

M42 Junction 6 Development Consent Order

Scheme Number TR010027

8.11 Statement of Common Ground with Warwickshire Wildlife Trust

Planning Act 2008

Rule 8 (1)(e)

The Infrastructure Planning (Examination Procedure) Rules 2010

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M42 Junction 6 Development Consent Order
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STATEMENT OF COMMON GROUND
WARICKSHIRE WILDLIFE TRUST

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Planning Inspectorate Scheme Reference	TR010027
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1	June 2019	Draft

STATEMENT OF COMMON GROUND

This Statement of Common Ground has been prepared and agreed by (1) Highways England Company Limited and (2) Warwickshire Wildlife Trust.

Note: The Draft SoCG has been shared with Warwickshire Wildlife Trust who have returned confirmation of receipt and indicated given the range of issues included within, would not be a position to provide further comment on the draft document in time for Deadline 2.

The Applicant provided clarity to the Trust on the status of the draft SoCG and the timeframe for their support in the process. The Trust informed the Applicant they will provide further comment upon the appointment of a new member of staff (late June-July 2019) who would amongst other tasks oversee Bickenhill Meadows SSSI. It was considered beneficial by both parties for the new appointment inputting into the SoCG.

Signed.....

Chris Harris

Project Manager

on behalf of Highways England

Date:

Signed.....

Karl Curtis

Warwickshire Wildlife Trust Land Manager

on behalf of Warwickshire Wildlife Trust

Date:

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- B. Technical Note HE551485-ACM-HML-Z1_JN_J5_ZZ-TN-CH-0002

1 Introduction

1.1 Purpose of this document

- 1.1.1 This Statement of Common Ground ("SoCG") has been prepared in respect of the proposed M42 Junction 6 Improvement ("the Application") made by Highways England Company Limited ("Highways England") to the Secretary of State for Transport ("Secretary of State") for a Development Consent Order ("the Order") under section 37 of the Planning Act 2008 ("PA 2008").
- 1.1.2 The order, if granted, would authorise Highways England to carry out the following works:
- a. a new dumbbell junction approximately 1.8 km south of the existing Junction 6 on the M42;
 - b. construction of a new 2.4 km dual carriageway link road between the new junction and Clock Interchange (an existing junction on the A45);
 - c. modifications to the existing Clock Interchange junction;
 - d. upgrades to the existing Junction 6; and
 - e. realignments and improvements to local roads to the west of the existing M42 in proximity to the proposed bypass.
- 1.1.3 This SoCG does not seek to replicate information which is available elsewhere within the Application documents. All documents are available in the deposit locations and/or the Planning Inspectorate website.
- 1.1.4 This SoCG has been produced to confirm to the Examining Authority where agreement has been reached between the parties to it, and where agreement has not (yet) been reached. SoCGs are an established means in the planning process of allowing all parties to identify and so focus on specific issues that may need to be addressed during the examination.

1.2 Parties to this Statement of Common Ground

- 1.2.1 This SoCG has been prepared by (1) Highways England as the Applicant and (2) Warwickshire Wildlife Trust.
- 1.2.2 Highways England became the Government-owned Strategic Highways Company on 1 April 2015. It is the highway authority in England for the strategic road network and has the necessary powers and duties to operate, manage, maintain and enhance the network. Regulatory powers remain with the Secretary of State. The legislation establishing Highways England made provision for all legal rights and obligations of the Highways Agency, including in respect of the Application, to be conferred upon or assumed by Highways England.
- 1.2.3 The Warwickshire Wildlife Trust is an independent charity focussed on nature conservation within the county. Their role includes the management of nature reserves, engaging communities to enjoy and care for wildlife as well as campaigning on behalf of the environment.
- 1.2.4 As an environmental interest group, Warwickshire Wildlife Trust's role in the DCO process derives from Section 42(1)(a) of the Planning Act 2008 as a prescribed body.

1.2.5 Collectively Highways England and Warwickshire Wildlife Trust are referred to as 'the parties'.

1.3 Terminology

1.3.1 In the table in the Issues chapter of this SoCG:

- a. "Agreed" indicates where the issue has been resolved.
- b. "Not Agreed" indicates a final position, and
- c. "Under discussion" where these points will be the subject of on-going discussion wherever possible to resolve, or refine, the extent of disagreement between the parties.

1.3.2 It can be taken that any matters not specifically referred to in the Issues chapter of this SoCG are not of material interest or relevance to Warwickshire Wildlife Trust's representation and therefore have not been considered in this document. It is recognised however that engagement between both parties will need to continue due to their joint vested interest in the area of the Scheme.

2 Record of Engagement

2.1.1 The parties have been engaged in consultation since the beginning of the proposed development. A summary of the meetings and correspondence that has taken place between Highways England and Warwickshire Wildlife Trust in relation to the Application is outlined in **Table 2-1**.

Table 2.1 - Record of Engagement

Date	Form of correspondence	Key topics discussed and key outcomes (the topics should align with the Issues tables)
07.01.18	Email from Warwickshire Wildlife Trust	Requesting consultation and ability to comment on the proposals, requested further details of the Scheme.
05.03.18	Email by Highways England	Clarified details of the statutory consultation process and details of the reports on the ecological impact of the scheme to date.
25.09.18	Meeting between WWT and AECOM	General update on Scheme changes and the Environmental Impact Assessment findings. Discussion about the potential impact on the Bickenhill SSSI and potential mitigation measures.
26.09.18	Email	Circulation of the <i>Bickenhill Meadows SSSI Preliminary Hydrological Investigation Technical Note V6</i> (Appendix A) to Warwickshire Wildlife Trust.
02.10.18	Email	Further consultation response from Warwickshire Wildlife Trust.
14.03.19	Meeting between AECOM, Warwickshire Wildlife Trust and Natural England	A meeting to present the current dataset and further knowledge associated with Bickenhill Meadows SSSI solution and to discuss the current solution. The meeting also covered DCO related issues relating to the loss of Aspbury's Copse ancient woodland.
28.03.19	Relevant Representation	WWT issued to the Planning Inspectorate on the 28.03.19

2.1.2 It is agreed that this is an accurate record of the key meetings and consultation undertaken between (1) Highways England and (2) Warwickshire Wildlife Trust in relation to the issues addressed in this SoCG.

2.2 Methods of environmental assessment and baseline information

2.2.1 Matters relating to the relevant methods of assessment, the collection of and quantum of data required to inform the applicable baselines have been agreed with applicable statutory environmental body and presented within the Environmental Statement for the Scheme.

3 Issues

3.1 Issues Raised

Table 3-1 – Record of Issues Raised

Sub-topic	Warwickshire Wildlife Trust Comment	Highways England Response/Actions	Status/Agreement-
<p>Landscape connectivity for Wildlife</p>	<p>The Trust are concerned about the severance effect of the new mainline link road on habitats, potentially isolating the land between it and the M42 for many species unless mitigation and crossing points are designed into the Scheme.</p>	<p>As part of the overall mitigation design for the Scheme, a number of measures have been included within the preliminary design to allow for species connectivity between habitats, these include planting hedgerows in locations that would benefit from re-establishing habitat connectivity where severance occurs and a minimum of two mammal tunnels to north and south of the mainline link road to encourage safe passage of mammals across the Scheme.</p>	<p>Agreed</p>
	<p>To date (Statutory Consultation in January 2018), the ecological survey reports have not been publically available so that the impact on our protected and notable wildlife species is unknown.</p>	<p>At the time of the comment made by the Trust no survey data had been released by Highways England into the public domain to supplement to Preliminary Environmental Information Report (PEIR).</p> <p>The findings of the surveys undertaken in addition to the relevant baseline data used to inform the environmental assessment of protected and notable species (notwithstanding confidential badger reports) have been included within the DCO Application for the Scheme.</p>	<p>Agreed</p>

Sub-topic	Warwickshire Wildlife Trust Comment	Highways England Response/Actions	Status/Agreement-
Biodiversity			
	The Trust are concerned that the evidence informing the DCO application is insufficient to understand the hydrology of the site and therefore the required mitigation to protect the grassland habitat	Highways England are continually collecting and evaluating data to better understand the interaction the Scheme may have on the Shadowbrook Meadows SSSI unit. The spatial extent and duration of monitoring has been agreed with Natural England and the Trust has not objected with these parameters in meetings held to date.	Agreed
Bickenhill Meadows SSSI	Would Highways England be happy with a pumping option as mitigation for the SSSI?	<p>The solution presented within the DCO Application for the Scheme was informed by the data collected at the time of submission. As such and if required, this solution can be implemented and operated to mitigate the impact to the Shadowbrook Meadows Unit of Bickenhill Meadows SSSI.</p> <p>Highway England are collecting data and seeking to refine the mechanical components of any solution to a minimum to reduce the risk of failure or fault, with the aim of implementing a mitigation solution with little or no mechanical components.</p>	Under Discussion

Sub-topic	Warwickshire Wildlife Trust Comment	Highways England Response/Actions	Status/Agreement-
	<p>The Trust questioned whether the new road may impact the flow of ground water to the SSSI which if not mitigated would destroy the grassland for which the site is designated and they questioned whether the mitigation plan is suitable for the site.</p>	<p>The below ground information (Ground Investigation works) gathered to inform the scheme’s design and environmental assessment indicate that it is unlikely that ground water would be significantly affected by the road cutting. A conceptual model has been generated as part of the Bickenhill Meadows SSSI – Preliminary Hydrological Investigation Technical Note Appendix 14.2 [APP-157] for the Scheme which presents the sub-surface composition around both component parts of the SSSI.</p>	<p>Under Discussion</p>
	<p>The Trust are concerned that the proposed mitigation to retain water supply to this grassland (SSSI) relies on an engineered solution, requiring a pump. We do not consider this engineered solution is sustainable as it will require long term maintenance and intervention by a third party or otherwise the grassland will be lost and this half of the SSSI destroyed.</p>	<p>In parallel to the evaluation of data, a mitigation solution is being devised which aims to be as passive as possible to reduce the risk of failure through function as far as practicable.</p> <p>Any solution (and eventually the operational management and maintenance protocol) will continue to be refined as more data is collected and interpreted.</p>	<p>Under Discussion</p>

Sub-topic	Warwickshire Wildlife Trust Comment	Highways England Response/Actions	Status/Agreement-
	<p>The Trust are concerned that there is a lack of detail regarding the mitigation measures for the northern unit of Bickenhill Meadows SSSI and adjacent land, and this detail is critical for being certain that significant harm will not be caused to this grassland meadow</p>	<p>Highways England have presented within Chapter 8: Biodiversity and Chapter 14: Drainage and the Water Environment [APP-059], in addition to Appendix 14.2 Bickenhill Meadows – Preliminary Hydrological Investigation Technical Note [APP-157], and further explained in the meeting held on the 14.03.19, the rationale for the conclusions within the ES as to why it is considered the Scheme would not generate significant adverse environment effects on the NW unit of Bickenhill Meadows SSSI. As such the ES concluded that no mitigation is required for this unit.</p>	<p>Agreed</p>
<p>Aspbury's Copse Ancient Woodland</p>	<p>The Trust objects to the destruction of ancient woodland at Aspbury's Copse and designated Local Wildlife Site at Castle Hill Farm and would like information about how connectivity for wildlife will be retained across the new road.</p>	<p>Highways England have committed to an approximate 1.9 ha parcel of land to the immediate south of the eastern parcel of the existing ancient woodland. This parcel is for the compensation planting and associated soil translocation due to the loss of Aspbury's Copse ancient woodland.</p> <p>Highways England will continue to liaise with the Warwickshire Wildlife Trust and Natural England over matters relating to the loss of ancient woodland at Aspbury's Copse.</p>	<p>Under Discussion</p>

Sub-topic	Warwickshire Wildlife Trust Comment	Highways England Response/Actions	Status/Agreement-
	<p>The Trust welcomes any reduction land take within the ancient woodland; the embankments which will support the slip roads will still be located inside the ancient woodland resulting in direct loss on both sides of the existing road. The Trust requests that the scheme is reconfigured further to ensure that no land take occurs within Asbury's Copse.</p>	<p>The Scheme has endeavored to reduce the impact to Asbury's Copse ancient woodland through iterative design process. The rationale of which is presented within the Technical Note HE551485-ACM-HML-Z1_JN_J5_ZZ-TN-CH-0002 (Appendix B) and within the Planning Statement for the Scheme [APP-173].</p> <p>Possible further reductions in the overall land take (and subsequent impact) within the ancient woodland may be possible during detailed design. Changes to the impact to ancient woodland will be shared with WWT and statutory environmental bodies.</p>	<p>Under Discussion</p>
<p>Local Wildlife Site</p>	<p>The Scheme will destroy part of Castle Hill Farm Local Wildlife Site which is a grassland parcel that buffers the north western of the SSSI meadows. The Wildlife Trust objects to the loss of Local Wildlife Sites which are of county value for nature conservation.</p>	<p>Construction of the new mainline link road between M42 Junction 5A and the A45 will result in the unavoidable loss of grassland from Castle Hill Farm Meadows LWS. The loss of which would be 1.6% of the existing designated area of this non-statutory site.</p> <p>As such, a parcel of land (as presented within Figure 8.8 [APP-095]) has been identified for the translocation of grassland associated with the loss to Castle Hill Farm LWS with appropriate control measures defined within Chapter 8 of the ES [APP-053] to manage the process of translocation.</p>	<p>Under Discussion</p>

APPENDICES

Appendix A - Bickenhill Meadows SSSI *Preliminary Hydrological Investigation Technical Note V6.*

M42 JUNCTION 6 IMPROVEMENT SCHEME

***BICKENHILL MEADOWS SITE OF SPECIAL SCIENTIFIC
INTEREST – HYDROLOGICAL INVESTIGATION TECHNICAL
NOTE (V6)***

Prepared for: HIGHWAYS ENGLAND

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Revision History

Revision	Revision date	Details	Authorized	Position
Version 0	13.02.2018	Original Version	Jamie Gleave	Associate Director
Version 1	09.08.2018	Update – new data	Jamie Gleave	Associate Director
Version 2	15.08.2018	Update – new data	Jamie Gleave	Associate Director
Version 3	20.08.2018 21.08.2018	Update – new data	Jamie Gleave Graeme Cowling	Associate Director Principal Consultant
Version 4	13.09.2018	Update – new data	Jamie Gleave Graeme Cowling	Associate Director Principal Consultant
Version 5	05.10.2018	Update – new data	Jamie Gleave Graeme Cowling	Associate Director Principal Consultant
Version 6	17.10.2018	FINAL - for inclusion within ES	Jamie Gleave Graeme Cowling	Associate Director Principal Consultant

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M42 Junction 6 Improvement Scheme – Bickenhill Meadows SSSI Hydrological Investigation

1. Introduction

M42 Junction 6 provides connections between the national motorway network and the A45 Coventry Road, which provides strategic access to Birmingham to the west and Coventry to the east. Current congestion and journey reliability issues on the M42 and at Junction 6 are causing severe delays on parts of the strategic road network, as the junction does not have sufficient capacity to accommodate the predicted growth in traffic associated with future planned development in the area.

