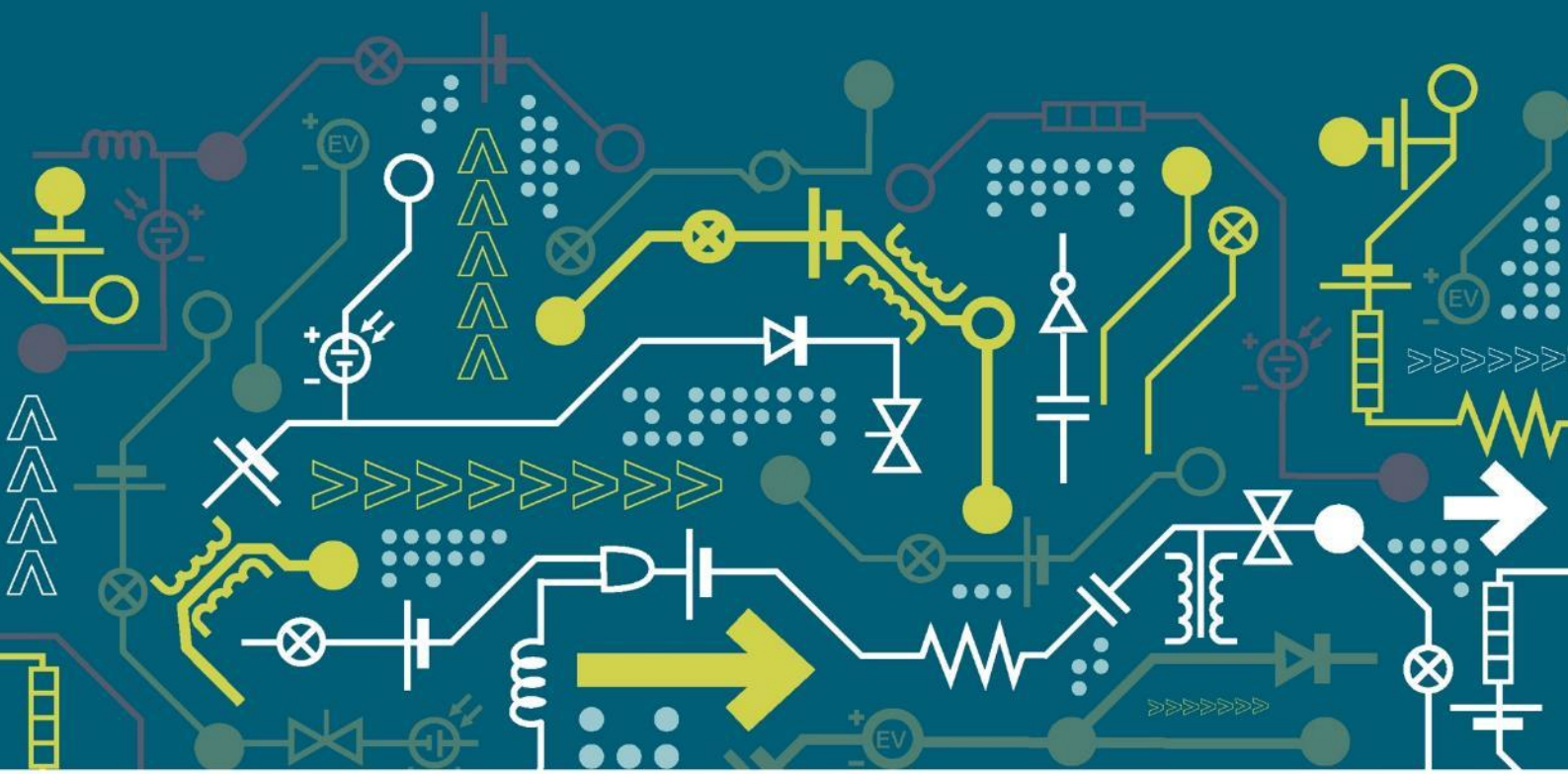
WPD INNOVATION

# Take Charge

## Site Selection Methodology

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# Glossary

| Acronym | Definition |
|---|---|
| AONB | Areas of Outstanding Natural Beauty |
| BSP | Bulk Supply Point |
| EMU | Electronic Mapping Utilisation |
| EV | Electric Vehicle |
| GIS | Geographic Information System |
| LTDS | Long Term Development Statement |
| MSA | Motorway Service Area |
| MVA | Mega Volt-Ampere |
| NIA | Network Innovation Allowance |
| OHL | Overhead line |
| OLEV | Office for Low Emission Vehicles |
| PoC | Point of Connection |
| SRN | Strategic Road Network |
| SSSI | Site of Special Scientific Interest |
| ULEV | Ultra Low Emission Vehicles |

# 1 Introduction

Take Charge is a £1.38m Network Innovation Allowance (NIA) project that aims to develop a new compact substation solution to supply large demands required for new rapid Electric Vehicle (EV) charging points at Motorway Service Areas (MSAs). The project will help support the transition from petrol and diesel vehicles to EVs by providing a more cost effective and faster solution to connect multiple rapid chargers compared with traditional solutions.

WPD's licence areas contain some of Great Britain's most important transport routes such as the M1, M4, M5, and M6. It is essential that these transport routes are prepared for the rapid increase in EVs, in particular, the requirement to provide adequate charging facilities for customers commuting for business and those that are travelling for leisure. The Office for Low Emission Vehicles (OLEV) is working alongside the government to support the early market for Ultra-Low Emission Vehicles (ULEV). OLEV are providing grant schemes for the installation of electric vehicle charging infrastructure which will contribute to the reduction of greenhouse gases and air pollution across the UK. The government also announced in the Clean Growth Strategy 2017 that it will support rapid charging infrastructure deployment for England's Strategic Road Networks (SRN)[1]. One of the OLEV projects, Project Rapid, is looking at development of rapid charging points at MSAs, which would ensure that charging points are convenient to access across the UK highway network.

MSAs have been identified as important locations where rapid EV charging would need to be implemented on a large scale to allow simultaneous charging by multiple customers when undertaking journeys on the SRN. WPD has been in discussions with Moto, the largest MSA operator in Great Britain, about them acting as a partner on the Take Charge project, and providing a trial site for the new compact substation solution. There are 13 MSAs owned by Moto within WPD's licence areas and this document outlines the methodology that has been implemented for the selection of the trial location for the project.

In order to select a suitable location for the deployment of the new compact substation solution, potential sites were evaluated against a number of different criteria. This document presents each of these criteria and how each criterion is ranked to provide an overall score for each MSA.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf

# 2 Motorway Service Areas

## 2.1 Overview

There are currently 13 MSAs operated by Moto within WPD's distribution licence areas that could be used for the Take Charge project trials. These are shown across the licence areas in Figure 2-1.

