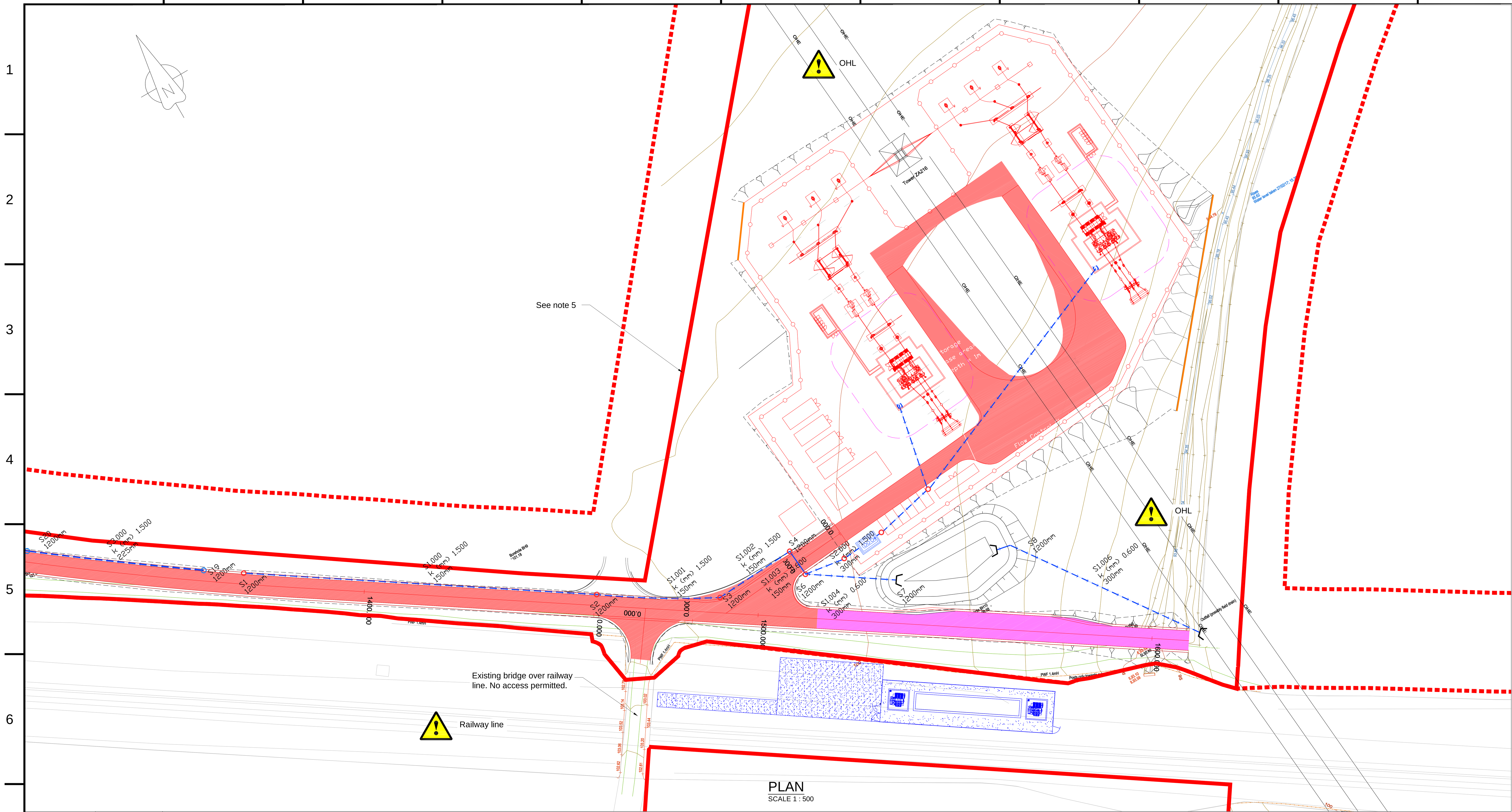
Document Title:
ROAD PLAN AND LONG SECTION
SHEET 3 OF 4
MARKET HARBOROUGH SUBSTATION