The M42 Junction 6 Improvement Scheme (the Scheme) has been developed by Highways England (HE) to provide a solution to improve junction capacity, support economic growth, improve access, and ensure the safe and reliable operation of the network.

The Scheme is currently being subject to a process of Environmental Impact Assessment (EIA), the design of which includes the following key components and works.

- A new junction approximately 1.8 km south of the existing Junction 6 off the M42 (referred to as M42 Junction 5A).
- A new 2.4 km long dual carriageway link road between M42 Junction 5A and Clock Interchange, with a free flow slip road to the A45 Coventry Road.
- Capacity and junction improvements at Clock Interchange.
- New free flow links between the A45 and M42 motorway at M42 Junction 6.
- The realignment and modification of the B4438 Catherine de Barnes Lane, Clock Lane and St. Peters Lane west of the M42 motorway, and of Eastway and the Middle Bickenhill Loop north east of M42 Junction 6.
- Modifications to the location and spacing of emergency refuge areas, overhead gantries and message signing along the M42 motorway.
- Modifications to the Gaelic Athletic Association (Páirc nah Éireann) sports facility.

A Ground Investigation is currently being undertaken to establish the existing ground conditions that would underlie key areas of the Scheme, and to obtain data for use in the EIA.

The proposed link road has been designed to be positioned below the flight path control zones of Birmingham International Airport, and to place much of the dual carriageway in cutting (up to 10m depth) in order to lower the road and thereby provide visual screening and noise attenuation benefits; however, construction of these earthworks has the potential to disrupt groundwater flows in the area.

The EIA process has so far identified that the proposed link road may also have an adverse impact on Bickenhill Meadows Site of Special Scientific Interest (SSSI), which consists of two separate units located either side of the proposed link road. The SSSI includes areas of wet woodland and wet meadows that support a range of plants and other species. The cutting and associated works are also in close proximity (within 300 m) of streams that flow through each SSSI unit, which may be impacted during the construction and operation phases.

Accordingly, the processes for maintaining the hydrology of the two SSSI units needs to be established in order to identify and understand the potential impacts of the Scheme on the SSSI, such that appropriate mitigation measures for any likely significant effects can be identified and, where possible, incorporated into its design. In particular, the importance of rainfall, groundwater, nearby streams and localised flooding needs to be investigated.

This Technical Note reports the outcomes of a hydrological investigation of the two SSSI units. It considers the soil and geological ground conditions from available data sources, the topography around the SSSI by reviewing LiDAR and contour data, and reports on the observations made during site visits (including one attended by Natural England). Based on preliminary findings, the note also considers the potential effects of the cutting and loss of surface water catchment, and sets out the scope of additional ground and field investigations, as requested by Natural England. The findings of the investigation are reported and developed into a conceptual model of each site, and potential mitigation and compensation measures are also discussed.

2. Proposed Link Road

The current general arrangement for the proposed link road is shown in Figure 1, set within its local context.

From M42 Junction 5A, the link road would initially travel north westwards through open fields to the north of Hampton Lane Farm, where it would cross a number of public rights of way. A roundabout would be constructed (Barber’s Coppice Roundabout) south of the SSSI which would provide a tie-in from the existing Catherine De Barnes Lane (both in a north and southbound direction) to the link road.

As the proposed link road continues north, it would cross Catherine De Barnes Lane approximately 70 m south of the T-junction of Shadowbrook Lane. Approximately 500m north of the crossing point with Catherine De Barnes Lane, a second local roundabout (Bickenhill Roundabout) would be constructed to provide a north and south tie-in with Catherine De Barnes Lane and St Peters Lane. Between these two local roundabouts, Catherine De Barnes Lane would be realigned at its furthest point approximately 20 m west of its current alignment.

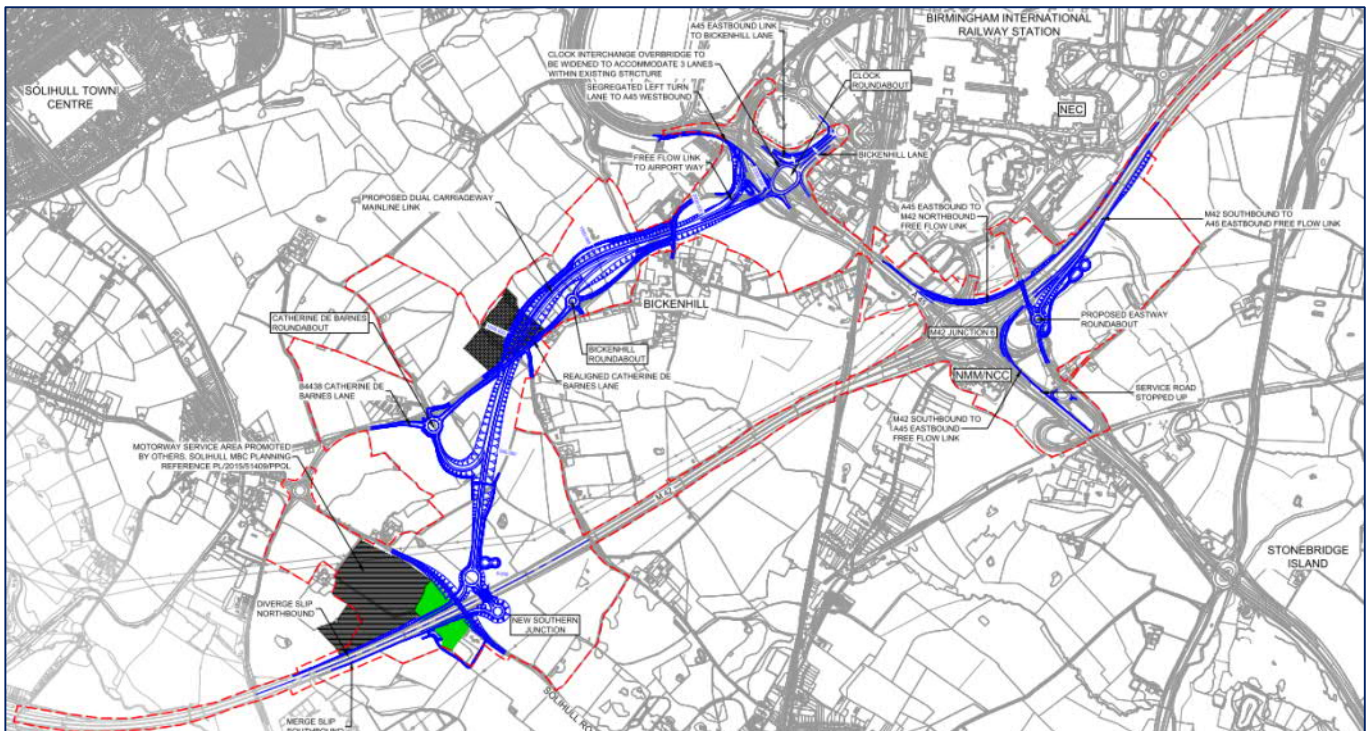


Figure 1: M42 Junction 6 Improvements – General Arrangement
 (source: extract from drawing HE551485-ACM-HGN-M42_GEN_ZZ_ZZ-DR-CH-0012 P02.3)

Figure 2 shows the Scheme in relation in the SSSI units.

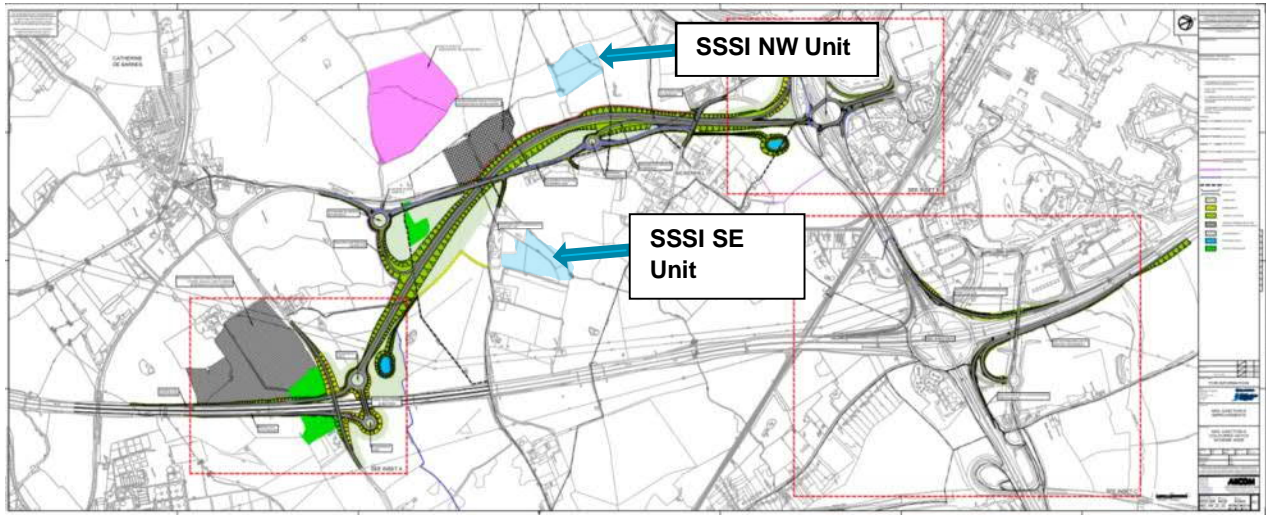


Figure 2: M42 Junction 6 design in relation to Bickenhill Meadows SSSI units (note that this is an earlier design. Figure 1 shows the latest Design Fix (3c)).

3. Bickenhill Meadows SSSI Designation

Bickenhill Meadows SSSI is split between two units, located either side of Catherine de Barnes Lane (centred on approximate national grid references SP182822 and SP188816) as shown in Figure 2 and on Ordnance Survey mapping in Figure 3. The total area designated covers 7.2 hectares and was notified in 1991.

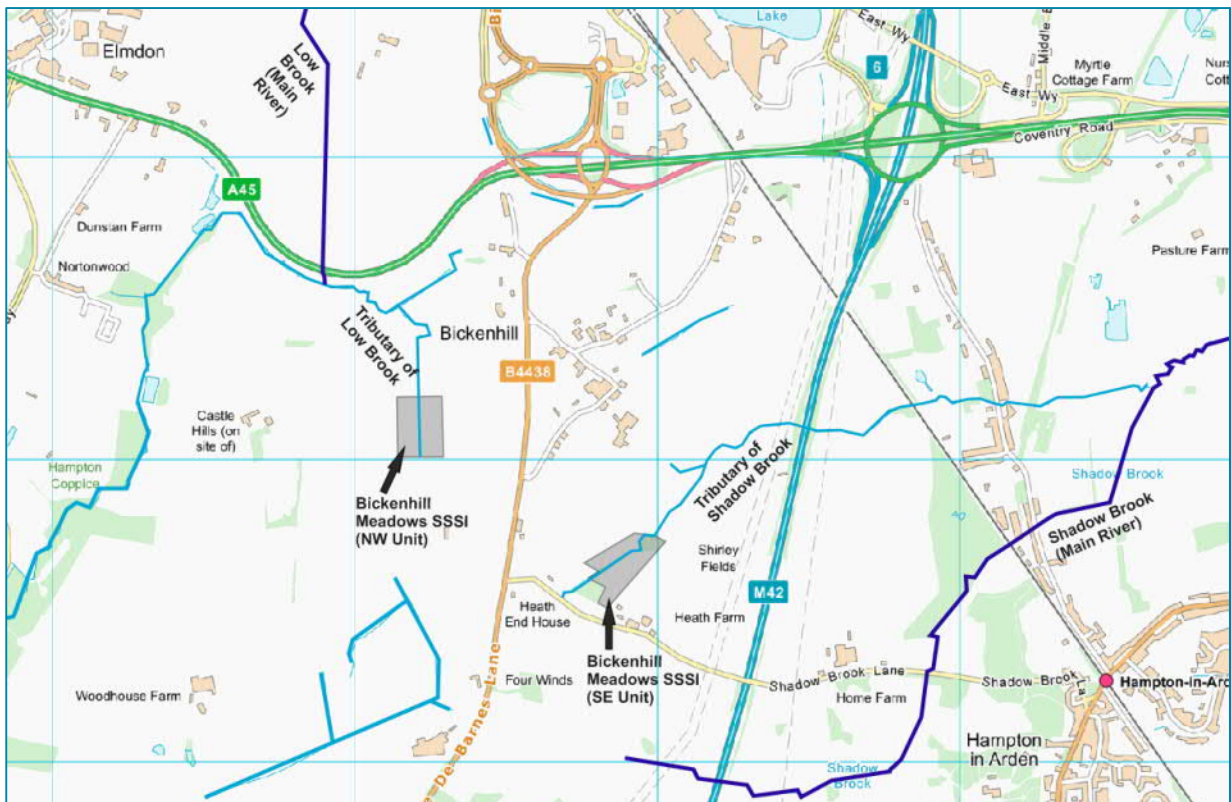


Figure 3. Location of the Bickenhill Meadows SSSI units, to west of the M42 Junction 6. (source: Ordnance Survey © Crown copyright and database rights 2018).

The Natural England citation¹ for the SSSI is as follows.

¹ <https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1002847>

Bickenhill Meadows consists of two groups of fields comprising species-rich grassland situated to the south and west of the village of Bickenhill on predominantly neutral soils overlying Keuper Marl.

*The meadows comprise one of the richest grassland floras in the county with good examples of both meadow foxtail (*Alopecurus pratensis*), great burnet (*Sanguisorba officinalis*), flood meadow and common knapweed (*Centaurea nigra*), crested dog's-tail (*Cynosurus cristatus*) meadow and pasture. Both grassland types have declined very severely nationally in the 20th century due to agricultural improvement. The West Midlands Region contains a major part of the national resource of the common knapweed – crested dog's-tail grassland type which is typically associated with level topography, loam or clay soils, moderately free drainage and the retention of traditional farming methods with small fields. There is a complex pattern of vegetation resulting from local variations in topography and drainage, such as the ridge and furrow pattern, evident in some of the fields. This has led to the development of mosaics where the main vegetation types intermingle, as well as to areas where each type can be recognised.*

*Further interest is provided by wetter areas characterised by rushes *Juncus* spp., sedges *Carex* spp. and tall herbs such as meadowsweet (*Filipendula ulmaria*) and great burnet. Both groups of meadows have streams and there is a good range of tree and shrub species in the hedgerows around the fields.*

Both units of the SSSI have a status of 'Unfavourable – Recovering'. However, the Natural England condition notes indicate that the southeastern SSSI shows a good cover of desirable species and may move to favourable in the near future.