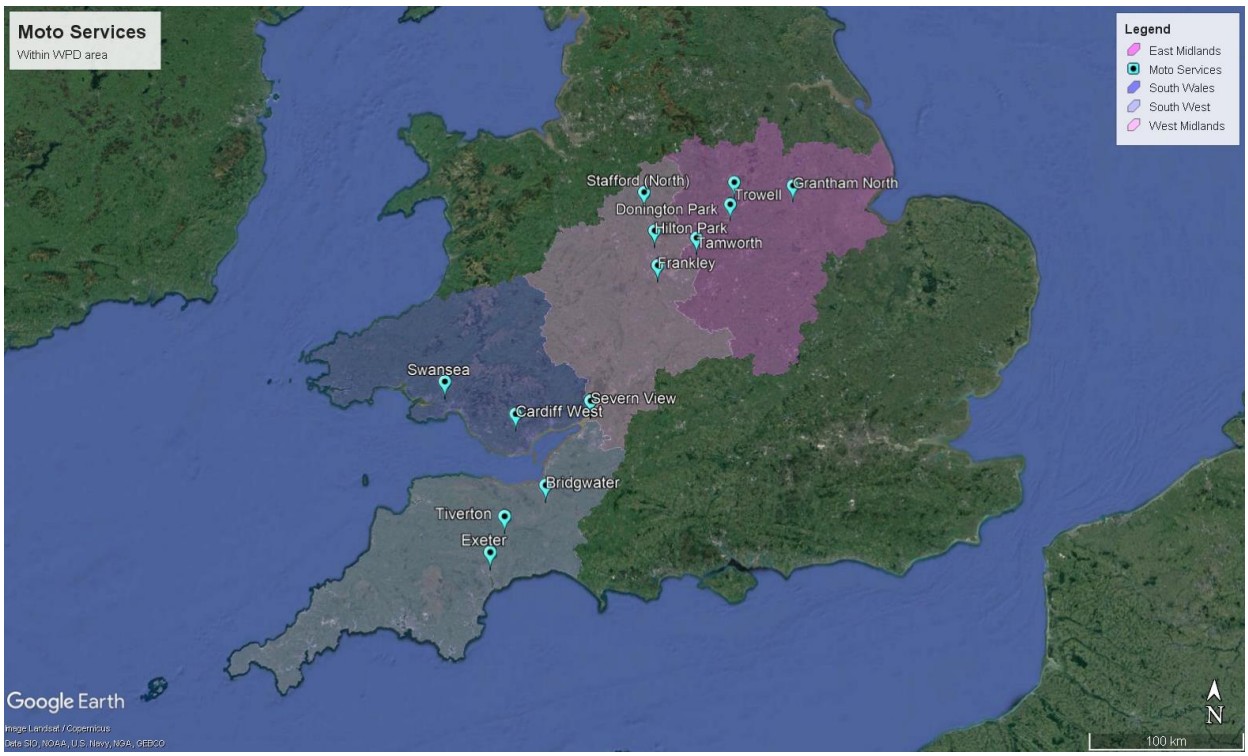



**Figure 2-1 Moto MSAs within the WPD's License Areas**

## 2.2 Site details

Table 2-1 below provides details about each of the MSAs across the four licence areas. The access for each site is described to indicate the configuration of the MSA. For example, some MSAs are located at motorway junctions that allow customers on both sides of the carriageway to access the facilities. Whereas other MSAs are divided across the motorway (North and Southbound for instance) and are only accessible for customers travelling in a particular direction on the motorway.

In addition to the 13 locations identified, Saltash Services (a site within WPD's South West licence area operated by Moto and located on the A338 in Cornwall) was initially considered as a trial location. However, this service station is not classed as a MSA due to the small size and location of the site and, therefore, has not been not included in the assessment.

**Table 2-1 MSA detail breakdown**

| Ref | Name | Location | Postcode | Access |
|---|---|---|---|---|
| **South West** | | | | |
| **1** | Bridgwater | M5, Junction 24 | TA6 6ST | Single site accessible from both sides of the M5 and local road network |
| **2** | Exeter | M5, Junction 30 | EX2 7HF | Single site accessible from both sides of the M5 and local road network |
| **3** | Tiverton | M5, Junction 25 | EX16 7HD | Single site accessible from both sides of the M5 and local road network |
| **South Wales** | | | | |
| **4** | Cardiff West | M4 Junction 33 | CF72 8SA | Single site accessible from both sides of the M4 and local road network |
| **5** | Swansea | M4 Junction 47 | SA4 9GT | Single site accessible from both sides of the M4 and local road network |
| **East Midlands** | | | | |
| **6** | Donington Park | M1, Junction 23A | DE74 2TN | Single site accessible from both sides of the M1 and local road network |
| **7** | Grantham North | A1 Gonerby Moor Interchange | NG32 2AB | Single site accessible from both sides of the A1 and local road network |
| **8** | Tamworth | M42, Junction 10 | B77 5PS | Single site accessible from both sides of the M42 and local road network |
| **9** | Trowell (North & South) | M1, between Junctions 25 & 26 | NC9 3PL | Two sites located between junctions 25 and 26, connected by an internal footbridge. No access to other roads. |
| **West Midlands** | | | | |
| **10** | Severn View | M48, Junction 1 | BS35 4BH | Single site accessible from both sides of the M48 and local road network |
| **11** | Frankley (North & South) | M5, between junctions 3 & 4 | B32 4AR | Two sites located between junctions 3 and 4. No footbridge connection and no access to other roads |
| **12** | Hilton Park (North & South) | M6, between junctions 10A & 11 | WV11 2AT | Two sites located between junctions 25 and 26, connected by an internal footbridge. No access to other roads. |
| **13** | Stafford North | M6 Northbound only, between junctions 14 & 15 | ST15 0EU | Single site located between junctions 14 and 15. No access to other roads (blocked by barrier). |

# 3 Selection criteria

## 3.1 Overview

In order to identify a suitable MSA to trial the new substation solution, a desktop study has been carried out to assess each MSA against a set of criteria. The range of criteria was prepared to assess the technical suitability of each site, and to evaluate each sites against the objectives to minimise costs, time and disruption associated with conducting the trial. In addition, the criteria also sought to maximise the learning from the trial in order to provide the best value to GB customers.

Section 3.2 provides further details on the criteria that have been chosen and the scoring method for each criterion.

## 3.2 Criteria

### 3.2.1 Scores

A consistent scoring methodology has been implemented for each of the criteria described in this section. Table 3-1 details how scores will be allocated from 0 (the lowest score, corresponding to severe barriers) to 3 (the highest score, corresponding to minimal barriers).

**Table 3-1 Criteria used in the scoring methodology**

| Mark | Description |
|---|---|
| 0 | **Severe barrier(s) evident – very likely to result in significant costs/delays/disruption** |
| 1 | **Major barrier(s) evident – likely to result in considerable costs/delays/disruption** |
| 2 | **Moderate barrier(s) evident – likely to have a minor effect on costs/delays/disruption** |
| 3 | **Minor barrier(s) evident – minimal effect on costs/delays/disruption** |

### 3.2.2 Split MSAs

There are three MSAs that are split across a motorway as detailed in Table 2-1 and listed below:

- Trowell North and South;
- Frankley North and South; and
- Hilton Park North and South.

For the purposes of the trial area selection we have chosen only one site (either Northbound or Southbound) to be assessed, and this site has been carried forward to the subsequent analysis. As the sites are separated by a motorway, the site that is closer to the Point of Connection (PoC) has been chosen to avoid having to cross the motorway. Figure 3-1 provides an overview for Trowell where we have chosen the Northbound MSA as it is closer to the PoC. The selection of the PoC for each site is discussed in section 3.2.3


**Figure 3-1 Overview on Trowell MSA and Point of Connection**

### 3.2.3 Proximity of existing network

The proximity of the distribution network to the MSA is a crucial factor to ensure that the costs for connecting the MSA are minimised and the time to provide the connection is reduced. Generally, the further the site is from the connection point, the more work will be required to facilitate the connection resulting in higher costs and longer time to carry out the work. As the MSA will need a connection capable of up to 20MVA in capacity, it is envisaged that a connection will be required at 33kV or 132kV.

As such, each site will be scored depending on its proximity to the nearest PoC whether that is an overhead line or substation. The distances between the PoCs and MSAs were obtained using the Electronic Mapping Utilisation (EMU) [2] programme in combination with Google Earth. Ideally, each MSA would be directly connected to the local 132/33kV Bulk Supply Point (BSP) to create a dedicated supply. However, a number of MSAs are located over 10km from the nearest BSP and, therefore, it is not economically feasible to provide such a connection. Hence, for the instances where the BSP is far from the MSA a nearby 33kV overhead line circuit has been chosen as the PoC.

Figure 3-2 shows an example of the analysis for Tamworth MSA. The MSA is located 1km from the nearest BSP, Tamworth 132/33kV and there are two 33kV circuits passing near the MSA location. In this example, Tamworth BSP has been chosen as the PoC and the connecting 33kV circuit (1 km) would need to cross a major road to connect to the BSP. Connecting to nearby 33kV circuits can often be problematic due to capacity and protection issues and this would need to be studied in more detail following the desktop assessment (the scoring in section 3.2.6 addresses the uncertainties associated with the PoC type). Therefore, for instances such as Tamworth MSA where the BSP is only a short distance away, this PoC configuration is chosen over nearby 33kV circuits.

[2] EMU is our current Geographic Information System (GIS) that shows the location of all assets from LV to 132kV


**Figure 3-2 Overview on Tamworth MSA with possible path for connection to PoC**

The range of scoring for the PoC distance criterion is detailed in Table 3-2.