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
SSG	28.06.2017	SMK	28.06.2017	TM	28.06.2017

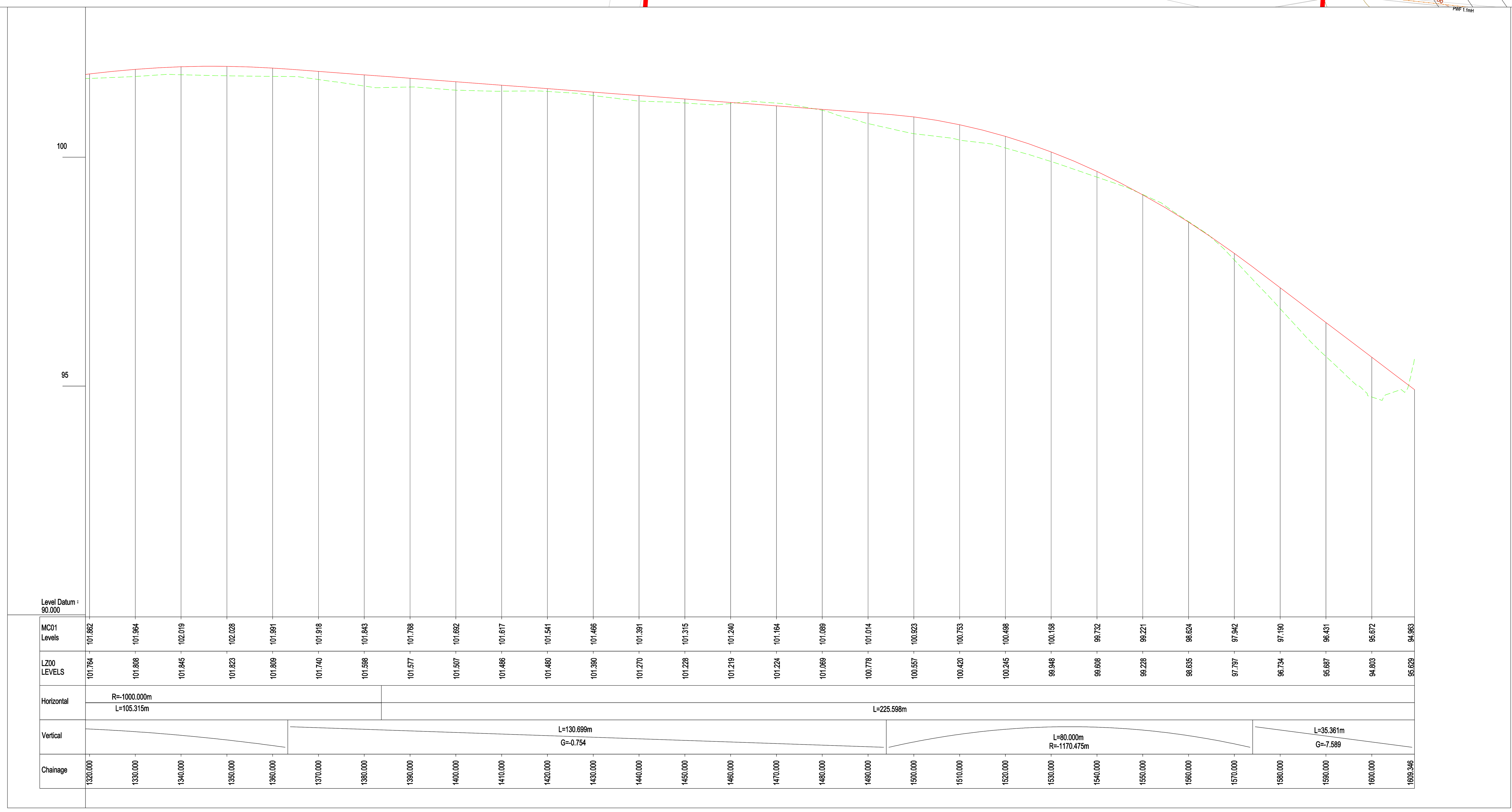
Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
ANDREA ROBERTSON	DWG	AS SHOWN	A0	3 OF 4	02

National Grid Drawing Number:
PDD-32519-LAY-013

Originator Drawing Number:
JAC/B3100023/32519-LAY-013



PLAN
SCALE 1 : 500



LONG SECTION
SCALE H = 1 : 500 & V = 1: 10

SHES Box

(Containing safety, health and environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction, maintenance and demolition work.