Natural England's Management Principles for the site includes the following information with regard to drainage, "*For both the damper pastures and meadows, regular and careful maintenance of surface drainage including ditches and drains can be essential to prevent adverse changes in the plant composition of the sward. Deepening of surface drainage should be avoided.*"

From the available information on the SSSI it is clear that the plant species in the wet meadows and woodland areas within the SSSI units require wet ground conditions, although subtle changes in topography and local features (such as the local ditches and spoil heaps from past clearing of them) exert an influence on the botanical communities and distinctive zones of MG4 (wetter) and MG5 (drier) plant communities according to the National Vegetation Classification (NVC). It is also not evident from Natural England's SSSI designation and management principles, or through consultation with Natural England and the Warwickshire Wildlife Trust (WWT), whether the maintenance of wet conditions in the SSSI is primarily dependent on surface water or groundwater inflow from the surrounding areas.

4. Shadowbrook Meadows Local Nature Reserve

The southeastern SSSI unit is wholly encompassed by the larger Shadowbrook Meadows Local Nature Reserve (LNR), which is owned and managed by WWT. The WWT website² describes the site as follows:

"The site contains old meadows and pasture with a stream and wet woodland. The small stream runs through the reserve and sumptuous hedgerows divide the site into two dry meadows, on the eastern side, with two wet meadows to the west. Unfertilised, unsprayed and unploughed, the meadows' diversity has been maintained over centuries by the unaltered, traditional haycutting and grazing regime".

5. Bickenhill Meadows SSSI / Shadowbrook Meadows LNR Site Visit Report

The Bickenhill Meadows SSSI was initially visited on 18/01/18 in dry conditions but following a week of occasional heavy rain showers and some light snow and sleet showers. It was subsequently visited in spring with representatives of Natural England on 26/04/18 in a period of prevailing dry conditions, and again on 02/05/18 following 12 hours of heavy rain showers, which had resulted in some waterlogging of the surface. The northwestern SSSI unit was visited during wintry showers on the 28/02/18 and with

² Warwickshire Wildlife Trust – Shadowbrook Meadows website, <http://www.warwickshirewildlifetrust.org.uk/reserves/shadowbrook-meadows>, accessed 15/8/18.

Natural England on 26/04/18 in fine weather. Numerous further visits have been taken to both units throughout the summer of 2018.

Southeast (SE) SSSI Unit / Shadowbrook Meadows LNR

The southeastern unit consists of four fields and wet woodland at the far north of the site, and (along with the LNR) covers 4.4 hectares. The stream that flows through the centre of the site (from southwest to northeast) is a tributary of Shadow Brook. It meets Shadow Brook to the east of the M42 approximately 2 km downstream at NGR SP 20625 82231. The dry meadows are to the east of the site, and wet meadows are to the west. General views of the wet meadows are shown in Photos 1 to 6 under different conditions.



Photo 1 (top left) and Photo 2 (top right) Wet meadow fields at Bickenhill Meadows SSSI SE Unit / Shadowbrook Meadows LNR in cold/wet conditions; Photo 3 (middle left) Wet meadow fields at

Bickenhill Meadows SSSI SE Unit in warm/dry conditions; Photo 4 (middle right) and Photo 5 (bottom left) Bickenhill Meadows SSSI SE Unit in warm/dry conditions; Photo 6 (bottom right) Bickenhill Meadows SSSI unit southern field after a prolonged period of hot weather.

The topography of the site is generally level, with a gentle rise in elevation away from the tributary of Shadow Brook, which flows through the approximate centre of the site. The wet meadow to the north of the brook is relatively flat and may have been the route of the former watercourse prior to digging of the new brook course to the south and the ephemeral ditch to the north (which collects runoff from the steeper hillside slopes but is essentially a soakaway).

Along the edge of the brook there is a slight rise in the elevation that may be a relic of digging out or maintaining the brook. From here north the land gently falls before rising towards the ditch along the northern boundary of the SSSI. Within this general topographic form are isolated depressions that form part of a complex ridge and furrow pattern extending across the site, and which are a relic of historic ploughing practices. This is very subtle with only small changes in elevation of the order of tens of centimeters, but sufficient enough to result in significant changes in plant communities as depicted by the varying position of MG4 and MG5 plant communities. Ground elevation decreases slightly to the north as the stream flows downslope, but the overall gradient across the site is minor.

To the south of the brook, the ground rises more steeply more the watercourse and the plant communities appear to be less diverse and well developed. A gas main runs east-west across this field, the route indicated by a line of flushes suggesting that soil hydrology has been locally affected. Due to the intervening presence of the brook, the elevation of this field, and the angle of the slope, it is unlikely to be affected by the Scheme.

There is a small pond towards the centre of the southern field of the LNR site (but not within the SSSI) with emergent reed vegetation and which is surrounded by a stock proof fence (see Photo 2). The origins of the pond are not known, but when observed in very wet conditions a 'trickle' of water flowed from the pond and overland to the north to ultimately meet the tributary of Shadow Brook, possibly as a result of any under-soil drainage being blocked.

The source of the tributary of Shadow Brook is mapped by Ordnance Survey as being immediately north of Shadowbrook Lane to the south of the SE SSSI unit. Here lateral ephemeral drainage ditches from the road coalesce and flow north beneath the caravan park site and emerge at the southern border of the SSSI. There is a pond on the opposite (south) side of Shadowbrook Lane to the mapped source of the stream, which collects water from the adjacent road and agricultural drainage from the arable field opposite the LNR. This field includes a small ditch of around 0.5 m width, which flows from Catherine de Barnes Lane in a northeasterly direction towards the LNR and SSSI. Catherine de Barnes Lane marks the watershed boundary, and all surface water in this upper section of the SSSI's catchment is expected to be channeled towards this agricultural ditch and collect in the pond adjacent to Shadowbrook Lane, which is a natural focal point for drainage to collect. Although there was no obvious culvert beneath the road it is believed that runoff finds its way under Shadowbrook Lane either through unknown drainage network or subsurface flow. Significant amounts of standing water have been observed in the ditches either side of Shadowbrook Lane after heavy rainfall in winter and spring and potentially indicate impeded flow beneath the road, presumably due to siltation and blockage by large woody debris and decomposing organic matter. In summary, it appears that the brook is likely to be rain fed, receiving drainage also from surrounding agricultural land and Shadowbrook Lane. There may also be drainage from the small caravan park site under which the brook flows prior to emerging in the SSSI.

Given its small size, intermittent and generally low flows, the brook is expected to suffer from water quality issues typical of an arable catchment, plus drainage from local roads and potentially other sources, such as runoff from the caravan site.

There is also an ephemeral drainage ditch bordering the northwest of the site (Photo 7), which varies between 1 and 1.5m wide. This was largely dry on the majority of site visits, with some ponded water in

places of 1-2 cm depth adjacent to the upper wet meadow. However, when observed after heavy rain there was obvious flow in the ditch, which presumably was sourced from runoff from the adjacent arable field which slopes significantly down to the SSSI. As the ditch enters the alder woodland at the northern extent of the SSSI there was a small amount of flow even during the drier site visits, which drains into the tributary of Shadow Brook (approximate NGR SP 18950 81743), see Photo 8.



Photo 7 (left) Ponded water in agricultural drainage ditch at NW border of SE SSSI Unit; Photo 8 (right) confluence of the tributary of Shadow Brook and the drainage ditch within the alder woodland; Photo 9. Furrows and depressions saturated with water following rainfall in meadow field of SE SSSI Unit.

Within the SE SSSI Unit the tributary of Shadow Brook is very straight and could have initially been an agricultural drainage ditch. It is around 0.5 m wide and water depth was in the region of 3-5 cm when observed on the site visits on the 02/05/18 (Photos 10 and 11). The bed was generally covered by accumulations of fine sediment (and leaf litter in the autumn), although some small accumulations of gravel of 4-5 mm in diameter were also evident.

Towards the centre of the SE SSSI Unit the brook is culverted under a grassed land bridge through a plastic pipe of around 400 mm diameter (Photo 12). Upstream the culvert is partially buried, and there is potential for impoundment of flow during extreme rainfall events, which may result in occasional flooding of the immediate grasslands, although there was no evidence of this. Several blockages across the stream from woody debris and accumulations of leaves were observed during the site visits, which again could cause localised impoundment of flows and encourage local out of bank events. Connectivity to the surrounding floodplain is good in some sections, particularly on the left bank in the northern field. However, the stream is not considered significant enough in size to cause widespread out of bank events across the grasslands and woodland, and Natural England and WWT are not aware of any widespread flooding at the site resulting from out of bank stream flows. However, the brook may locally support groundwater levels in the close vicinity of the channel, and it is possible that soil on either side has been compacted in places due to the past placing of dredgings, and this may influence soil hydrology on the upslope side by helping to maintain wetter ground conditions.

In the northeastern (wet) field of the SE SSSI unit, the ridge and furrow topography gives rise to diverse ecological communities. The furrows tend to be saturated and support grassland species designated as MG4 under the National Vegetation Classification (NVC). MG4 represents a nationally rare flood meadow community. Characteristic species include greater burnet (*Sanguisobra officinalis*) and meadowsweet (*Filipendula ulmaria*). The ridges are drier and support MG5 neutral grassland species with assemblages of English crested dog's tail (*Cynosurus cristatus*) and common knapweed (*Centaurea nigra*), amongst others. Subtle changes in colour across the wet meadow, shown in Photo 1, indicate the changes in vegetation across the site.

When the SE SSSI unit was observed following heavy rainfall on 02/05/18 the entire site was extremely wet, with most grassland areas appearing to be fully saturated (Photo 9). All furrows and depressions that were observed during the visit contained surface water, including in the generally drier meadow fields.

This observational evidence indicates that the moisture source for the wet grasslands is most probably rainwater, which is slow to drain away due to the poor permeability of the subsurface layers.



Photo 10 (left) and Photo 11 (centre): Tributary of Shadow Brook within the wet woodland. Photo 12: (right) Culvert exit downstream of the grassed land bridge.

Northwest (NW) SSSI Unit

The NW SSSI unit is a small, roughly square grassland area of 2.7 ha, bordered on all sides by a scrub and woodland margin (Photo 13). A tributary of Low Brook flows from south to north and divides the field approximately in half, with the topography rising away from the tributary gently on both sides initially, becoming steeper further afield. The brook itself is surrounded by intermittent hedgerow vegetation. Immediately south of the site is a historic landfill site of raised elevation, from which groundwater (of unknown quality) may flow out towards the SSSI, as indicated by iron staining seeping from the embankment.

The watercourse appears to emanate from numerous ephemeral drainage ditches which flow around the elevated historic landfill area and coalesce at the south of the site to then flow north through the SSSI. A further drainage ditch flows north along the western boundary of the site. As the watercourse flows north through the SSSI unit it widens out into a very silted marshland area, with little discernable surface water flow (Photo 14), before reverting to a well-defined stream of up to 2.5m wide (Photo 15) which has generally good floodplain connectivity within the SSSI, and emergent macrophytic vegetation in places. The watercourse is not considered of sufficient size to cause significant flooding of the adjacent fields.



Photo 13 (left), Photo 14 (centre) and Photo 15 (right). Bickenhill Meadows SSSI NW Unit.

Vegetation patterns on the eastern side of the SSSI indicate that there may be an insulated wetter area just upslope of the tributary of Low Brook towards the centre of the site. This is indicated by a slightly raised area with a distinct and 'spongey' vegetation assemblage, which is different in character from the surrounding communities of MG4 grasslands (including great burnet (*Sanguisorba officinalis*) and meadowsweet (*Filipendula ulmaria*) and MG5 grasslands (including knapweed (*Centaurea nigra*)) that are

found across the eastern field of the site. The wetter ground conditions may also be influenced by dredged material placed in a bund along the eastern bank, which may be compacting the soil below and reducing permeability.

The western field has a generally drier and more uniform character than the eastern field (Photo 16), and is at a slightly greater elevation than the eastern field. The spatial distribution of the MG4 and MG5 grasslands across both fields is a likely consequence of local variability in moisture content in the upper 30-40 cm of soil, with tussocks and ridges across the site providing slightly drier conditions than localised depressions and troughs.



Photo 16 (left) – eastern field within the NW SSSI Unit showing the fringing blackthorn trees.



Photo 17 (right) tributary of Low Brook immediately north of the SE SSSI Unit boundary looking towards Birmingham International Airport.

As the tributary of Low Brook flows out of the SSSI to the north of the site, the watercourse becomes a perfectly straight (artificially straightened), deeply incised drainage channel with a width of around 1 m (see Photo 17). This flows north to Low Brook, which is then culverted beneath the Birmingham International Airport runway.

6. Ground Condition and Soils

According to the British Geological Survey's Geology of Britain website (<http://mapapps.bgs.ac.uk/geologyofbritain3d/>) the bedrock geology beneath both SSSI units is Sidmouth Mudstone Formation (Mercia Mudstone) (Figure 4). No superficial deposits are recorded below the SE SSSI unit, while alluvium (clay, silt, sand and gravel) is mapped around the stream through the NW SSSI unit (Figure 5).

The alluvium deposits at the northwestern SSSI unit are Secondary 'A' aquifer. The Sidmouth Mudstone Formation is classified as Secondary 'B' aquifer. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Secondary B aquifers are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Borehole records collected from historic ground investigations undertaken during the development of the M42 motorway in the 1970s and 1980s showed that groundwater was generally encountered within 10m of the ground surface adjacent to the M42 at Junction 6. The nearest borehole records for the NW SSSI unit shows a depth to groundwater of 6.75m at the western extent of the SSSI (within 50m of the northwestern corner of the SSSI), as recorded in 1978 (reference SP18SE/511)³, and the borehole log indicates sand and gravel pockets within clay to a depth of 4.7m. Another borehole approximately 130m

³British Geological survey, Geology of Britain website, available at <http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html> (accessed 20/5/18)

to the south of the SSSI had a depth to water of 3m, also in 1978 (reference SP18SE/510)⁴. The borehole log here indicated sandy clay and gravel to a depth of 1.3m, with stiffer clay below to a depth of 5.8m, underlain by mudstone.