**Table 3-2 Distance from the nearest PoC**

| Distance from the nearest Point of Connection (PoC) | Score according to Table 3-1 |
|---|---|
| <2km | 3 |
| ≥2km <5km | 2 |
| ≥5km<8km | 1 |
| ≥8km | 0 |

### 3.2.4 Access to Point of Connection (PoC)

This criterion relates to the route access from the MSA location to the PoC. This is an important factor that needs to be considered and researched as there could be a number of obstacles on the route between the MSA and PoC that will have an impact on the cost and time to facilitate the connection. For example, in some cases the route between the MSA and the PoC could utilise a verge adjacent to a public highway with no major obstacles. Based on this criterion, such an MSA would be preferable to one that has obstacles to the connection since this would reduce costs and time whilst also causing less disruption to the local community. In contrast, it is conceivable that there may be cases where there are a number of challenging obstacles to be overcome between the MSA and PoC. These may include major road and motorway crossings, railway line crossings, waterways (such as canals or rivers), Area of Outstanding Natural Beauty (AONB), Site of Special Scientific Interest (SSSI) or densely populated urban areas. Overcoming any of these obstacles is likely to require significant engineering effort resulting in a significant impact on cost, time and disruption to the local area. Figure 3-3 shows a possible route (in blue) for Tamworth MSA to connect to the chosen PoC at Tamworth BSP. It was noted during the analysis that to enable the connection to the BSP, the circuit would need to cross a major road at least in two points.


**Figure 3-3 Overview on Tamworth MSA with possible obstacles on the path**

Therefore, careful consideration needs to be given to the route between the PoC and MSA. Details of the obstacles for each MSA have been assessed using EMU and Google Earth to provide an overview of potential access route issues.

The range of scoring for this criterion is detailed in Table 3-3.

**Table 3-3 Access to the PoC**

| Access to the PoC | Score according to Table 3-1 |
|---|---|
| Clear access with very limited impact on local environment, community or/and infrastructure | 3 |
| Access possible with minor impact of need to change local environment, community or/and infrastructure | 2 |
| Access possible with a major impact on local environment, community or/and infrastructure | 1 |
| No access possible without significant impact on local environment, community or/and infrastructure | 0 |

### 3.2.5 Network capacity

The trial will require up to 20MVA of capacity to meet the rating of the new compact substation solution. As such, the PoC will need to be assessed to ensure that the upstream network can facilitate this demand, ideally, without the need to carry out system reinforcement. The data used to perform the scoring has been collected from the 2019 Long Term Development Statement (LTDS) for each specific

licence area. The available capacity for each site was determined by finding the BSP that supplies the PoC and comparing the firm capacity with the latest peak demand (2019).

The range of scoring for this criterion is detailed in Table 3-4.

**Table 3-4 Network Capacity**

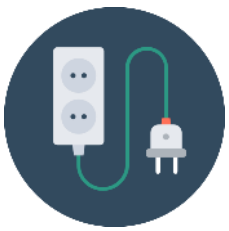
| Available Capacity at PoC | Score according to Table 3-1 |
|---|---|
| ≥20MVA | 3 |
| ≥14MVA <20MVA | 2 |
| ≥7MVA <14MVA | 1 |
| <7MVA | 0 |

### 3.2.6 PoC configuration

The PoC configuration relates to the type of connection to the MSA. For the purposes of the trial it is important to ensure that the connection to the network is as simple as possible by avoiding expensive extensions to BSPs and complex integration of circuits on existing overhead line and cable networks. Therefore, the PoC was evaluated for each site to establish the impact of providing the connection. Connection directly to the BSP is the preferred option, especially when there is sufficient space (such as spare 33kV circuit breaker bays) to establish new connection equipment without extension to an existing compound. A connection to an existing overhead line/cable network (in the instance where the distance from the MSA to the nearest BSP is much greater than the distance to a passing circuit) is not preferred as integrating the new solution will involve complex alterations to protection schemes and could cause issues with power flows. However, it is noted that this may be the best solution from a financial perspective to avoid expensive routing of long 33kV circuits back to a BSP and is included in the assessment with a lower score for this criterion.

The range of scoring for this criterion is detailed in Table 3-5

**Table 3-5 PoC Configuration Status**



| PoC Configuration status | Score according to Table 3-1 |
|---|---|
| Direct Connection to a BSP / Primary (No extension required) | 3 |
| Direct Connection to a BSP / Primary (Extension required) | 2 |
| Connection to passing OHL/cable circuit | 1 |
| Connection not possible (Substation cannot be extended or no passing circuits available) | 0 |

### 3.2.7 MSA space

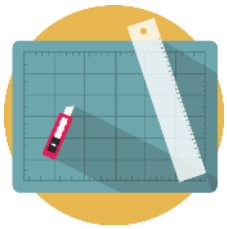
The space availability at the MSA is very crucial to ensure that there is sufficient provision of space for the installation of new EV charging units (and adjacent parking spaces) and the new substation solution. There will be a requirement for a section (or sections) of the parking area to be changed from standard car spaces to dedicated EV charging parking spaces and potentially the creation of new parking areas dedicated for EVs. The MSA operator needs to ensure that these changes will not have a detrimental

impact on the number of people that use the MSA due to the disruption caused by modifying the car park. In addition, the MSA operator will need to provide around 150m² (area approximately 12m x 12m) for the installation of the new compact substation solution.

The total area of each MSA site has been assessed using Google Maps. The area has been estimated by measuring the perimeter of the MSA including all parking and recreational land belonging to Moto surrounding the site.

The range of scoring for this criterion is detailed in Table 3-6 below.

**Table 3-6 MSA size**



| MSA size in m2 | Score according to Table 3-1 |
|---|---|
| ≥50,000m² | 3 |
| ≥30,000m² - <50,000m² | 2 |
| ≥10,000m² - <30,000m² | 1 |
| <10,000m² | 0 |

For comparison, the area of a standard football pitch is 7,140m$^2$. Figure 3-4 illustrates an example where the area of Bridgwater MSA (9,292 m$^2$) is approximately one and a third times the size of a standard football pitch. In contrast, Figure 3-5 presents the area of Exeter MSA (65,576m$^2$), which is approximately nine times the size of a football pitch.


**Figure 3-4 Representative illustration of Bridgwater MSA area**


**Figure 3-5 Representative illustration of Exeter MSA area**

### 3.2.8 Visitor usage

The annual footfall for each MSA (visitor numbers) is also a key factor when deciding which MSA to use for the trial. Increased footfall indicates that there will be greater potential for EV owners/drivers to participate in the trial. It should be noted that the configuration of the MSAs has an important influence on the footfall. For example, MSAs that are located at a motorway junction with access to both sides of the carriageway, as well as connections to the local road network, typically have higher footfall as they are more accessible compared with MSAs that are located between junctions. Footfall data for each MSA has been provided by Moto in their media information pack from 2017.

The range of scoring for this criterion is detailed in Table 3-7.

**Table 3-7 Volume of people visiting per year**

| Volume of people visiting annually | Score according to Table 3-1 |
|---|---|
| ≥4m | 3 |
| ≥3m - <4m | 2 |
| ≥2m - <3m | 1 |
| <2m | 0 |

# 4 Scoring

## 4.1 Overview

The assessment of the MSAs within WPD's distribution licence areas presented in this section has been undertaken using the methodology described in section 3. Each of the MSAs presented in Table 2-1 has undergone careful analysis to consider the suitability for installation of equipment and trialling a new connection solution as part of the project.

The assessment aims to select the most suitable MSA across WPD's licence areas, identified as having the highest combined score using the criteria detailed in the section 3. For each criterion a weighting has been assigned to the score to prioritise the features or aspects. One of the key areas considered was the PoC for the MSA. Identifying a connection point with sufficient capacity as close as possible to the MSA with minimal obstacles on the route was deemed to be extremely important. As such, the "Proximity to PoC", "Access to PoC" and "Network Capacity" are attributed with the highest weightings (20-30%) in order to minimise the capital cost and reduce the delivery risks. The configuration of the PoC has been assigned a weighting of 15% as there are more unknowns and, therefore, higher risks associated with different types of connection. Finally, the "MSA Space" and "Visitor Usage" are important to derive learning from the trial, however, these criteria have a lower impact on the cost and risk of the trial and therefore are assigned lower weightings.

The details of the weighting for each criterion are presented in Table 4-1

**Table 4-1 Scoring weightings used in the assessment**

| Criteria | Percentage |
|---|---|
|  Proximity to PoC | 20% |
|  Access to PoC | 20% |
|  Network Capacity | 30% |
|  PoC Configuration | 15% |
|  MSA Space | 10% |
|  Visitor Usage | 5% |
| Total | 100% |

## 4.2 Assessment

The following section provides the details of the scores across each of the criterion for each MSA.