CONSTRUCTION

- Construction adjacent to railway line
- Bridge is not to be used for access

OPERATION

- -

MAINTENANCE (Including cleaning)

- -

DEMOLITION

- -

0 10 20 30 40 50 m
SCALE 1 : 500

NOTES

1. This is a 4.3 drawing and is for development purposes only.
2. All dimensions are in m.
3. Alignment based on Electricity Substation Construction Civil, Structural and Building Engineering Design Handbook DH 10 Issue 4 section 2.11 and drawing NG-BS-TC01 Indicative Transport Configuration 97Te Transformer carried upon typical 5 Axel Bed 5 Axel Draw Bar Trailer Showing Minimum Turning Radii found at report Abnormal Indivisible Load Access Study - Transportation of a 97te Transformer to Proposed Braybrooke Substation Revision 1 dated 26/06/15
4. Access for the farmer to be maintained at all times.
5. New stockproof fence to run along NG ownership / red line boundary.

LEGEND

PLAN-

- Center line
- Carriageway line
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- Design line
- Existing ground

REFERENCE

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PDD-32519-MOD-002	EARTHWORKS MODEL
PDD-32519-MOD-003	DRAINAGE MODEL

Rev	Description	Cre'd	Chk'd	App'd	Date
03	Revised Earthworks Layout	SSG	SMK	TM	12.07.2017
02	Minor modifications	SSG	SMK	TM	28.06.2017
01	Revised road layout	SSG	SMK	TM	31.05.2017
00	First Issue	SSG	SMK	TM	18.05.2017

nationalgrid

Master Scheme No:	Sub-Scheme No:	Site:
32519	N/A	MARKET HARBOROUGH 400/25kV SUBSTATION