Further ground investigations were undertaken to the north of the NW SSSI unit in 2011 in relation to the Birmingham International Airport runway extension and re-routing of the A45⁵. The nearest borehole was located approximately 250m north of the SSSI unit, adjacent to the tributary of Low Brook (i.e. towards the valley bottom). This borehole (reference CP26) indicated slightly gravelly sandy clay with gravelly sand lenses to 2.2m, underlain by Mercia Mudstone, with groundwater struck at 4.2m depth (in October 2011). A borehole approximately 380m north of the SSSI (reference CPRC31) recorded slightly sandy clay to 1.65m underlain by Mercia Mudstone. No groundwater was encountered in October 2011.

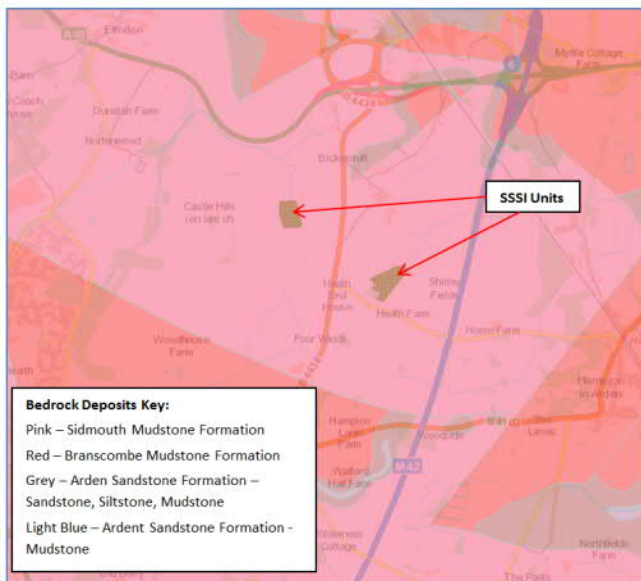


Figure 4. Bedrock deposits in the area around Bickenhill Meadows SSSI (source: British Geological Survey Geindex website, <http://www.bgs.ac.uk/geindex>).



Figure 5. Superficial deposits in the area around Bickenhill Meadows SSSI (source: British Geological Survey Geindex website, <http://www.bgs.ac.uk/geindex>).

There are no historic borehole records in the immediate vicinity of the SE SSSI unit. The nearest is 340m to the east of the site (SP18SE/26B) and was drilled as part of the ground investigation for the M42 in 1970. This borehole had a depth to water of 11.05m. The borehole log indicates that the upper layers consisted of silty clay (weathered mudstone), with lumps of hard mudstone apparent – from 4.45m depth, and weathered mudstone extending to the borehole base at 13.55m.

According to the Environment Agency there are no groundwater abstractions within 3 km of either SSSI unit. Solihull Metropolitan Borough Council has confirmed that there are five known Private Water Supplies within 2 km of the site, although exact locations have not been provided.

No springs are marked on current Ordnance Survey mapping in the immediate vicinity of the SSSI units, or on historical mapping that is available online. The nearest spring is marked ('issues' on Ordnance Survey mapping) approximately 500m to the southeast of the SE SSSI Unit at the source of Shadow Brook. When visited on site on 27/10/17, Shadow Brook was completely dry at its source and along its channel until east of the M42. This suggests that there may be low groundwater levels, or that there may only be an ephemeral groundwater input to the stream at times of high groundwater level conditions. While several pockets of sand and gravel that could contain groundwater are mapped in the area,

⁴British Geological survey, Geology of Britain website, available at <http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html> (accessed 20/5/18)

⁵ Birmingham Airport (December 2011) Factual Report on Ground Investigation for the Proposed Runway Extension at Birmingham Airport,

particularly on higher ground, these do not extend to the SSSIs, although it is not currently known whether this is simply due to a lack of available information. The Ground Investigation for the Scheme will help clarify the full spatial location of the sand and gravel pockets.

Cranfield University's Soilscape website (<http://www.landis.org.uk/soilscape/>) indicates that the soil across the study area, including both SSSI units, is slowly permeable seasonally wet slightly acid base-rich loamy and clayey soils. Habitats typically associated with such soils are seasonally wet pastures and woodlands.

7. Topographic Survey

LiDAR topographic data has been obtained from the UK Government's Open Data website (<https://data.gov.uk/>) for the area covering the two SSSI units. This is shown in Figure 6 overlain onto Ordnance Survey Mapping. The surrounding topography is also shown in contour form in Figure 7. Areas of the highest elevation (shown as pale green shading in Figure 6) are located: i) immediately to the east of the northwestern SSSI unit; ii) at Bickenhill village; iii) at Catherine de Barnes Lane north of the Shadowbrook Lane junction; and iv) close to Four Winds to the south of the SE SSSI unit. Areas of progressively lower elevation are found along the streams that flow through each SSSI (yellow to light brown to dark brown shading).

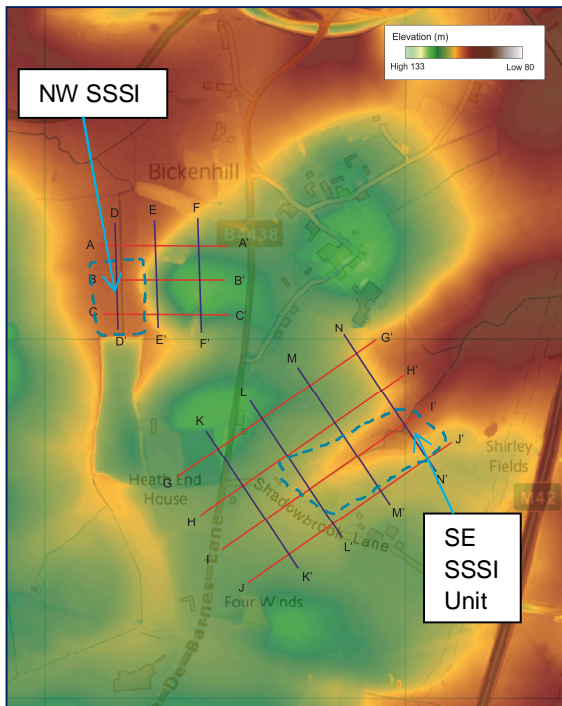


Figure 6. LiDAR data (source: UK open data website) overlain on Ordnance Survey data (crown copyright and database rights 2018 Ordnance Survey). Solid lines indicate locations of topographic sections, as shown in Appendix A. Dashed lines indicate approximate SSSI locations. The figure shows a surface water divide between the two sites running NE-SW.

Around the SE SSSI unit the topography gently declines in elevation from the east, south and west towards the tributary of Shadow Brook, which has gentle valley slopes surrounding it as it flows to the northeast. Similarly, the northwestern SSSI unit has slopes falling away from the east, south and west, with a gentle valley forming to the north as the stream in the SSSI flows towards Low Brook. A series of topographic sections have been derived from the LiDAR data. The section lines are indicated and labelled in Figure 6, and are all presented in Appendix A.

It is clear from the sections that there is a general decline in elevation from east to west towards the NW SSSI unit (sections A-C). This is essentially a valley side to the tributary of Low Brook. As the new dual carriageway would be located to the east of the NW SSSI (see Figures 1 and 2) there is potential for flow pathways between the Scheme and the downslope SSSI. If construction and operational runoff was not properly controlled, and appropriate mitigation measures not put into place, then there could be adverse impacts to habitats and water quality within the SSSI unit from this runoff. However, the Scheme includes

mitigation for all potential adverse impacts from road drainage and spillage incidents during construction and operation.

There is also a decline in elevation from south to north towards the NW SSSI unit (sections D-F). This includes a field directly south of the SSSI unit which is elevated in comparison to the surrounding land, and is a former landfill site.

The topographic long sections for the SE SSSI unit (sections G-J) indicate a general decline in elevation from the south of Shadowbrook Lane towards the SSSI, while the cross sections (sections K-N) indicate gentle valley slopes rising each side of the watercourse. As designs indicate that the new dual carriageway will cross Catherine de Barnes Lane just south of the Shadowbrook Lane junction, and will continue in a southeast direction (Figure 8), there is potential for surface water flows between the Scheme and the SSSI unit. Again, this could have impacts on the habitats in the SSSI if appropriate mitigation for surface water runoff from construction and operation was not implemented; however, various mitigation measures are built into the Scheme design.

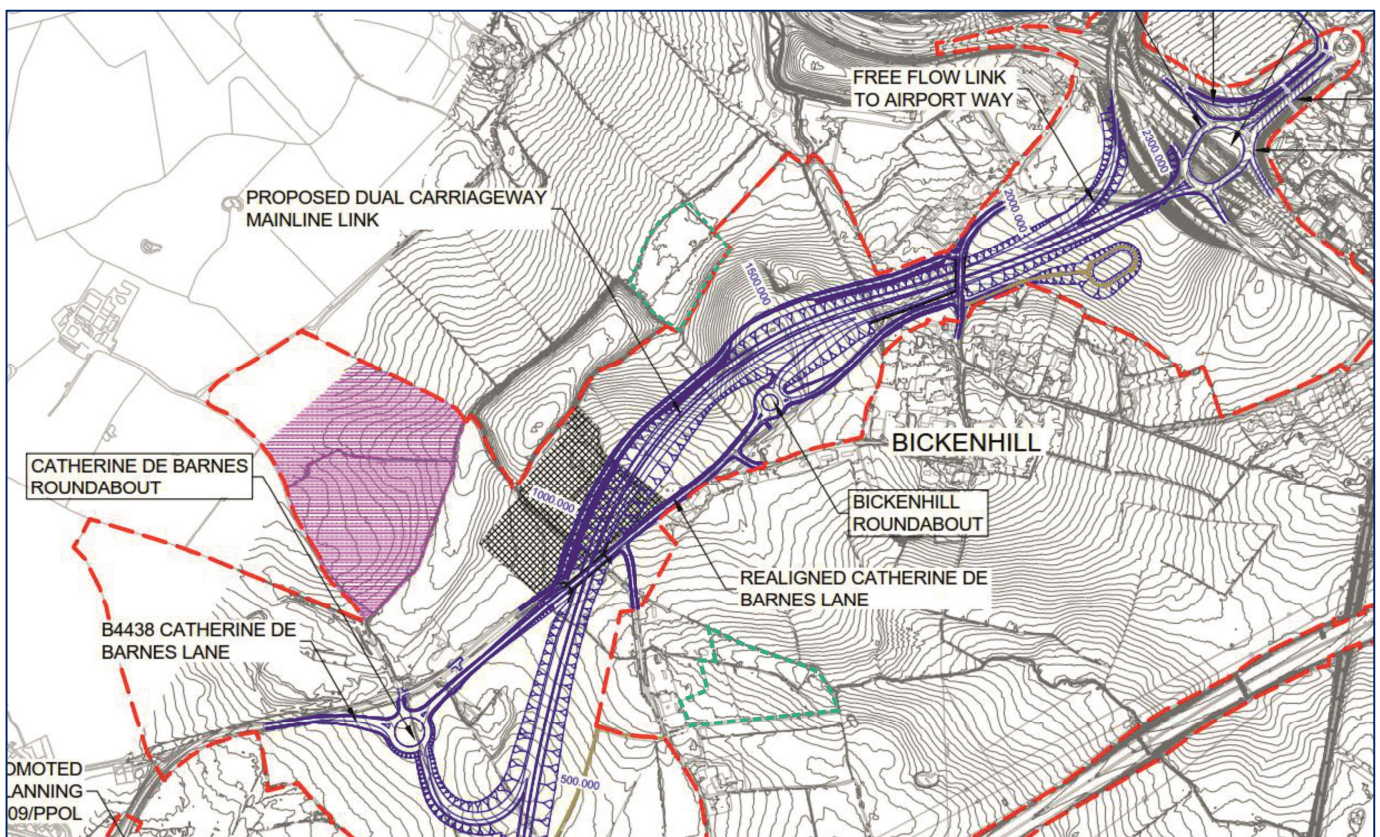


Figure 7. Contour map to show topography surrounding the two SSSI units. SSSI units are outlined in a green dashed line, with the Scheme red line boundary shown in red). Contours were derived from topographic survey undertaken at PCF Stage 2 for the Scheme.

In Figure 8, the surface water catchments for each SSSI unit have been derived from the LiDAR data. The NW SSSI unit has a noticeably larger catchment than the SE SSSI unit, and extends a considerable distance to the southwest where it is interrupted by the Grand Union Canal near Catherine de Barnes. On the basis of the approximate road alignment shown in Figure 8, the proportion of the catchments lost to the Scheme for each SSSI unit would be 4.7% for the NW unit and 21.4% for the SE unit, based on Design Fix 3c.

The site observations and topographic investigation of LiDAR data suggest that surface water flows are important contributors to the habitats in the two SSSI units, particularly in the close vicinity of the channels. However, significant flooding of the units is very unlikely and it is more likely that rainfall combined with the ridge and furrow topography and localised hillslope runoff is the most significant source of water controlling the hydrology of the wet meadows. The role of groundwater flow is uncertain.

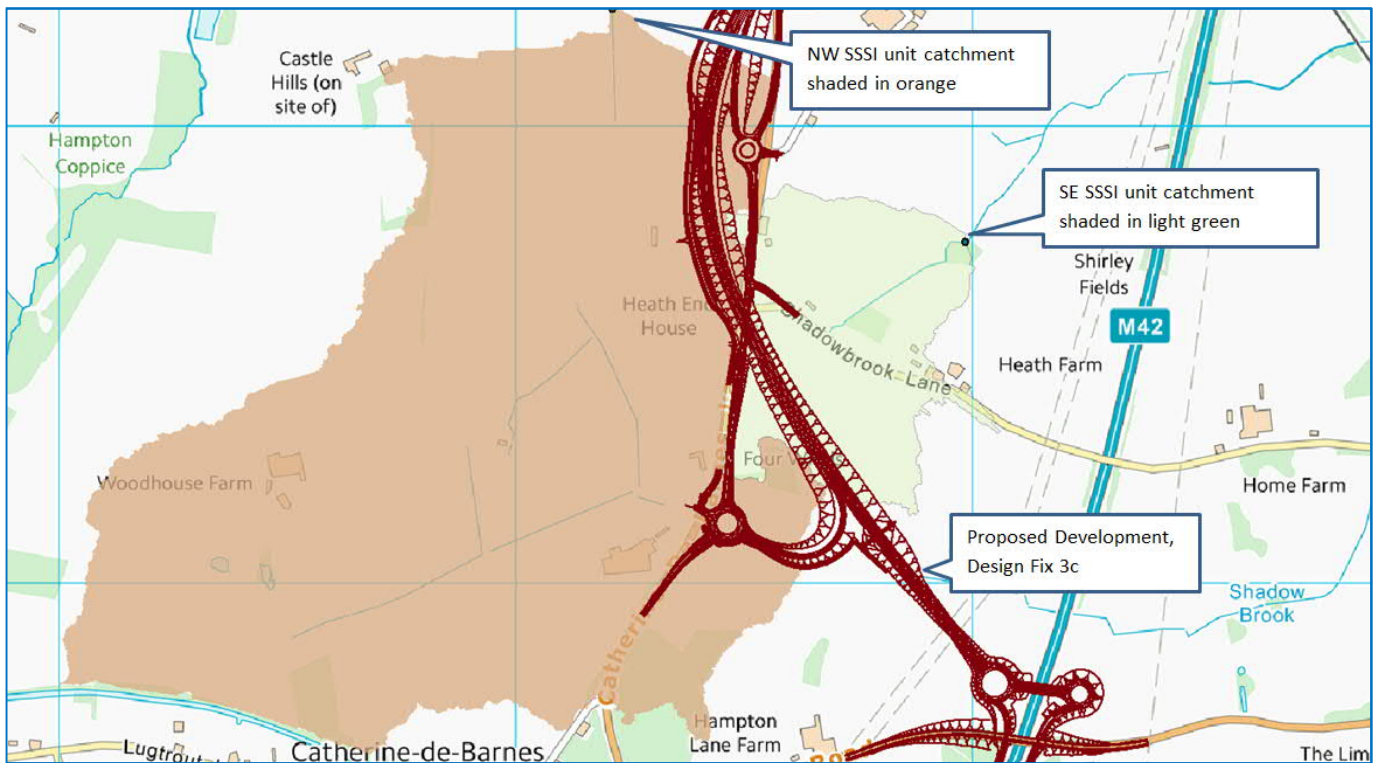


Figure 8. Catchment boundaries as determined from GIS catchment analysis, with the Design Fix 3c road alignment overlain in red.