### 4.2.1 Bridgwater

# Bridgwater MSA

**Overview:**

Bridgwater Moto Service Area is located at Junction 24 of the M5 motorway, approximately 3.1km away from Bridgwater in Somerset, England. The MSA can be accessed from both sides of the motorway. The MSA is located 3km from the nearest BSP, Bridgwater 132/33kV. There is a 33kV circuit within close proximity to the MSA (<1.5km), however, the PoC has been chosen to be Bridgwater BSP as it is only a short distance away and would simplify the connection. There is a motorway and canal that would need to be crossed to provide the 33kV connection to the MSA from the BSP.

**Licence area: South West**

**Location:**


| Criteria Item | Answer | Score |
|---|---|---|
| **Proximity to PoC (km)** | 3 | 2 |
| **Access to PoC** | Major Obstacles | 1 |
| **Network capacity (MVA)** | 12 | 1 |
| **PoC configuration** | BSP Expansion | 2 |
| **MSAs space (m²)** | ~9,292 | 0 |
| **Visitor usage (Million ppl/yr)** | 1.8 | 0 |
| **Weighted Total** | | **1.2** |

### 4.2.2 Exeter

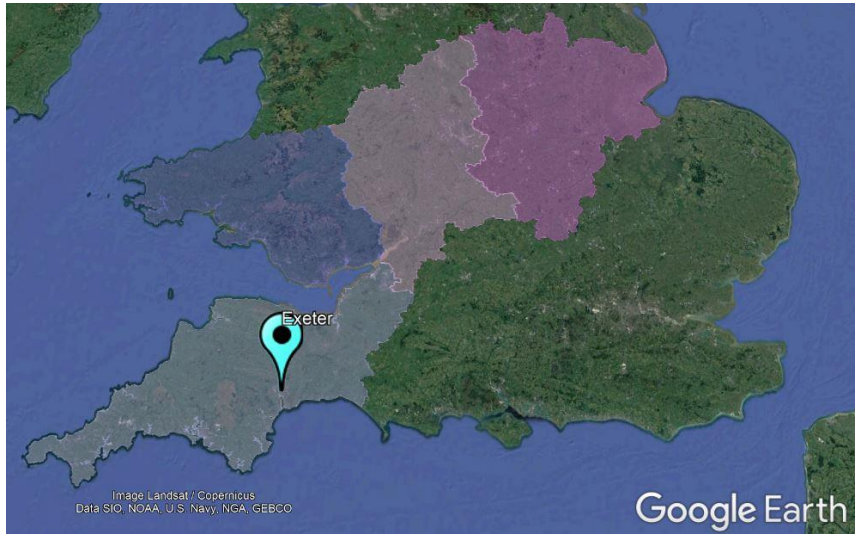
## Exeter MSA

**Overview:**

Exeter MSA is located at Junction 30 of the M5 motorway, approximately 6.5km away from Exeter in Devon, England. The MSA can be accessed from both sides of the motorway and it is located near an industrial area. The MSA is located approximately 1.1km from the nearest BSP, Sowton 132/33kV. There are a number of 33kV circuits in close proximity to the MSA (<0.4km), however, the PoC has been chosen to be Sowton BSP as it is only a short distance away and would simplify the connection. There are no major obstacles to provide the 33kV connection to the MSA from the BSP.

**Licence area: South West**

**Location:**




| Criteria Item | Answer | Score |
|---|---|---|
| **Proximity to PoC (km)** | 1.1 | 3 |
| **Access to PoC** | No Obstacles | 3 |
| **Network capacity (MVA)** | >20 | 3 |
| **PoC configuration** | BSP Expansion | 2 |
| **MSAs space (m²)** | ~75,576 | 3 |
| **Visitor usage (Million ppl/yr)** | 4.2 | 3 |
| **Weighted Total** | | **2.85** |

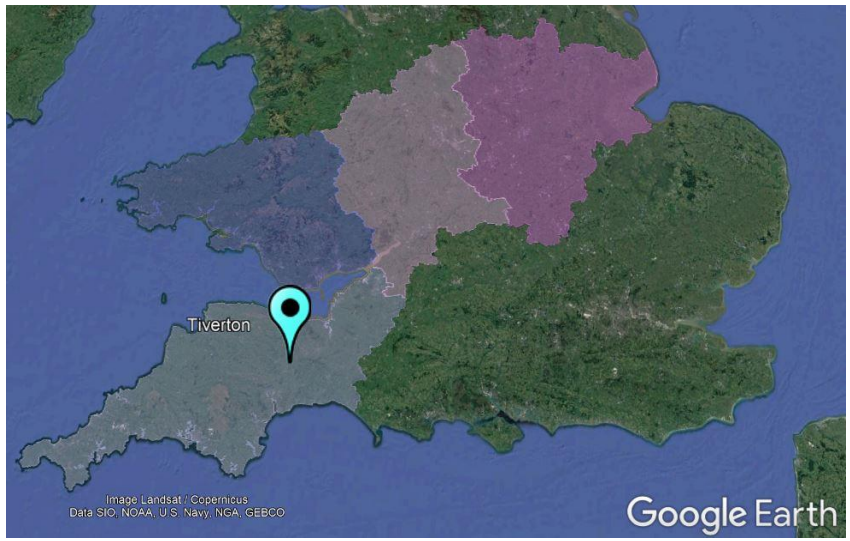
### 4.2.3 Tiverton

## Tiverton MSA

**Overview:**

Tiverton MSA is located at Junction 25 of the M5 motorway, approximately 12.5 km away from Tiverton in Devon, England. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 3km from the nearest BSP, Tiverton 132/33kV. There is a 33kV circuit, which runs in close proximity to the MSA (<0.7km) between Tiverton BSP and Burlescombe Substation , however, the PoC has been chosen to be Tiverton BSP as it would simplify the connection. There is a railway and a motorway between the trial location and PoC.

**Location:**




| Licence area: South West | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 3 | 2 |
| | **Access to PoC** | Major Obstacles | 1 |
| | **Network capacity (MVA)** | 15.2 | 2 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~7,429 | 0 |
| | **Visitor usage (Million ppl/yr)** | 1.1 | 0 |
| | **Weighted Total** | | **1.5** |

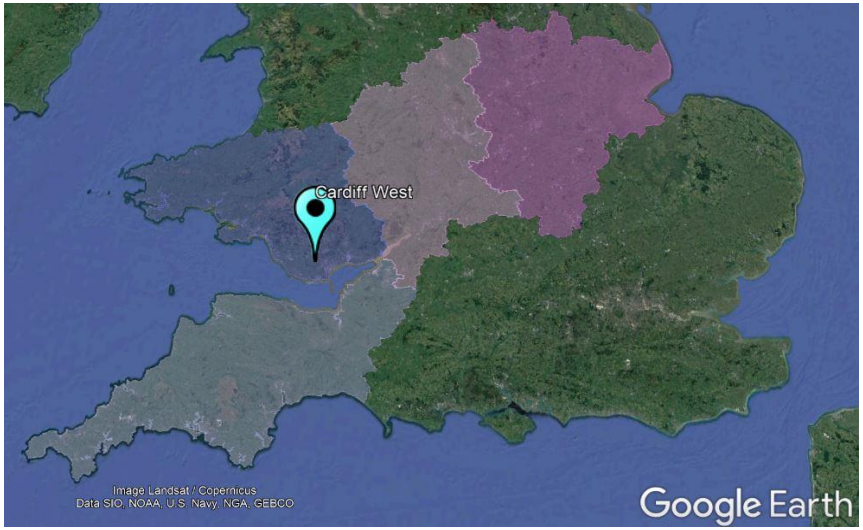
### 4.2.4 Cardiff West

## Cardiff West MSA

**Overview:**

Cardiff West MSA is located at Junction 33 of the M4 motorway, approximately 13.5km away from Cardiff in Wales, United Kingdom. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 7.5km from the nearest BSP, Upperboat 132/33kV. Due to the long distance to the BSP, the PoC has been chosen to be a T connection to a 33kV overhead line, which runs between Creigiau primary substation and Morlanga Farm substation. There are no major obstacles to provide the T connection to the MSA.

**Location:**




| Licence area: South Wales | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 0.6 | 3 |
| | **Access to PoC** | No Obstacles | 3 |
| | **Network capacity (MVA)** | 7.75* | 1 |
| | **PoC configuration** | T Connection | 1 |
| | **MSAs space (m²)** | ~46,967 | 2 |
| | **Visitor usage (Million ppl/yr)** | 1.1 | 0 |
| | **Weighted Total** | | **1.85** |

*For available capacity on the 33kV circuit, 50% of the rated capacity of the circuit is assumed, using information from LTDS.