Scheme Name: BRAYBROOKE NR CONNECTION SCHEME

Document Title:
ROAD PLAN AND LONG SECTION
SHEET 4 OF 4
MARKET HARBOROUGH SUBSTATION

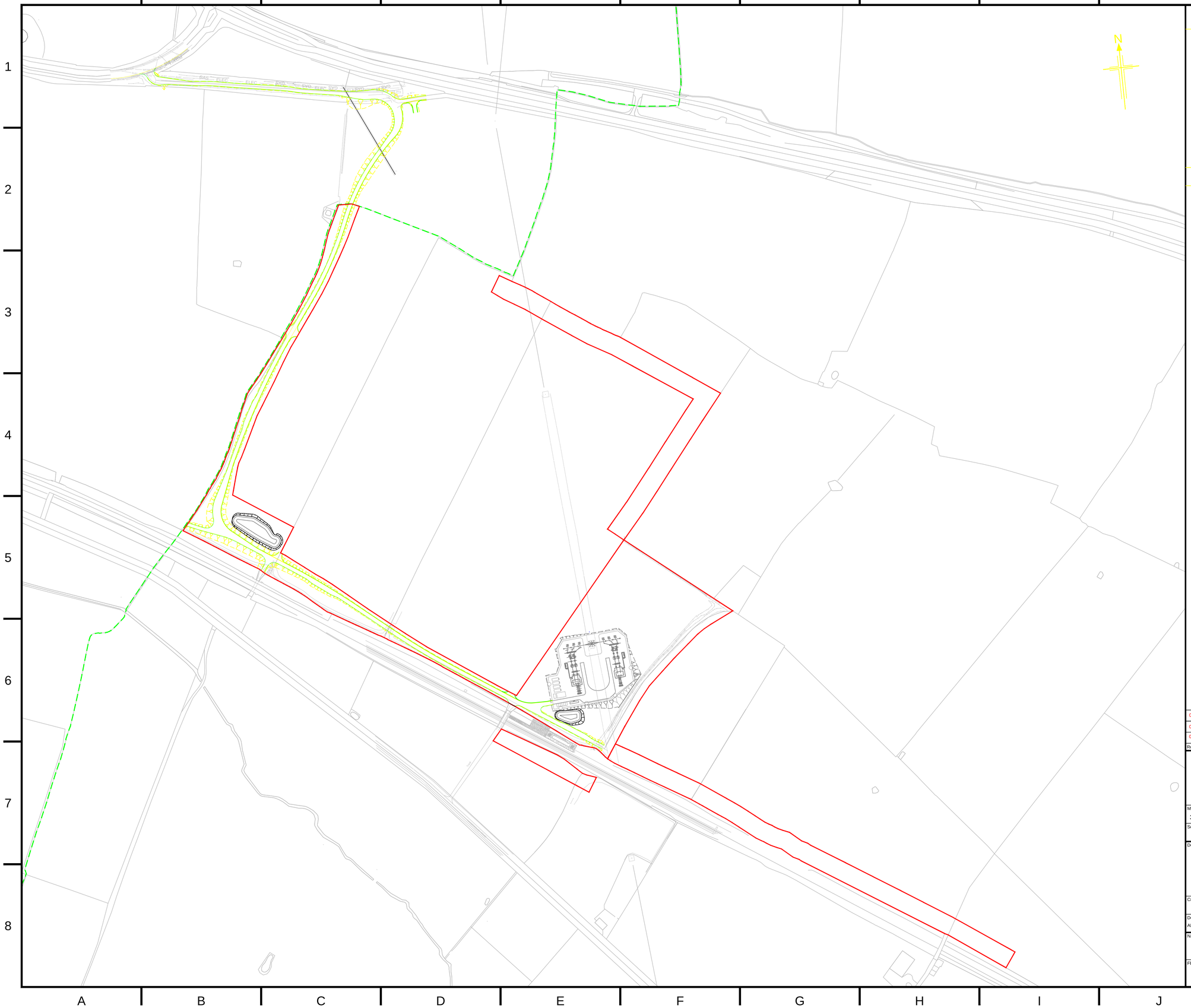
Created by:	Date:	Checked by:	Date:	Approved by:	Date:
SSG	12.07.17	SMK	12.07.17	TM	12.07.17

Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
ANDREA ROBERTSON	DWG	AS SHOWN	A0	4 OF 4	03

National Grid Drawing Number:
PDD-32519-LAY-014

Originator Drawing Number:
JAC/B3100023/32519-LAY-014

Appendix B: Proposed Development Layout



NOTES

1. This is a 4.3 drawing and is for development purposes only.

LEGEND

Red Line Boundary

District boundary line

Rev	Description	Cre'd	Chk'd	App'd	Date
02	Red Line Boundary Amended	AR	SS	NT	07.09.17
01	Red Line Boundary Amended	DA	IJ	TM	12.07.17
00	First Issue	DA	IJ	TM	28.06.17

nationalgrid

Master Scheme No:	Sub-Scheme No:	Site:
32519	N/A	MARKET HARBOROUGH 400/25kV SUBSTATION

Scheme Name: BRAYBROOKE NR CONNECTION SCHEME

Document Title:

KETTERING BOROUGH COUNCIL
RED LINE BOUNDARY
MARKET HARBOROUGH 400kV SUBSTATION

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
DA	12.07.17	IJ	12.07.17	TM	12.07.17

Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
ANDREA ROBERTSON	DWG	1:2500	A1	1 OF 1	02

National Grid Document Number:

PDD-32519-LAY-028

FEED Document Number:

JAC/B3100023/32519-LAY-028

Appendix C: EA Flood Maps

Joshua Moore
Joshua.Moore@arcadis.com

Our ref: CCN/2017/47865

Date: 31st May 2017

Dear Joshua

Provision of Flood Risk Information for SP75565 85382 to SP75182 85885.