8. Ground Investigation

The Ground Investigation currently being undertaken as part of the Scheme will provide some understanding of groundwater levels in the vicinity of the SSSI and the extent to which they may intersect with the wet meadows and woodlands. It will also reveal whether glacial sand and gravel deposits extend to, or intersect with, the two SSSI units.

The design of the proposed link road indicates that in places the cuttings will have a depth of up to 10 m below existing ground level. Adjacent to the SE SSSI unit, the cutting would have depths varying between 5 and 8 m below existing ground level, while adjacent to the NW SSSI unit depths would be between 0 and 9 m lower than existing levels. The potential for drawdown of groundwater is thought to be greatest where the cutting will intersect patches of glacial sands and gravel and Arden Sandstone. There are no mapped Arden Sandstone outcrops adjacent to the SSSIs that would be impacted by the cutting (see Figure 4), but there are deposits of glacial sands and gravels as indicated in Figure 9 and 10. Dewatering of these deposits due to the road could impact on lateral groundwater flow towards the SSSIs, and it remains a possibility that they are more extensive than current mapping suggests. While there is potential for drawdown in areas of Mercia Mudstone, the impact is likely to be much reduced in comparison to the areas of sand and gravel deposits.

Given that groundwater in the area has historically been within 10m of the surface, and that in places the cutting is to be up to 10m deep, there is some potential for disruption of groundwater flows. While groundwater flow is not currently considered to be the primary source of water maintaining wet conditions and streamflow in the SSSI units, it is not ruled out as having a contributory role, particularly if the sands and gravels are more spatially extensive than mapped. As such, the relationship between groundwater levels at the site of the proposed road and at the two SSSI units needs to be better understood to determine whether the cutting would have any impact. To achieve this, the Ground Investigation for the Scheme has been extended to take account of the SSSI units.

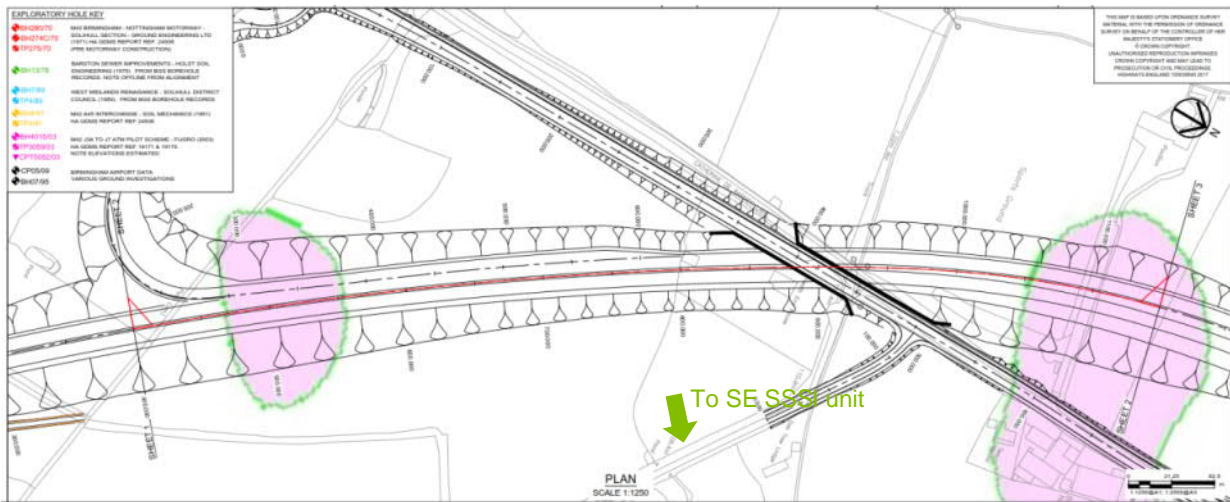


Figure 9. Location of Glacial Sands and Gravels along the proposed link road (shown by Pink shading), in the vicinity of the southeastern SSSI unit.

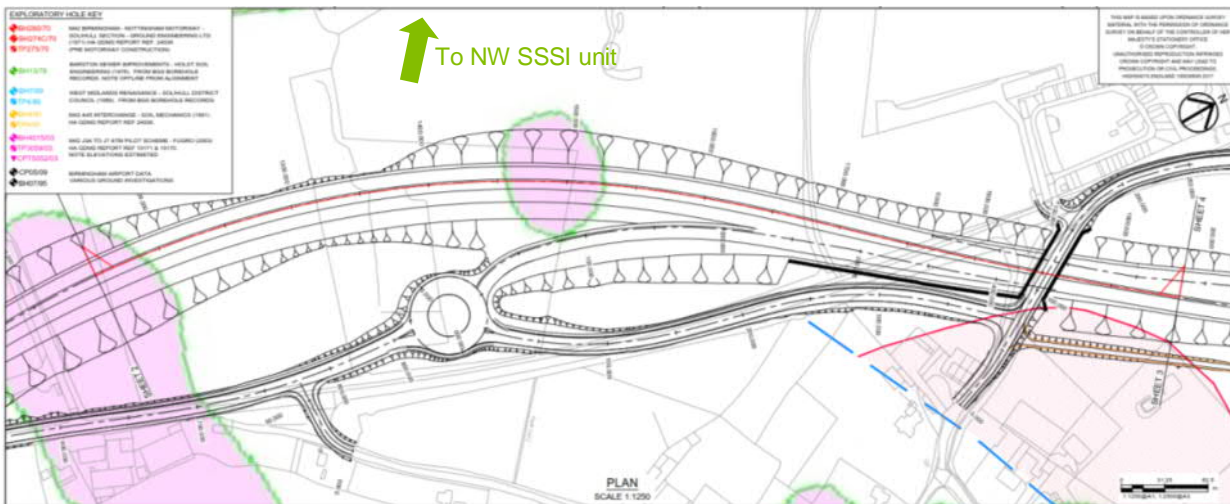


Figure 10. Location of Glacial Sands and Gravels along the proposed link road (shown by Pink shading), in the vicinity of the northwestern SSSI unit.

Figure 11a and 11b show the location of the Ground Investigation works, which were completed in October 2018). The works now include boreholes around the periphery of both SSSI units and within the SSSI units. Those on the periphery of the units are window samples with a standpipe installation to allow monitoring of groundwater levels over time. The standpipes terminate on proving the surface of the Mercia Mudstone Formation. The boreholes within the SSSI units are not long-term installations for monitoring, but have been included to prove the underlying geology and provide a snapshot of groundwater conditions that can be related to the levels around the periphery of the sites.

The proposed monitoring of groundwater levels around the periphery of the SSSIs will help understand the groundwater dependence of the two SSSI units, and hence the likelihood of any adverse impact from the Scheme that would need to be mitigated.

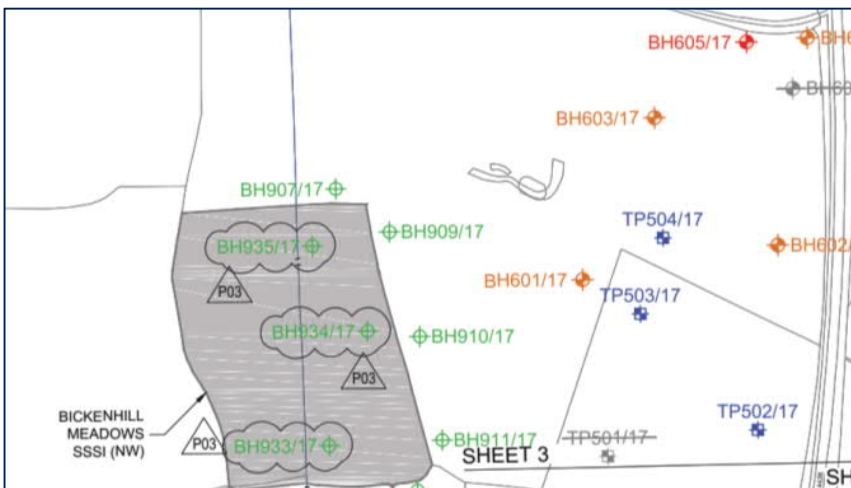
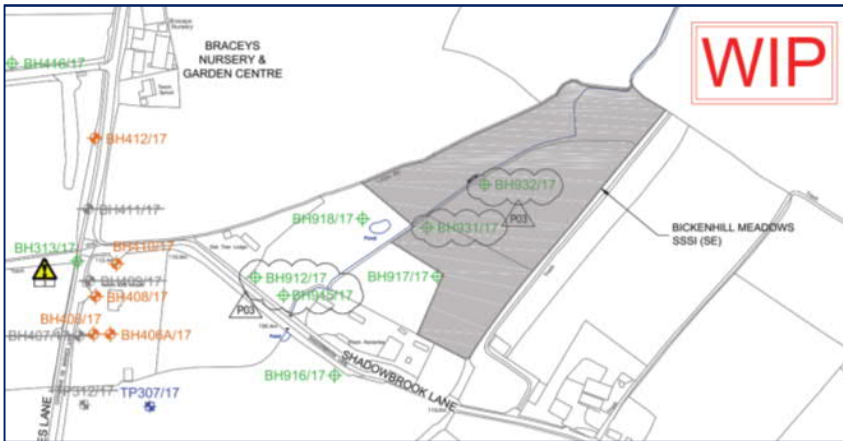


Figure 11a (top) and 11b (bottom) Ground Investigation locations – extended to include the SSSI units. Red – cable percussion boreholes; orange – rotary coring boreholes; green – window sample; blue – trial pit.

9. Soil Saturation Monitoring

During site visits to the SE SSSI unit following heavy rainfall events, it has been apparent that rainfall can periodically accumulate on the ground surface and be slow to drain away. This is particularly the case in depressions and furrows across the site. This supports the assertion that maintenance of wet ground conditions required for many of the grassland species may be rainwater fed to a large extent, perhaps supported by localised out of bank flows very close to the stream, and/or limited groundwater flows from any surrounding glacial sand and gravel deposits. These glacial deposits may act somewhat like a sponge, filling with groundwater in response to rainfall. In the wet meadow at the SE SSSI unit, it appears that the MG4 species are more successful in the saturated furrows across the site, while MG5 species are more successful on the slightly elevated and therefore drier ridges.

To better understand the variability in soil saturation and how long it takes the SSSI sites to drain following heavy rainfall, it was proposed in discussions with Natural England (on site on 26/4/18) to install a series of dipwells on the wet meadow field at the SE SSSI unit and within the NW SSSI unit. Soil water levels and conductivity would then be measured fortnightly within the dipwells over a period of at least 6 months to build an understanding of subsurface moisture conditions, and whether they are indeed largely rainwater fed. While less than six months of monitoring may be available at the point that the Environmental Statement is finalised and the Development Consent Order (DCO) application submitted, the monitoring would continue post submission, with Natural England kept informed with data and technical interpretation. The findings presented in the Environmental Statement would be updated at DCO Examination if necessary, and monitoring could potentially be maintained during construction of the Scheme to assess any impact on the two SSSI units.

Prior to land owner consent being granted for installation of dipwells at the two SSSI units, ground conditions at both sites were inspected visually every fortnight. The streams through both sites had dried up by 1/7/18 and the pond immediately outside the SE SSSI unit had dried up by mid August (13/8/18). At both sites the grass was also straw-like in colour and wilting by late July, and no ground moisture was apparent on any visit between July and early September. As such, if dipwells had already been installed earlier in the summer of 2018, there is a strong likelihood that they would have been dry throughout the period (between mid-May and September) due to the especially dry summer conditions.

Dipwells were installed in the SE SSSI unit on 13-14th August 2018 (see Figure 12a for locations and Photo 18 for an example). A total of 10 dipwells were installed, covering MG4 grassland, MG5 grassland and transitional grassland areas. The dipwells were prefabricated from a perforated plastic pipe of 32 mm diameter. They are sealed above ground to prevent rainwater from filling the pipe. The plastic pipe is perforated at regular intervals along its length on all sides, to allow throughflow of soil water, and to allow equilibration to be achieved with the surrounding water table.



Figure 12a. Locations of dipwells installed in the wet meadow field at the SE SSSI unit

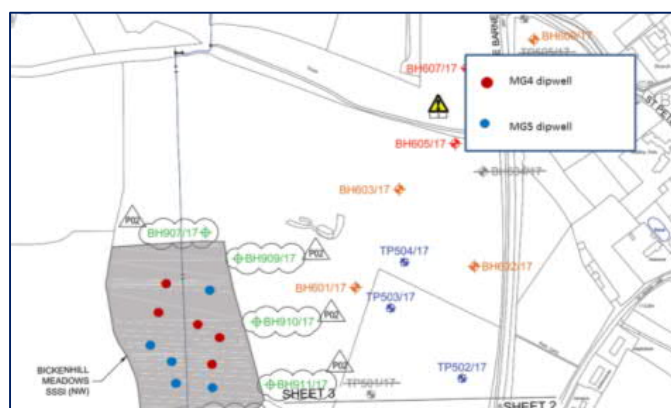


Figure 12b. Locations of dipwells in the NW SSSI unit.