### 4.2.5 Swansea

## Swansea MSA

**Overview:**

Swansea MSA is located at junction 47 of the M4 motorway, approximately 9km away from Swansea in Wales. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 2.5km from the nearest BSP, Swansea North 132/33kV. There is a 33kV circuit, which runs in close proximity to the MSA (<1km) from Garngoch Substation to Swansea North BSP , however, the PoC has been chosen to be Swansea North BSP as it is only a short distance away and would simplify the connection. There are no major obstacles to provide the 33kV connection to the MSA from the BSP.

**Licence area: South Wales**

**Location:**


| Criteria Item | Answer | Score |
|---|---|---|
| **Proximity to PoC (km)** | 2.5 | 2 |
| **Access to PoC** | No obstacles | 3 |
| **Network capacity (MVA)** | >20 | 3 |
| **PoC configuration** | BSP Expansion | 2 |
| **MSAs space (m²)** | ~39,875 | 2 |
| **Visitor usage (Million ppl/yr)** | 1.2 | 0 |
| **Weighted Total** | | **2.4** |

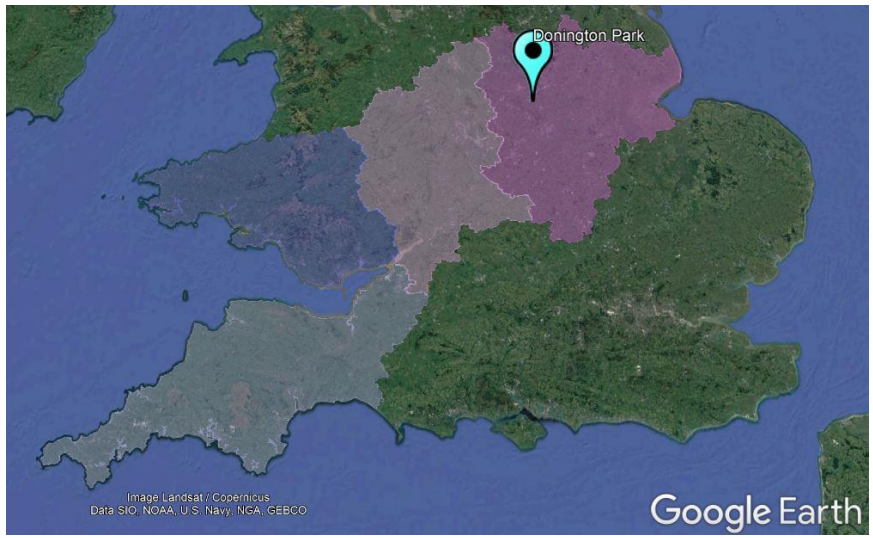
### 4.2.6 Donington Park

## Donington Park MSA

**Overview:**

Donington Park MSA is located at junction 23A of the M1 motorway, approximately 8 km away from Castle Donington in Leicestershire, England. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 11km from the nearest BSP, Spondon 132/33kV. Due to the long distance to the BSP, the PoC has been chosen to be a T connection to a 33kV overhead line, which runs between Spondon BSP and Worthington Substation. There are no major obstacles to provide the T connection to the MSA.

**Location:**




| Licence area: East Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 3.5 | 2 |
| | **Access to PoC** | No obstacles | 3 |
| | **Network capacity (MVA)** | 11* | 1 |
| | **PoC configuration** | T Connection | 1 |
| | **MSAs space (m²)** | ~58,976 | 3 |
| | **Visitor usage (Million ppl/yr)** | 3.5 | 2 |
| | **Weighted Total** | | **1.85** |

*For available capacity on the 33kV circuit, 50% of the rated capacity of the circuit is assumed, using information from LTDS.

### 4.2.7 Grantham

## Grantham North MSA

**Overview:**

Grantham North MSA is located at the Gonerby Moor interchange of the A1, approximately 6 km away from Grantham in Lincolnshire, England. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 2.5km from the nearest BSP, Grantham North 132/33kV, which has been chosen to be the PoC for Grantham North MSA. There is a railway between the trial location and PoC.

**Location:**


| Licence area: East Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 2.5 | 2 |
| | **Access to PoC** | Minor obstacles | 3 |
| | **Network capacity (MVA)** | >20 | 3 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~31,923 | 2 |
| | **Visitor usage (Million ppl/yr)** | 1.3 | 0 |
| | **Weighted Total** | | **2.4** |

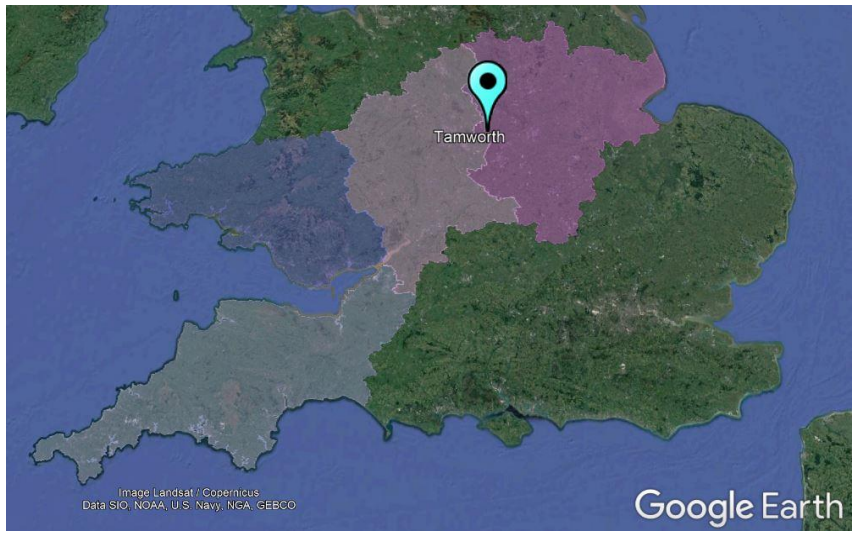
### 4.2.8 Tamworth

## Tamworth MSA

**Overview:**

Tamworth MSA is located at junction 10 of the M42 motorway, approximately 8 km away from Tamworth in Staffordshire, England. The MSA can be accessed from both sides of the motorway. The MSA is located 1km from the nearest BSP, Tamworth 132/33kV. There are a number of 33kV circuits in close proximity to the MSA (<0.5km), however, the PoC has been chosen as Tamworth BSP as it is only a short distance away and would simplify the connection. There are a number of major roads that would need to be crossed to provide the 33kV connection to the MSA from the BSP.

**Location:**




| Licence area: East Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 1 | 3 |
| | **Access to PoC** | Major roads | 1 |
| | **Network capacity (MVA)** | >20 | 3 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~ 82,564 | 3 |
| | **Visitor usage (Million ppl/yr)** | 3 | 2 |
| | **Weighted Total** | | **2.4** |

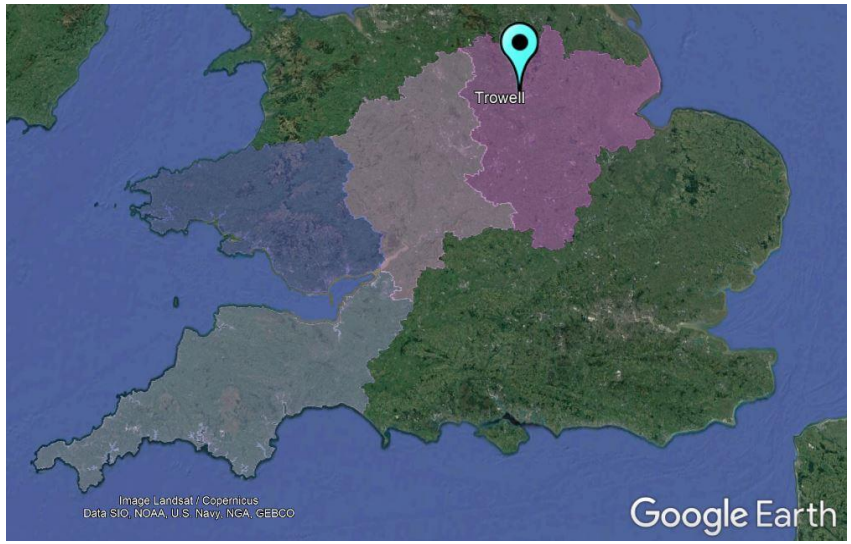
### 4.2.9 Trowell

## Trowell MSA

**Overview:**

Trowell MSA is located at between junction 25 and 26 of the M1 motorway, approximately 17.3 km away from Nottingham in Nottinghamshire, England. The MSA has two sites, one located Northbound, the other Southbound. The nearest PoC to Trowell is Stanton 132/33kV BSP approximately 3.4km South West of the Northbound side of the MSA. In the analysis we have only considered Trowell Northbound to avoid having to cross the M1 motorway. However, there are number of obstacles between the Northbound carriageway and the BSP, including a major railway line, two rivers and a dense built up area.