Thank you for your request to use our flood risk information in the development of the Flood Risk Assessment (FRA) for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

Flood Map

The attached map includes the current Flood Map for your area. The Flood Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defence water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

History of Flooding

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible other flooding may have occurred we do not have records for, and other organisations, such as the Local Authority or Internal Drainage Boards, may have records.

Fluvial Flood Risk Information

There are no formal flood defences reducing the risk of flooding to this site.

Modelled Levels and Flows
Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are "in-channel" levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Modelled Flood Information
We do not have any detailed modelled flood information (such as extents) for this location.

Development Planning
If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of our information for Flood Risk Assessments.

https://www.gov.uk/planning-applications-assessing-flood-risk

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Climate change will increase flood risk due to overtopping of defences. Please note the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on www.gov.uk on 19 February 2016. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

Supporting Information
Please see the Standard Notice or licence for details of permitted use. The Standard Notice can be found at the link below.
http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Further information on flood risk can be found on the GOV.UK website at:
https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

Further Contact
I hope we have correctly interpreted your request. If you are not satisfied with our response to your request for information you can contact us within two calendar months to ask for our decision to be reviewed.

If you have any queries or would like to discuss the content of this letter further please contact Jason Fife using the details below.

Waterside House, Waterside North, Lincoln, LN2 5HA.
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

Yours faithfully

FOR Alastair Windler
Partnerships and Strategic Overview Team Leader - Welland and Nene

Direct dial 02084 749413
Direct e-mail PSOLINCS@environment-agency.gov.uk

Enc.
FRA Advisory Text
Flood Map
Modelled Fluvial and Flows Data Sheet

Awarded to Lincolnshire & Northamptonshire Area

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important
If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

http://www.environment-agency.gov.uk/research/planning/33580.aspx

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

http://www.environment-agency.gov.uk/research/planning/82587.aspx

http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance

http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales,** you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones
http://new.wales.gov.uk/splash;jsessionid=8ylGTfGZthmB0t2vhp6hS1GcB1LXvZzB3Ylczf20Xn7LK3zK0nMk!981825250?orig=/topics/planning/policy/tans/tan15/

You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

In both **England and Wales** you should note that:

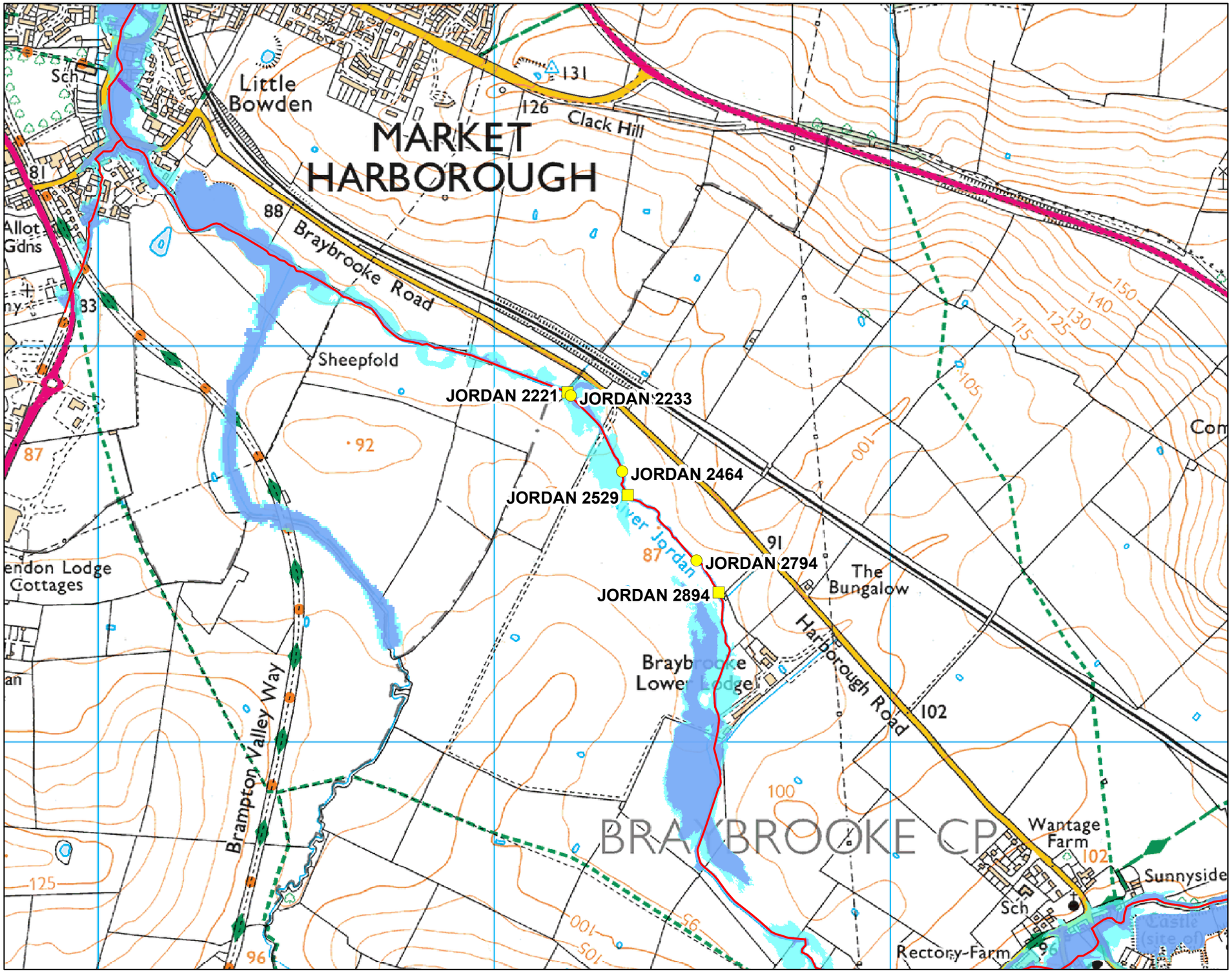
1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.

4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Flood Map centred on SP 75349 85619 - created May 2017 [Ref: CCN-2017- 47865]



Environment Agency

Scale 1:10,000

N W E S

- Modelled Levels
- Modelled Flows
- Main River
- Raised Defences
- Area at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.

- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Created by the Partnerships and Strategic Overview Team, Lincoln

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Datasheet [Ref: CCN-2017-47865] Data Model – Welland Catchment - dated 2016

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)										
Node Label	**Easting**	**Northing**	**50% (1 in 2)**	**20% (1 in 5)**	**10% (1 in 10)**	**5% (1 in 20)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc 20% Climate Change**	**0.5% (1 in 200)**	**0.1% (1 in 1000)**	**0.1% (1 in 1000) inc 20% Climate Change**
JORDAN 2233	475194	285874	83.04	83.17	83.26	83.34	83.44	83.46	83.48	83.57	83.57	83.85	83.94
JORDAN 2464	475324	285683	83.83	84.02	84.15	84.27	84.43	84.47	84.51	84.70	84.70	85.18	85.31
JORDAN 2794	475512	285458	85.72	85.89	86.01	86.09	86.18	86.20	86.23	86.35	86.35	86.67	86.77

Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)										
Node Label	**Easting**	**Northing**	**50% (1 in 2)**	**20% (1 in 5)**	**10% (1 in 10)**	**5% (1 in 20)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc 20% Climate Change**	**0.5% (1 in 200)**	**0.1% (1 in 1000)**	**0.1% (1 in 1000) inc 20% Climate Change**
JORDAN 2221	475186	285882	5.09	6.72	7.98	9.20	11.18	11.57	12.07	14.32	14.32	21.93	25.28
JORDAN 2529	475338	285623	4.89	6.46	7.67	8.89	10.65	11.01	11.46	13.74	13.74	22.58	27.07
JORDAN 2894	475568	285377	4.65	6.15	7.30	8.24	9.18	9.42	9.71	11.43	11.43	16.84	18.74

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