Of the 10 dipwells installed at the SE SSSI unit, 6 were installed to a depth of 90 cm and four to a depth of 50-60 cm (due to difficulty penetrating the substratum with hand held soil augering equipment). Environment Agency Ecohydrological Guidelines⁶ for MG4 grasslands suggest an indicative target mean water table depth range from 35 cm depth in winter to 70 cm depth in summer, and so ordinarily the installed dipwells should be of sufficient depth to monitor the water table for these grasslands. Soil conditions beneath the site were variable, with a mix of upper dark brown sandy silt layers and stiff dark grey clay layers generally encountered to around 50cm depth. Light grey and orange sand layers and gravel layers were commonly found beneath this, including isolated pockets of large cobbles (mix of rounded and angular cobbles, 10-20cm diameter), as well as some layers of blue-grey clay. A full description of the soils encountered during augering at each dipwell as well as further details on location and depth are described in Appendix B.

The dipwells in the NW SSSI unit were installed on 5th-6th September 2018 (see Figure 12b for locations, and an example in Photo 19). Despite sporadic rainfall in the period since the installation of the SE unit dipwells, the ground conditions at the NW unit remained extremely dry with no groundwater encountered during augering of any of the holes. In total, four dipwells were installed to 90 cm depth, two to 70 cm depth, and additional dipwells to 66 cm, 60 cm, 50 cm and 43 cm depth. The shallower depths of some dipwells are a result of impenetrable stiff clay layers being encountered. In general, the top soil at the NW SSSI unit was up to 20cm to 40 cm depth below ground, before trending to extremely stiff, dark grey clay to the base of the dipwells. The main exception were the two dipwells towards the centre of the eastern half of the SSSI (close to the wetter area potentially thought to be a spring), where sand and gravel layers were encountered at depths below 50 cm. Further details are described in Appendix B.

⁶ Environment Agency (2004) Protective and Enhancing Wetlands: Ecohydrological Guidelines for Lowland Wetland Plant Communities.

The dipwells have been monitored fortnightly since installation to capture water table recharge in response to rainfall. The regular measurement of water levels is undertaken using a dip tape inserted into the pipe. Conductivity will be measured using a Hanna Instruments conductivity meter should enough water accumulate in the dipwells to enable measurement. One dipwell at each site has also been fitted with a water level data logger to allow continuous measurement of soil water levels.

Rainfall data from the nearest Environment Agency meteorological stations and/ or the Birmingham Airport Meteorological Station will be obtained to compare with the water level record once a more significant period of monitoring has been undertaken.



Photo 18. Dipwell T2-D at the SE SSSI unit.



Photo 19. Dipwell N2-B on the NW SSSI unit.

10. Ground Investigation Results at the SSSIs

The boreholes shown in the SE SSSI and immediate periphery in Figure 11a were installed in July 2018. The boreholes in the immediate periphery of the NW SSSI unit (Figure 11b) also were installed in July 2018, and those inside the NW SSSI unit in September 2018.

A summary of the preliminary results is given in Table 1.

Table 1 Ground Investigation findings for the SE and NW SSSI units and periphery. [For borehole locations refer to Figure 11a and 11b].

Borehole	Geology Summary	Groundwater strike
SE SSSI		
BH932 (within SSSI)	4m depth - gravelly sand to 0.8m, very sandy clay to 2.25m, sandy clay with weak mudstone fragments to 4m.	Water strike at 2.25m rising to 2.18m after 20 minutes.
BH931 (within SSSI)	3m depth – gravelly sand to 0.8m, sandy slightly gravelly clay to 1.2m, silty clay to 3m.	Water strike at 1.96m rising to 1.8m after 20 minutes.
BH917 (within SSSI)	3m depth – gravelly sand to 0.8m, slightly sandy slightly gravelly clay to 1.75m, sandy clay to 3.0m	Water strike at 2.19m.
BH918 (within nature reserve but not SSSI)	3m depth – fine to coarse sand with some gravel to 1.15m, sandy clay to 1.5m, gravelly fine to coarse sand to 3m.	Water strike at 1.48m.
BH912 (within nature reserve but not SSSI)	4m depth – gravelly sand to 0.8m, sandy slightly gravelly clay to 1.5m, sand to 1.6m, sandy clay to 2.10m, slightly sandy slightly gravelly clay to 2.6m including extremely weak mudstone, sandy clay to 4m.	Water strike at 2.6m, rising to 1.74m after 20 minutes.
BH915A (within nature reserve but not SSSI)	6.4m depth – gravelly fine to coarse sand to 0.8m, sandy gravelly clay to 3.10m, sandy clay to 5.0m, fine to coarse sand to 5.6m, sandy clay to 6.1m, clay tending to extremely weak mudstone to 6.4m	Water strike at 3.10m, rising to 1.8m after 40 minutes.
BH916 (SW periphery, outside of SSSI and LNR, opposite side of Shadowbrook Lane)	6.0m depth – gravelly silty sand to 1.8m, slightly gravelly silty clay to 2.5m, sandy silty clay to 3.5m, interlaminated sandy silt to 4.0m, clay to 5.0m, Mercia Mudstone to 6.0m.	Water strike at 4.0m
NW SSSI		
BH933 (within SSSI)	2.65m depth – sandy gravelly clay to 0.2m, very stiff clay to 0.4m, silt clay to 0.9m, sandy gravelly clay to 1.1m, gravelly silty clay to 1.2m, gravelly silt to 1.5m, Mercia Mudstone to 2.65m.	Water strike at 1.40m.
BH934 (within SSSI)	2.0m depth – stiff slightly gravelly clay to 0.2m, sandy gravelly clay to 1.3m and Mercia Mudstone to 2.0m.	No water strike
BH935 (within SSSI)	2.1m depth – slightly gravelly clay to 0.15m, slightly sandy clayey gravel to 0.9m, gravelly sandy clay to 1.10m, grey sandy clay to 1.3m, sand to 1.4m, Mercia Mudstone to 2.1m.	No water strike
BH907 (northern periphery of SSSI)	2.0m depth – slightly sandy slightly gravelly clay to 0.6m, Mercia Mudstone to 2.0m	No water strike
BH909 (eastern periphery of SSSI)	2.3m depth - slightly sandy slightly gravelly clay to 0.6m, Mercia Mudstone to 2.3m	No water strike
BH910 (eastern periphery of SSSI)	2.7m depth - slightly sandy slightly gravelly clay to 0.6m, Mercia Mudstone to 2.7m	No water strike
BH911 (eastern periphery of SSSI)	2.0m depth - slightly sandy slightly gravelly clay to 0.5m, Mercia Mudstone to 2.0m	No water strike

11. National Vegetation Classification (NVC) Surveys

A Phase 2 NVC survey was undertaken of the identified homogenous stands of grassland vegetation within the Bickenhill Meadows SSSI in summer 2018. The survey followed the standard published methodology (Rodwell, 2006)⁷ and comprised recording a minimum of five quadrats in each identified grassland type and at least one in each parcel of each grassland type. Following this, the data sets identified were matched to the published grassland community types using the keys provided in Rodwell (1992)⁸ and using the software TABLEFIT⁹. The survey was undertaken on the 27th June and the 7th August 2018.

⁷ Rodwell, J. S. (2006) National Vegetation Classification; Users' Handbook. Joint Nature Conservation Committee, Peterborough

⁸ Rodwell, J. S. (ed.) 1992. British Plant Communities. Volume 3. Grassland and montane communities. Cambridge University Press.

⁹ Hill (2015) TABLEFIT Version 2; A program to identify types of vegetation by measuring goodness-of-fit to association tables. Centre of Ecology and Hydrology, Wallingford

The vegetation in all the fields on the days of the survey was tall and coarse and because of this appeared uniform with the subtle changes in ground level apparent earlier in the year masked by the dense growth.

The SE SSSI comprises three fields separated by a small watercourse (dry on the day of the survey); two of the fields are on the eastern side and the third on the western side. A fourth field is not within the SSSI but along with the fields in the SSSI is managed as a nature reserve by Warwickshire Wildlife Trust.

The two fields on the eastern side slope down to the watercourse and the vegetation on the day of the survey was grass dominated (tall and lodging in places) and dry (Photo 20 and 21). Yorkshire fog (*Holcus lanatus*) was abundant with other grasses such as cock's foot (*Dactylis glomerata*), common bent (*Agrostis capillaris*), red fescue (*Festuca rubra*), crested dog's tail (*Cynosurus cristatus*) and meadow fescue (*Schedonorus pratensis*). A range of generally common forbs were recorded and included ribwort plantain (*Plantago lanceolata*), common knapweed (*Centaurea nigra*), bird's foot trefoil (*Lotus corniculatus*) and red clover (*Trifolium pratense*). Less common species included yellow rattle (*Rhinanthus minor*) and tormentil (*Potentilla erecta*).



Photo 20 (left) and Photo 21 (right), typical vegetation in the SE SSSI unit eastern fields.

Seven quadrats were recorded in the two fields, as they were uniform in appearance and structure. The data obtained was run through TABLEFIT and the goodness of fit to the NVC community type MG5; *Cynosurus cristatus* - *Centaurea nigra* was around 83% and classed as very good fit. The second best fit was to the MG5a *Lathyrus pratensis* sub-community type.

The field within the SE SSSI unit on the western side of the watercourse was generally flat but with an apparent rise towards the northern boundary; the grasses did not dominate to the degree they did in the dry fields and there were patches of meadowsweet (*Filipendula ulmaria*) and great burnet (*Sanguisorba officinalis*) (Photo 22 and 23). Meadowsweet and other wetland species such as wild angelica (*Angelica sylvestris*) seemed to be more frequent towards the watercourse where the vegetation was taller and coarser. Interesting species recorded here were betony (*Stachys officinalis*) and tormentil (*Potentilla erecta*). It has been reported that meadow thistle (*Cirsium dissectum*) is also present but this was not found during the current survey.



Photo 22 (left) and Photo 23 (right), typical vegetation in the SE SSSI unit wet meadow field.

Five quadrats were recorded in this western field and along with the data collected from similar vegetation recorded in the NW section of the SSSI (described below) were run through TABLEFIT. The goodness-of-fit to the NVC community type MG4; *Alopecurus pratensis* – *Sanguisorba officinalis* was around 63% and classed as a fair fit. Any variation in the vegetation from topographical variation was masked by the tall growth and a better understanding of this would be obtained once the field has been cut. This will provide information on the relationship of the community boundaries to topography, depth to water and ditch levels, and enable the communities to be tied with soils information to determine the mechanism whereby any vegetation changes are driven.

The NW SSSI unit comprises two fields separated by a small, ephemeral watercourse, which was dry on the day of the survey. The western field appeared to be uniform in structure and was generally a mix of patches of larger forbs such as great burnet (*Sanguisorba officinalis*) and meadowsweet (*Filipendula ulmaria*), and grasses with a range of smaller forbs including several legumes scrambling through the vegetation (Photo 24 and Photo 25). This field appeared to be more diverse than the corresponding field in the SI SSSI unit and here saw-wort (*Serratula tinctoria*), quaking grass (*Briza media*) and devil's bit scabious (*Succisa pratensis*) were recorded in addition to the more typical and commoner forb species. When visited in August 2018, tufted hair grass (*Deschampsia cespitosa*) was the dominant species in this field.



Photo 24 (left) and Photo 25 (right), typical vegetation in the NW SSSI unit western field.

Five quadrats were recorded in the field and along with the data collected from similar vegetation recorded in the SE SSSI unit were run through TABLEFIT. The goodness-of-fit to the NVC community type MG4; *Alopecurus pratensis* – *Sanguisorba officinalis* was around 63% and classed as a fair fit.

The eastern field of the NW SSSI unit was only visited in August and had much coarser vegetation and the dominant grass across large areas was tufted hair grass (*Deschampsia cespitosa*) but with meadowsweet and great burnet also frequent throughout the field. Sedges appeared to be more common in this field and included hairy sedge (*Carex hirta*), false fox sedge (*Carex otrubae*), common sedge (*Carex nigra*) and tufted sedge (*Carex acuta*). Otherwise it was very similar to the western field (Photos 26 and 27).



Photo 26 (left) and Photo 27 (right), typical vegetation in the NW SSSI unit eastern field.

Part way along the western boundary of the field, there was a distinctive change in vegetation and whilst this will have to be shown by survey, it appeared to be delineated by a low spot, possibly linked to the ditch and was demarked by young alders (*Alnus glutinosa*). The vegetation here was dominated by tall rushes including soft rush (*Juncus effusus*), hard rush (*Juncus inflexus*) and sharp flowered rush (*Juncus acutiflorus*), along with sedges with abundant great hairy willowherb (*Epilobium hirsutum*) and in the wettest areas patches of fool's watercress (*Apium nodiflorum*). This is the area considered to be a potential spring in the preceding discussion (Photo 27 and Photo 28).



Photo 27 (left) and Photo 28 (right), typical vegetation in the distinct wetter area within the NW SSSI unit eastern field.

Five quadrats were recorded in this area and the data was run through TABLEFIT. The goodness-of-fit to the NVC community type OV26; *Epilobium hirsutum* community was around 58% and classed as a fair fit. A similar fit was obtained from the MG9 community; *Holcus lanatus-Deschampsia cespitosa* grassland. This community is found in area where the ground is seasonally waterlogged and can be found in association with MG4 grassland but is not usually as species diverse and is tolerant of less free draining soils.

It is clear from the surveys that the two dry grassland fields in the SE SSSI unit fit closely to the MG5 community type and that for the most part, the wetter field in the SE unit and the two fields in the NW unit fit to the MG4 community type. Within the wetter fields, there may be localised variation and this seems to have been picked up by the walkovers earlier in 2018 but by summer the tall vegetation was masking much of this variation.

12. Conceptual Model

The baseline information described in this Technical Note, along with the extended Ground Investigation results¹⁰, vegetation surveys (described in Section 11) and further observations of subsurface conditions derived during dipwell installation have informed the development of a conceptual model of each SSSI unit. The purpose of the conceptual model is to illustrate the hydrological processes that have been observed or inferred from the collated evidence in order to better understand how the two SSSI units maintain suitable conditions to support the sensitive grassland species contained within. The two conceptual models are presented in Appendix C as Figures C1 and C2. The following provides an explanation to accompany the two conceptual models.