**Location:**




| Licence area: East Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 3.4 | 2 |
| | **Access to PoC** | Major obstacles & significant impact | 0 |
| | **Network capacity (MVA)** | >20 | 3 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~39,789 | 2 |
| | **Visitor usage (Million ppl/yr)** | 2.8 | 1 |
| | **Weighted Total** | | **1.85** |

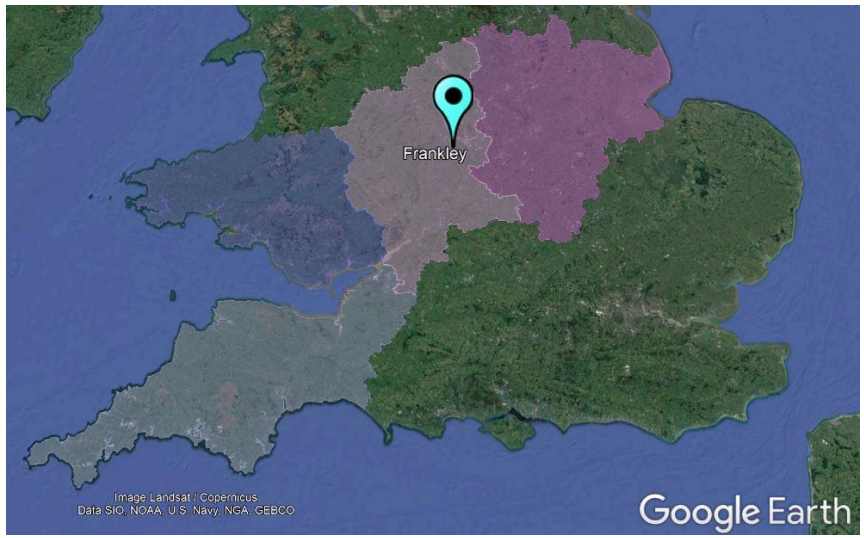
### 4.2.10 Frankley

## Frankley MSA

**Overview:**

Frankley MSA is located between junction 3 and 4 of the M5 motorway, approximately 15 km away from the centre of Birmingham in the West Midlands, England. The MSA has two sites, one located Northbound, the other Southbound. The nearest PoC to Frankley is Bartley Green 132/11kV substation approximately 2.5km North East of the Southbound side of the MSA. In the analysis we have only considered Frankley Southbound to avoid having to cross the M5 motorway. However, the route from the MSA to PoC travels through a heavily populated area which can cause engineering challenges.

**Location:**




| Licence area: West Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 2.5 | 2 |
| | **Access to PoC** | Major Obstacles | 1 |
| | **Network capacity (MVA)** | 10.8 | 1 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~46,971 | 2 |
| | **Visitor usage (Million ppl/yr)** | 3.2 | 2 |
| | **Weighted Total** | | **1.5** |

### 4.2.11 Hilton Park

## Hilton Park MSA

**Overview:**

Hilton Park MSA is located between junction 10A and 11 of the M6 motorway, approximately 16 km away from Wolverhampton in Staffordshire, England. The MSA is located on both sides of the motorway. The MSA is located approximately 4km west from the nearest BSP, Bushbury B 132/33kV, There are a number of 33kV circuits in close proximity to the MSA (<2km), however, the PoC has been chosen to be Bushbury BSP as it is only a short distance away and would simplify the connection. Only Hilton Park North has been considered in the analysis because the PoC is on the west side of the motorway. There are a number of major roads that would need to be crossed to provide the 33kV connection to the MSA from the BSP.

**Location:**


| Licence area: West Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 4 | 2 |
| | **Access to PoC** | Major Obstacles | 1 |
| | **Network capacity (MVA)** | >20 | 3 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | 35,125 | 2 |
| | **Visitor usage (Million ppl/yr)** | 3.2 | 2 |
| | **Weighted Total** | | **2.1** |

### 4.2.12 Severn View

## Severn View MSA

**Overview:**

Severn View MSA is located at junction 1 of the M4 motorway, approximately 22km away from Bristol in Somerset, England. The MSA can be accessed from both sides of the motorway. The MSA is located approximately 7.3km from the nearest BSP, Bardley Stoke BSP. The connection to the BSP would require crossing a motorway in two locations (M4 and M5). Therefore, the PoC has been chosen to be a T connection to a 33kV overhead line, which runs between Bradley Stoke BSP and Alveston Substation. There are minor obstacles such as a roads and a residential area between the T connection and the MSA.

**Location:**


| Licence area: West Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 6.9 | 1 |
| | **Access to PoC** | Minor obstacles | 2 |
| | **Network capacity (MVA)** | 5 | 0 |
| | **PoC configuration** | T Connection | 1 |
| | **MSAs space (m²)** | ~29,310 | 1 |
| | **Visitor usage (Million ppl/yr)** | 1 | 0 |
| | **Weighted Total** | | **0.85** |

*For available capacity on the 33kV circuit, 50% of the rated capacity of the circuit is assumed, using information from LTDS.

### 4.2.13 Stafford

## Stafford North MSA

**Overview:**

Stafford North MSA is located between junctions 14 and 15 northbound of the M6 motorway, approximately 17 km away from Stoke-on-Trent in Staffordshire, England. The MSA can only be accessed from the north side of the motorway. The MSA is located approximately 5km from the nearest BSP, Meaford 132/33kV. There are a number of 33kV circuits within close proximity to the MSA (<4km), however, the PoC has been chosen to be Meaford BSP as it would simplify the connection. The route from MSA to the BSP is complex with a number of river, railway and motorway crossings.

**Location:**


| Licence area: West Midlands | Criteria Item | Answer | Score |
|---|---|---|---|
| | **Proximity to PoC (km)** | 5 | 1 |
| | **Access to PoC** | Significant Obstacles | 0 |
| | **Network capacity (MVA)** | >20 | 3 |
| | **PoC configuration** | BSP Expansion | 2 |
| | **MSAs space (m²)** | ~117,536 | 3 |
| | **Visitor usage (Million ppl/yr)** | 4.3 | 3 |
| | **Weighted Total** | | **1.85** |

# 5 Summary

## 5.1 Overview

This section describes the results of the site selection process conducted in the previous chapters. The results of the weighted scoring are presented in Table 5-1. It can be seen that Exeter MSA scores the highest with an overall weighted score of 2.85 out of 3. This is primarily due to the fact that Exeter MSA is one of the largest sites with a large number of visitors, and is in close proximity to a BSP.

An overview of detailed scoring is provided in Table 5-2.

**Table 5-1 Ranking of MSA with total weighted scores**

| Ranking | MSA | Weighted Score |
|---|---|---|
| **1** | Exeter | 2.85 |
| **2** | Swansea | 2.40 |
| **3** | Grantham North | 2.40 |
| **4** | Tamworth | 2.40 |
| **5** | Hilton Park (North) | 2.10 |
| **6** | Cardiff West | 1.85 |
| **7** | Donington Park | 1.85 |
| **8** | Stafford North | 1.85 |
| **9** | Trowell (North) | 1.85 |
| **10** | Tiverton | 1.50 |
| **11** | Frankley (South) | 1.50 |
| **12** | Bridgwater | 1.20 |
| **13** | Severn View | 0.85 |

## 5.2 Summary of findings

**Table 5-2 Summary Scores**

| *Licence Area* | MSA | Proximity of PoC | Access to PoC | Network Capacity | PoC Configuration | MSA Space | Visitor Usage | Weighted Score |
|---|---|---|---|---|---|---|---|---|
| ***South West*** | Bridgwater | 2 | 1 | 1 | 2 | 0 | 0 | 1.20 |
| | **Exeter** | **3** | **3** | **3** | **2** | **3** | **3** | **2.85** |
| | Tiverton | 2 | 1 | 2 | 2 | 0 | 0 | 1.50 |
| ***South Wales*** | Cardiff West | 3 | 3 | 1 | 1 | 2 | 0 | 1.85 |
| | Swansea | 2 | 3 | 3 | 2 | 2 | 0 | 2.40 |
| ***East Midlands*** | Donington Park | 2 | 3 | 1 | 1 | 3 | 2 | 1.85 |
| | Grantham North | 2 | 3 | 3 | 2 | 2 | 0 | 2.40 |
| | Tamworth | 3 | 1 | 3 | 2 | 3 | 2 | 2.40 |
| | Trowell (N) | 2 | 0 | 3 | 2 | 2 | 1 | 1.85 |
| ***West Midlands*** | Frankley (S) | 2 | 1 | 1 | 2 | 2 | 2 | 1.50 |
| | Hilton Park (N) | 2 | 1 | 3 | 2 | 2 | 2 | 2.10 |
| | Severn View | 1 | 2 | 0 | 1 | 1 | 0 | 0.85 |
| | Stafford North | 1 | 0 | 3 | 2 | 3 | 3 | 1.85 |

## 5.3 Discussion of findings

In the site selection process, 13 MSAs were initially identified as potential trial areas for the installation of a new connection solution for rapid EV charging as part of the Take Charge project. The possible trial sites were investigated using the selection methodology described in section 3. This process involved a review of the distribution network diagrams, network maps, surrounding infrastructure and local environment to assess how each trial site could be connected to the existing network without expensive reinforcement or disruption to the local environment. The assessment involved analysis of the network configuration, firm capacity and peak loadings from the LTDS to establish that it would be possible to install the project equipment in the selected area.

From the selection process, the most viable location for the trial has been identified as Exeter MSA with a PoC at Sowton BSP. Exeter MSA recorded the highest score across the criteria due to:

- The short distance between MSA and PoC – Sowton BSP (1.1km);
- Clear access to the PoC and no major obstacles resulting in a low risk of potential interference with local infrastructure and environment;
- Sufficient network capacity available at BSP (>20MVA);
- Large area within the MSA minimising the risk of significant disruption during the installation period; and
- High footfall per year potentially resulting in high utilisation of the charging points and collection of a large volume of data and learning during the trial period.

The site selection process shortlisted other possible trial areas for the project should Exeter become unavailable. Swansea, Grantham and Tamworth MSAs have been identified as possible locations due to their high scores across all selection criteria. Both Swansea and Grantham MSA are characterised by having available capacity at the PoC and a short distance between the MSA and PoC with no major obstacles en-route. However, the potential disadvantages of these locations are low footfall numbers and relatively small areas of the MSAs, which may cause customer and business disruption during the installation.

## 5.4 Conclusion and learning

The aim of this document was to select a suitable trial site for Take Charge by preparing and implementing a robust scoring methodology.

The selection methodology focused on six key areas that would have an influence on successful delivery and learning generated from the project. The areas included identifying a suitable connection for the MSA ideally as close as possible to a BSP with sufficient capacity available. The route of the connection to the PoC was also deemed to be important to ensure that there were no significant engineering challenges that would need to be tackled. Finally, the space and usage of the MSA are other factors that have been considered to ensure that the new solution could be installed and high levels of participation by EV customers could be achieved.

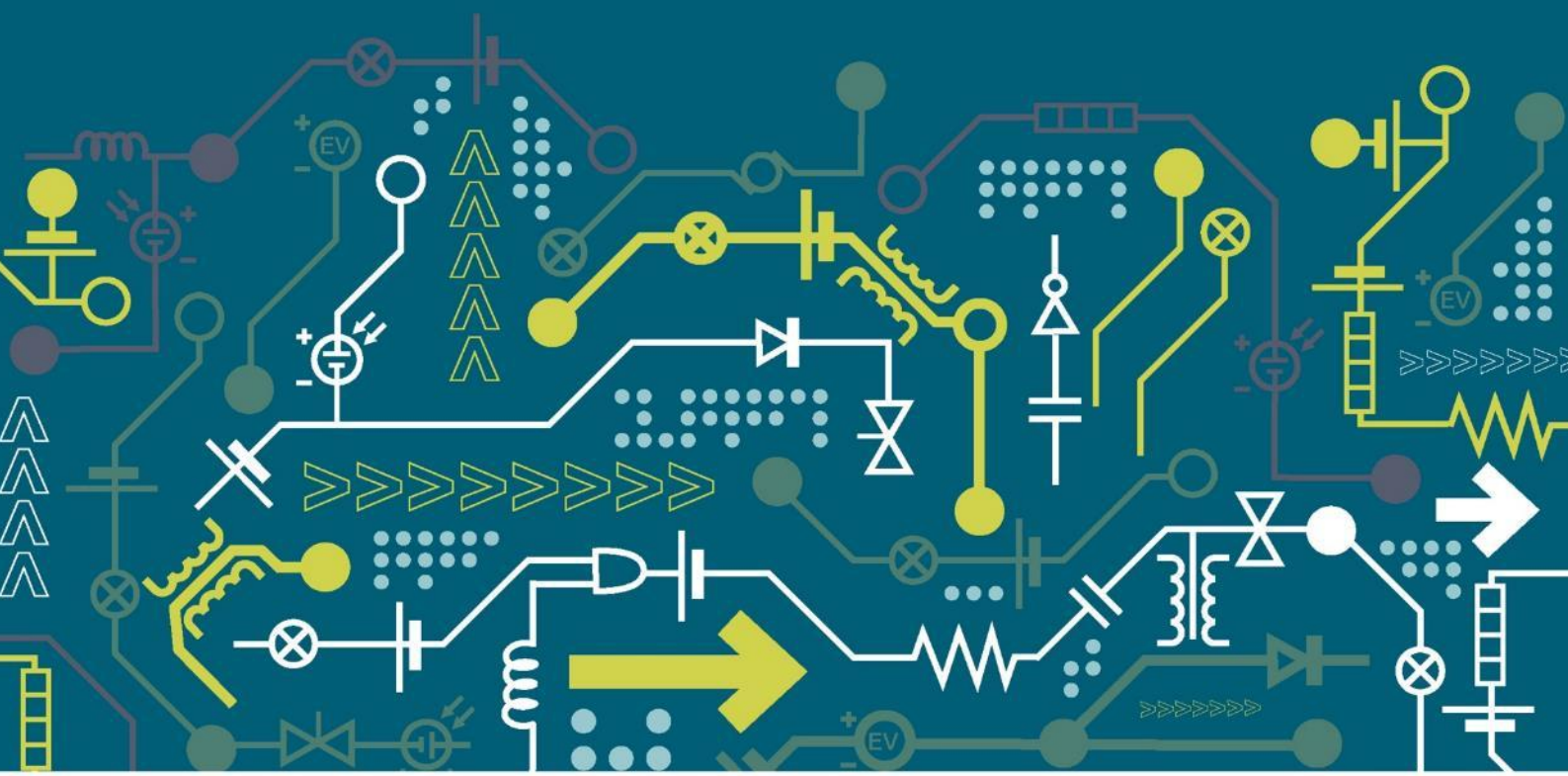
Important learning has been generated during the process of selection of the preferred trial location, including building a range of criteria to consider as part of the methodology and review of system data. Table 5-3 outlines key learning points gathered from the trial site selection process.

**Table 5-3 Lesson learnt during the selection process**

| Topic | Learning |
|---|---|
| **Access to MSA** | A number of the shortlisted sites have MSAs split across a motorway (such as Trowell North and South). Having evaluated the data for these sites it was confirmed that the footfall and space were reduced compared with sites that are accessible from both sides of the motorway. Choosing an MSA located with access to both sides of a motorway (and near to large town or city) will provide more space and footfall that should result in greater participation in the trial (i.e. more EVs). |
| **Footfall** | In the selection process, MSA sites that lie on both sides of a motorway were disadvantaged due to low footfall and limited space available on one side of the motorway. Low levels of visitors per year could bring risks to the project trials and feasibility of the study. It was found that, ideally, MSAs should be located near large towns or cities to ensure large footfall. |
| **Access to PoC** | In the selection process, major obstacles such as built up areas, large roads, railways, bridges or areas with difficult environmental conditions were identified as having potential to introduce difficulties during implementation of the project. Locations with these obstacles between the MSA and PoC should be avoided to minimise the risk of complex routes, interference to the local environment and further investments. |

The selection process aimed to choose the most suitable location for the trial, which would demonstrate all the benefits of the project. As Exeter has been selected as the trial location for the Take Charge project, the next stage will involve gathering further details from our internal sources and our project partners, Moto and Ecotricity, to begin to develop the initial designs to integrate the new compact connection solution.