SE SSSI Unit

The SE SSSI unit consists of a wet meadow field to the west, two dry meadow fields to the east, and wet alder woodland in the north of the site. The wet western field and dry eastern fields are separated by a small watercourse with a ditch-like character, which is a tributary of Shadow Brook. A further ditch is located on the northwestern boundary of the site. Both are ephemeral but would flow towards the northeast of the site where they combine and continue north to Shadow Brook. The central ditch was observed to flow between around November 2017 to May 2018, but no regular flow has ever been observed in the western ditch and it is believed to act more like a soakaway with lateral flow only following extremely heavy or persistent rainfall. The ground elevation rises either side of the central ditch, but with greater relief on the eastern side. The low point of the site is in the alder woodland to the north. The western field contains ridge and furrow micro-topography from past agricultural practices, while the eastern field rises steadily away from the watercourse and does not have such obvious ridges or depressions.

The geological logs for the boreholes, probeholes and trial pits on and in the vicinity of the SE SSSI unit show that across much of the area there is a surface layer of sand between 0.8 m and 1.15 m thick. This is typically underlain by a layer of sandy clay, resting on the Mercia Mudstone. In some of the ground investigation boreholes a second thin sand layer has been proved below the sandy clay layer. The results of the Ground Investigation indicate that there is a 'bowl' of mixed superficial deposits that reaches up to 6m thickness below ground level, and which is centred on the Shadowbrook Meadows Nature Reserve, immediately SW of the SSSI. From this central point the superficial deposits extend across the SSSI to the northeast where thicknesses of up to 3m were recorded, and west/southwest into the arable field where thinner deposits of around 1.2m were recorded adjacent to Catherine de Barnes Lane (Figures 13A and 13B).

The superficial deposits are able to support groundwater and therefore provide a local water source to the surrounding grassland communities. Boreholes within the SSSI in the late summer, after a prolonged period of dry weather, indicated groundwater levels between 1.8 and 2.25 m b.g.l, while much shallower levels would be expected in winter and spring. The bowl of superficial deposits is surrounded by, and underlain by, low permeability Mercia Mudstone (where deeper water strikes were generally recorded e.g. over 6m b.g.l adjacent to Catherine de Barnes Lane). Figure 13A shows the likely contours of the surface of the Mercia Mudstone, and indicates that it is present at a shallow depth in the vicinity of the proposed road alignment at approximately 110 m AOD (2m b.g.l). The surface of the Mercia Mudstone falls to the north east and at Shadowbrook Lane is at a level of 102.84m AOD (6.1m b.g.l). Groundwater flows through the more permeable units (i.e. the sand and gravel) in the superficial deposits above the Mercia

¹⁰ Socotec, 2018, Factual Report on Ground Investigation, Report E8005-18

Mudstone, generally following the topography of the land towards the SE SSSI Unit and the northeast. As such, the SSSI receives groundwater flows from the east, south and west, and this ultimately flows towards the north-eastern area of the SSSI in the wet alder woodland. The watercourse flowing through the centre of the SSSI Unit is ephemeral, but may provide a contribution to the supply of water for recharging the thicker superficial deposits beneath the SSSI unit during the late autumn-winter-spring period when it has been observed as flowing. It is likely that the watercourse is in connectivity with the superficial deposits due to the shallow depth below ground level and the possible flow from groundwater back to the watercourse at the downslope extent of the SSSI unit.

The superficial sands, clays and gravels across the SE Unit and the surrounding area are thought to allow drainage through to the Mercia Mudstone, at which point water will tend to flow laterally over these less permeable deposits to the northeast and ultimately out of the SSSI at its lowest point. More constant streamflow has been observed in the watercourse at this location in the SSSI than elsewhere, presumably because it is supported by the lateral groundwater flows at this low point. During the late autumn-winter-spring period the water table is expected to generally be high due to greater amounts of rainfall and low rates of evapotranspiration, resulting in the predominant recharging of groundwater in the superficial deposits at a rate that exceeds flows to the northeast. Due to the permeability of the superficial deposits, surface saturation and surface water ponding is expected to be limited to the periods immediately following heavy rainfall when the infiltration capacity is exceeded. However, a high water table may also encourage saturation of the upper soil layers during rainfall events, especially in the spring when monthly rainfall amounts may be at their lowest.

The watercourse flowing through the centre of the site will also help to prevent over-saturation of the surface layers by draining away excess water. The flows in this ephemeral watercourse are thought to be maintained from a mix of subsurface flow pathways and occasional surface drainage pathways during periods when surrounding soils are fully saturated. It is possible that in extreme rainfall and runoff events, the watercourse may overtop and cause very localised out of bank floods (which are unlikely to spread fully across the wet meadow noting that along part of the ditch is a shallow earth bund likely created when the channel was dug or last cleared out), although this is expected to be a rare occurrence and the WWT were unaware of this ever occurring. The ditch on the northwestern boundary of the SSSI may occasionally flow following receipt of surface water runoff and sub-surface egress from the arable field that rises away to the west of the SSSI. This ditch is usually ponded and may already act as an infiltration trench providing some additional recharge to the wet meadow field through the surface sand layer.

MG4 grasslands are found in the furrows across the western wet meadow field of the SSSI. They are dependent on wet conditions being maintained in the surface layers through winter and spring, but are relatively intolerant of flooding and prolonged saturation. MG5 grasslands are found in drier locations and so are located on the ridges across the wet meadow field and across the eastern dry meadow. It is considered likely that the water table in winter and spring is generally just below the surface, and rises regularly after rainfall to temporarily intersect the furrows, whereas it will rarely intersect the ridges. The water table intersection of furrows will be short-lived as the water drains away through the superficial deposits, although water tables are kept reasonably high throughout the winter and spring by the groundwater recharge that also occurs.

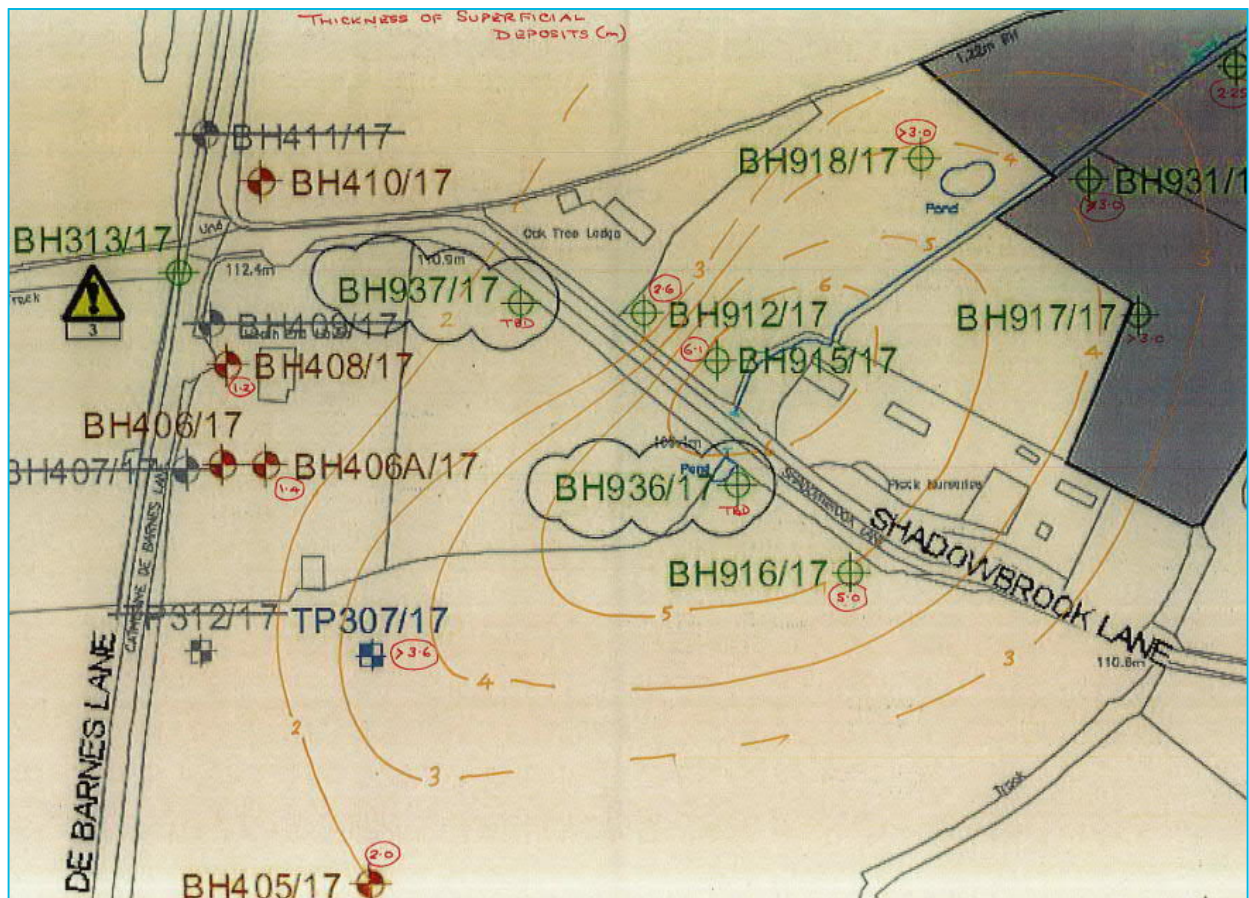
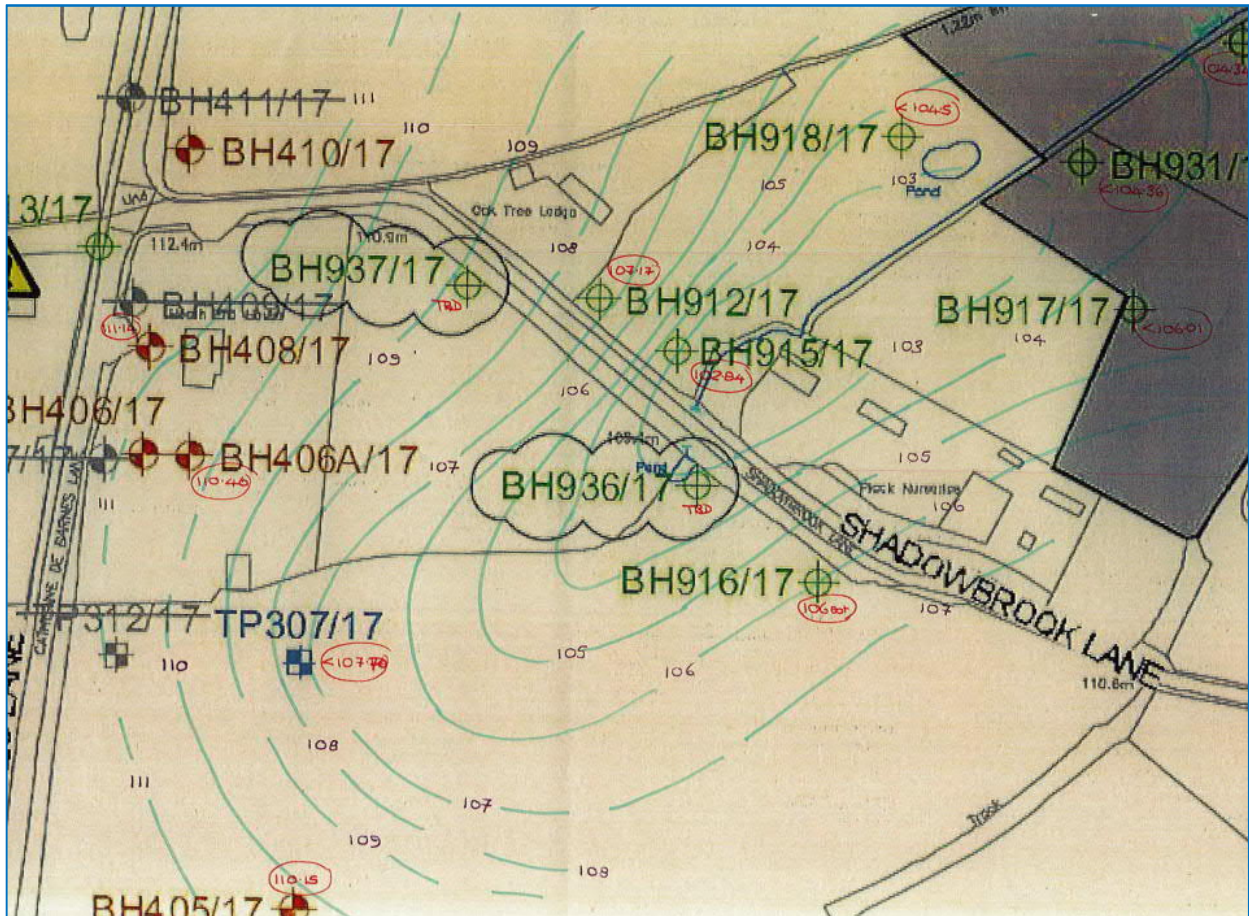


Figure 13A (top) Contours showing top of the Mercia Mudstone (mAOd) and 13B (bottom) Contours showing thickness of superficial deposits(m). Plots are based on available information (October 2018).

The eastern dry meadow field has a greater relief than the western wet meadow field, and so rainwater is encouraged to drain more rapidly away downslope and towards the central watercourse and therefore fails to maintain a sufficiently high water table for MG4 communities. There is also an absence of furrows and depressions which reduces the potential for the hydrological conditions seen on the wet meadow where MG4 communities have developed. As a result, the dry meadow is wholly dominated by MG5 grasslands. A Cadent gas pipeline is orientated southwest to northeast through the dry meadow field. This may cause some interruption of groundwater flows from the east of the SSSI with potential for preferential flow to occur northeast along the pipeline's backfill material. There was some evidence of a change in plant types along the route of this gas main during a site visit in April, although no significant difference in grass species across the Site was observed when the NVC survey was undertaken in the summer, suggesting that the effect may be seasonal and insufficient to provide MG4 plants a sufficient competitive advantage over MG5 species.

In the summer and autumn, when there is typically reduced rainfall and greater evapotranspiration rates, the water table beneath the SSSI is lowered (i.e. to more than 90 cm b.g.l as observed from dipwell monitoring in late summer 2018 and dry ditches). However, although the water table is generally deeper than the furrows in the wet meadow field, the grassland communities may be supported through the drier summer months by deeper groundwater in the superficial deposits rising by capillary action to the root zone. This may be important for sustaining the plant communities across the SSSI, but is less important in determining the mix of species and grassland types.

Potential Impact of the Scheme on the Hydrology of the SE SSSI Unit

The geometry and orientation of the 'bowl' of superficial deposits (Figures 13A and 13B) that underlie the SE SSSI unit thin out in a westerly direction towards the Proposed Link Road. Along the Proposed Link Road, the superficial deposits are generally less than 2 m thick and consist principally of clay rather than the more permeable sands and gravels. There is no evidence that the cutting will intersect significant thicknesses of sand or gravel, which could provide groundwater recharge to the SSSI. The majority of the cutting will intersect the low permeability Mercia Mudstone. As it is considered that the cutting will not intersect permeable superficial deposits which could provide groundwater to the SSSI, it is concluded that the cutting will have no significant impact on groundwater flows to the SE SSSI Unit.