# Appendix



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# Appendix A Network Maps

This section includes Network Maps for a suggested PoC for the site selection process. The appendix contains network maps for the following MSAs locations:

1. Exeter (preferred location)
2. Swansea
3. Grantham

POC - SOWTON
BSP 31/0005

MSA

X - 296089.383 91654.627

| REV. | DATE | SCHEME PROGRESS BLOCK | DRN | CHK'D |
|---|---|---|---|---|
| . | . 06/05/20 | . Suggested POC for site selection | . NJD | . |
| . | . | . | . | . |
| . | . | . | . | . |
| . | . | . | . | . |
| . | . | . | . | . |
| . | . | . | . | . |

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Exeter MSA
Take charge info only
.
.

UNDERGROUND CABLES
132KV | 33KV | 11KV
L.V. | SERVICE | STREET LTG.
HV EARTH | LV EARTH | EARTH ELECTRODE
SERVICES CABLE SIZES AS SHOWN

OVERHEAD LINES
132KV | 33KV
11KV | L.V.
SERVICE | STREET LTG.
PYLON ⊠ POLE o STAY —|

DUCT & ALKATHENE TUBE
HOUSE METER POSITIONS - EXTERNAL ■ INTERNAL ●
SURF TELECOMS S——S
PILOT CABLES P——P
PROPOSALS ALTERATIONS DISMANTLED
TRAFFIC SENSITIVE AREA YES/NO

DEVELOPER.
BUILDER.
ARCHITECT Drg. No.
O.S. MAP.
SCALE 1:5000 @ A3
PARISH.
11kV DIAG.
LV. DIAG.
PLAN No.
Enq No. of

# POC - Swansea North Grid 52/0035

MSA

Information is given as a guide only and it's accuracy cannot be guaranteed.

PLEASE NOTE: This plan ONLY shows assets owned by Western Power Distribution. Electricity assets owned by IDNO's (Independent Network Operators) MAY be present in this area.

X - 261827.336,198534.302

| REV. | DATE | SCHEME PROGRESS BLOCK | DRN | CHK'D |
|---|---|---|---|---|
| 1 | 05/06/20 | Suggested POC (BSP dedicated supply) | 1 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

UNDERGROUND CABLES
132KV | 33KV | 11KV
L.V. | SERVICE | STREET LTG.
HV EARTH | LV EARTH | EARTH ELECTRODE
SERVICES CABLE SIZES AS SHOWN

OVERHEAD LINES
132KV | 33KV
11KV | L.V.
SERVICE | STREET LTG.
PYLON | POLE | STAY

DUCT & ALKATHENE TUBE

HOUSE METER POSITIONS - EXTERNAL / INTERNAL

SURF TELECOMS S——S

PILOT CABLES P——P

PROPOSALS | ALTERATIONS | DISMANTLED

TRAFFIC SENSITIVE AREA YES/NO

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Swansea West MSA
Take Charge project info only

DEVELOPER.
BUILDER.
ARCHITECT Drg. No.

O.S. MAP.

SCALE 1:7500 @ A3

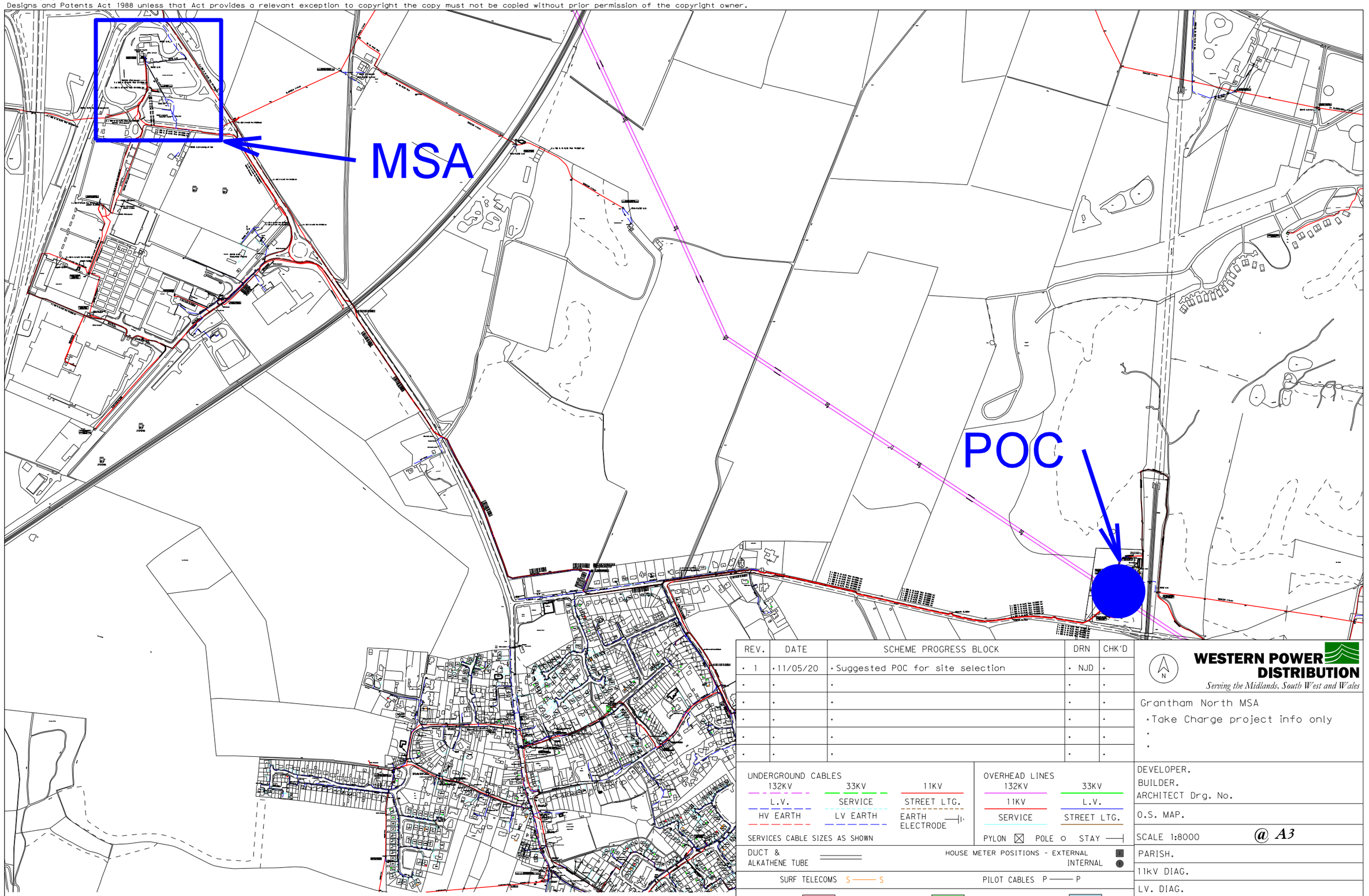
PARISH.

11kV DIAG.

LV. DIAG.

PLAN No.

*Enq No.* | *of*




Information is given as a guide only and it's accuracy cannot be guaranteed.

PLEASE NOTE: This plan ONLY shows assets owned by Western Power Distribution. Electricity assets owned by IDNO's (Independent Network Operators) MAY be present in this area.

| REV. | DATE | SCHEME PROGRESS BLOCK | DRN | CHK'D |
|---|---|---|---|---|
| 1 | 11/05/20 | Suggested POC for site selection | NJD | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

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Grantham North MSA
Take Charge project info only

UNDERGROUND CABLES
132KV | 33KV | 11KV
L.V. | SERVICE | STREET LTG.
HV EARTH | LV EARTH | EARTH ELECTRODE
SERVICES CABLE SIZES AS SHOWN

OVERHEAD LINES
132KV | 33KV
11KV | L.V.
SERVICE | STREET LTG.
PYLON | POLE | STAY

DUCT & ALKATHENE TUBE

HOUSE METER POSITIONS - EXTERNAL / INTERNAL

SURF TELECOMS S—S

PILOT CABLES P—P

PROPOSALS | ALTERATIONS | DISMANTLED

TRAFFIC SENSITIVE AREA YES/NO

DEVELOPER.
BUILDER.
ARCHITECT Drg. No.

O.S. MAP.

SCALE 1:8000 @ A3

PARISH.

11kV DIAG.

LV. DIAG.

PLAN No.

*Enq No.* | *of*

X - 488541.930,337845.818

Western Power Distribution (East Midlands) plc, No2366923
Western Power Distribution (West Midlands) plc, No3600574
Western Power Distribution (South West) plc, No2366894

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