While interception of groundwater inflows by the cutting is considered insignificant, the route of the Proposed Link Road will result in the severance of approximately 21%¹¹ of the surface water catchment to the SE SSSI Unit. This severed area currently drains to the ditch in the arable field southwest of the SSSI and is thought to flow beneath Shadowbrook Lane and into the watercourse that flows northeast through the SSSI. However, the connectivity between the surface water catchment upstream of Shadowbrook Lane and that downstream of this road could not be established through non-intrusive survey. Any culvert may be buried beneath silts and this would limit surface water flows across Shadowbrook Lane. As such, direct rainwater is considered the most significant source of water to recharge the superficial deposits beneath the SSSI unit. Nevertheless, given the size of the surface water catchment that would be potentially cut off, it is possible that interruption of flows along this watercourse when it is flowing (which has been observed in winter and spring) could have an influence on groundwater levels beneath the SE SSSI Unit. Reduction in recharge from the watercourse to the surrounding ground would depress groundwater levels and potentially encourage more rapid draining of the soil layers and reduced surface water ponding. In wet springs this may not be significant, but in drier years it is possible that the lower water table could encourage MG5 grass species in place of MG4 species.

Long term rainfall records for the region obtained from the Environment Agency's Coleshill rain gauge at SP 21102 86956 are shown in Figure 14A and 14B for the 16 year period between 1998 and 2014. The rainfall total for water years (Figure 14A) ranges from 424 mm to 886 mm per year, with an average of 705 mm per year. There is clearly significant year-on-year variability in rainfall inputs to the SSSIs and

¹¹ Catchment area based on the latest design 3c (October 2018).

their catchment, and as such it is anticipated that the loss of 21% of the surface water catchment would fall within this range of natural fluctuations in water availability from rainfall.

Although, the loss of a proportion of surface water catchment may not reduce water availability significantly in a typical year, over the longer term it could reduce the resilience of the SSSI unit by exacerbating the impact of the reduced catchment area. However, despite there being some particularly dry years, such as 1998-1999, 2004-2005 and 2010-2011, in the rainfall record (Figure 14A), these have not occurred in consecutive years (at least between 1998 and 2014) suggesting that. In addition, although Figure 14B shows that the number of days of heavy rainfall greater than 30 mm / day has declined between 1997 and 2014, the longer term averages (monthly and yearly) appear less affected and remain stable implying no obvious long term trend of declining rainfall (Figure 14B).

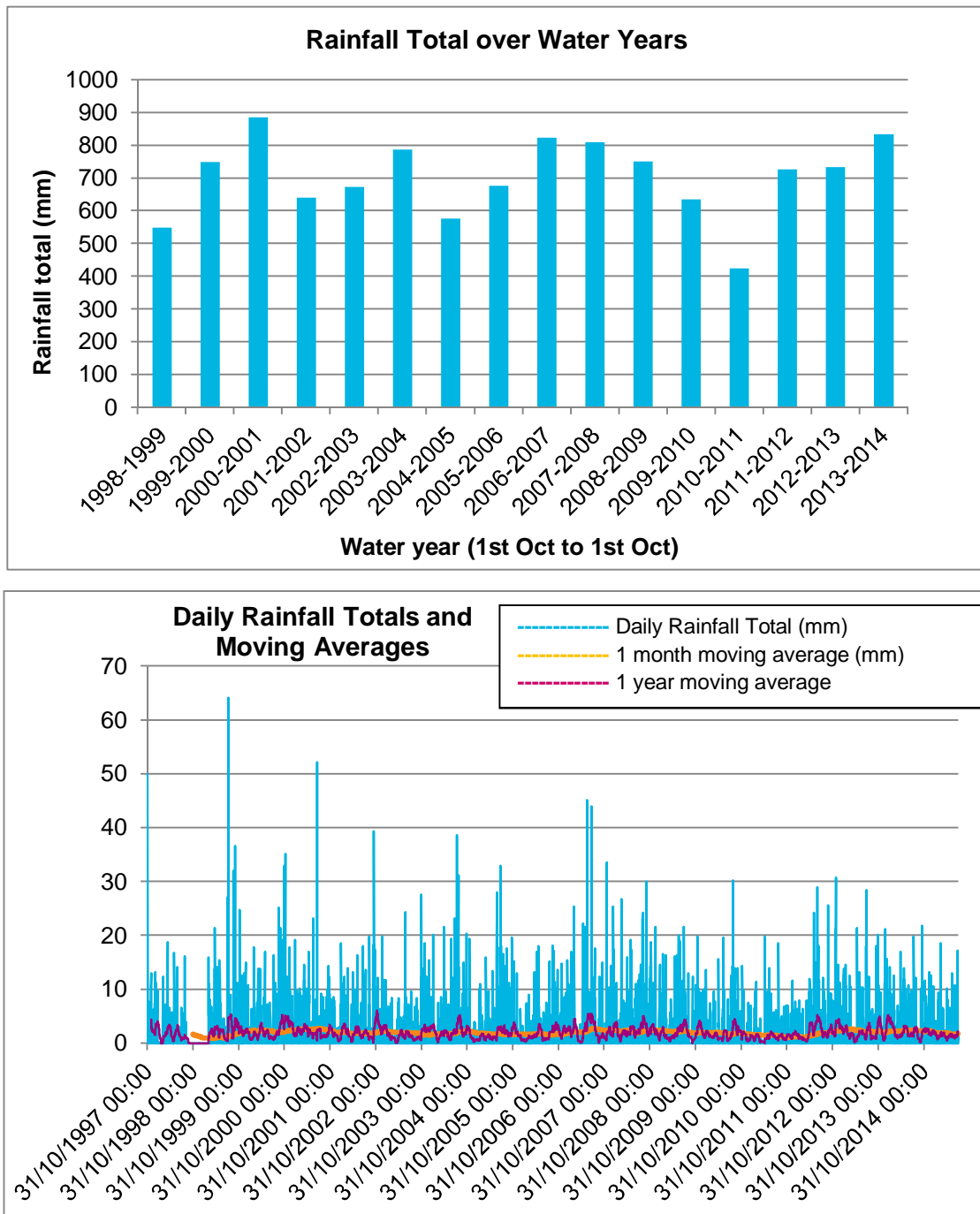


Figure 14A (top) Rainfall total for water years at Coleshill raingauge (1998-2014); and 14B (bottom) Daily rainfall totals and moving averages at Coleshill raingauge (1998-2014). Data provided by the Environment Agency.

To mitigate the potential impact of cutting off a portion of the surface water catchment, it is proposed that flows in the watercourse upstream of the Proposed Link Road are intercepted and pumped to the SSSI side. Water would be intercepted by a collection drain that would drain via gravity beneath the road to a sump on the eastern side, and then be pumped from the sump into the northern ditch close to Shadowbrook Lane. The collected surface water would then follow the existing northern ditch along the SSSI boundary where water would soak away to recharge the superficial deposits beneath the SSSI Unit. Check dams constructed using natural materials would be provided along the ditch to encourage water to pool and drain to ground and recharge the water table. Excess water would flow to the northeast and back into the central watercourse, as it does currently. By recharging the superficial deposits beneath the Site using this ditch there is reduced potential for water to bypass the SSSI and thus is likely to provide greater benefits, especially in drier years. Appendix D presents the proposed mitigation design. Using this approach, no significant loss of water to the SE SSSI unit is predicted. Furthermore, given the uncertainty over whether surface water from the south of Shadowbrook Lane can cross beneath the road to the northern side and into the SSSI, the mitigation solution may actually improve the water supply to the SE SSSI Unit.

NW SSSI Unit

The NW SSSI unit consists of two grassland meadow fields separated by an ephemeral watercourse with a ditch-like character that flows north through the site to eventually reach Low Brook. The elevation of both fields rises relatively rapidly away from the watercourse and both contain a series of ridges and furrows which support both MG4 and MG5 grasslands.

The Ground Investigation indicates that Mercia Mudstone is located at a shallow depth of between 0.5 and 0.6 m b.g.l to the east of the Site between the Proposed Link Road and the SSSI boundary, but is slightly deeper beneath the SSSI itself (i.e. up to 1.4 m b.g.l). Similar to the SE SSSI Unit, the Ground Investigation thus implies that there is also a 'bowl' of thicker superficial deposits across the NW SSSI Unit surrounded by shallower Mercia Mudstone, but that the thickness of the superficial deposits is much less than what is found at the SE SSSI Unit. The shallow Mercia Mudstone around the periphery of the NW SSSI Unit and between it and the cutting for the Proposed Link Road suggests that there is not a significant groundwater pathway that would be interrupted by the Scheme.

In the winter and spring, because the Mercia Mudstone is relatively shallow and has a low permeability, it will not require much rainfall to cause a high water table to develop in the overlying deposits beneath the NW SSSI Unit. The greater amount of stiff clay substrate across this SSSI Unit also impedes infiltration and encourages frequent saturation of the near surface soil layers, particularly in hollows and depressions. There may be pockets of sands and gravels with improved drainage, but in general infiltration is expected to be slow. Due to the thinner superficial deposits rainwater recharge onto these slowly permeable upper substrate layers is considered to be the principal mechanism supporting the higher water table during the winter and spring. As in the SE SSSI Unit, MG4 grasses occupy the depressions and furrows across the Site, which are periodically, but not permanently, saturated. MG5 grass species tend to occupy the more elevated and drier ridges which are less regularly saturated.

The ephemeral central watercourse helps prevent over-saturation of the grassland communities by draining away excess water, although there is a relatively pronounced artificial bund along sections of the bank on both sides, which will block overland flow and sub-surface flow (by compacting the soil beneath and making it less permeable). A particularly wet area is located behind the bund towards the centre of the eastern field, and this has a distinct vegetation community (classified as NVC OV26/MG9), including young alders and rushes. This area has a discrete substrata with more sands and gravels noted during dipwell installation than at adjacent locations. The combination of the more permeable substrata and the adjacent bund downslope means that this area acts like a sump, retaining groundwater and surface water runoff and resulting in a different vegetation community than elsewhere on the SSSI Unit. There is no evidence that this feature is supported by a spring, that it extends outside the boundary of the SSSI, or that it is supported by groundwater flows from further east. As the Proposed Link Road cutting to the east

is predominantly in the impermeable Mercia Mudstone, it is predicted that the Scheme will not influence the hydrogeology of this localised feature.

In the summer and autumn when there are higher evapotranspiration rates and lower amounts of rainfall, the water table within the SSSI will be depressed towards the Mercia Mudstone. With no significant groundwater flow contributing to this SSSI Unit, the water table is reliant on rainfall recharge. Sub-irrigation and capillary rise through the thin superficial deposits above the Mercia Mudstone may provide some moisture to the root zone, but the water table is likely to be low throughout this period, other than the area with the OV26/MG9 plant communities.

Potential Impact of the Scheme on the Hydrology of the NW SSSI Unit

Due to the shallow Mercia Mudstone deposits between the Proposed Link Road and the SSSI, there is no significant groundwater pathway between the two that would be disturbed by construction of the cutting. A maximum of 5% of the surface water catchment to the east would be cut off by the proposed development, but this area is not well connected to the site other than through limited surface and sub-surface flows, and is not likely to significantly influence the flows along the central watercourse which drains from the south/southwest. The Site is also underlain only by relatively thin superficial deposits, containing more clay than found across the SE SSSI Unit, which also suggests that rainfall is the predominant factor controlling hydrological conditions on the Site, suitable for the formation of the grass communities that are found.

There is also no evidence that the particularly wet area with distinct vegetation in the eastern field has a hydrogeological connection that extends beyond the SSSI, or that any disruption would be caused to this feature by the proposed road cutting. Instead, this feature appears to be a consequence of an isolated pocket of more abundant sand and gravel holding water that is impounded by the artificial bund, which inhibits drainage to the watercourse.

Overall, it is considered that based on the available data it is unlikely that the Scheme would have any significant adverse effects on the hydrology of the NW SSSI Unit, and thus no mitigation measures are needed to protect the hydrology of this SSSI unit from the road construction. However, it is recommended that the monitoring of surface saturation conditions by the network of dipwells is continued.

Limitations

The conceptual models presented here are based on the best available data at the time of writing in October 2018. Monitoring of groundwater levels is ongoing for the boreholes that are located around the periphery of the SSSIs, and for the dipwells that have been installed within the SSSIs. It is anticipated these will support the initial interpretations which indicate that rainwater recharge is the dominant mechanism driving water table levels in both SSSI units, albeit with the hydrology of the SE SSSI also being supported by surface water recharge from the central and northwestern watercourses. Initial monitoring data gathered to date currently reflects only the summer and early autumn seasons only, when water tables have been low following a summer of particularly dry conditions. If additional monitoring requires any changes to the interpretation in this technical note a revision will be issued.

Two further boreholes are still to be installed between the SE SSSI and the Proposed Link Road cutting, and these will enable the geometry of the 'bowl' of superficial deposits at the site to be finalised. As described above, the disruption of groundwater flows is expected to be insignificant at the SE SSSI Unit based on current data, and so mitigation is focused on mitigating the loss of surface water catchment in order to replicate the natural recharge that surface water provides. As above, if additional monitoring requires any changes to the interpretation in this technical note a revision will be issued.

13. Summary and Recommendations

The Scheme comprises a new dual carriageway link road to link a new junction south of M42 Junction 6 to Clock Interchange to the southwest of the Birmingham National Exhibition Centre. This would be an approximate length of 2.4 km and located to the west of the M42 motorway, close to Catherine de Barnes Lane. Much of the carriageway would be within cutting with varying depths below ground level, up to a maximum of 10m.

The Bickenhill Meadows SSSI is located in two units situated either side of the proposed link road cutting. The SSSI is designated for its species-rich grassland and includes areas of wet meadows and wet alder woodland. Small streams run through each SSSI unit, and are tributaries of the Shadow Brook and Low Brook, respectively. Wet ground conditions need to be maintained in the SSSIs, especially in the spring, to ensure the preservation of the important grassland habitats that the SSSI is designated for.

An investigation has been undertaken, and monitoring is continuing, to determine the importance of direct rainfall, surface water runoff and groundwater flows in maintaining the hydrological conditions needed to support the designated grasslands, and to predict how the construction of the new link road in a cutting could potentially impact the two SSSI Units. This has included extension of the Ground Investigation for the scheme to include eight additional boreholes within and immediately around the SE SSSI, as well as a further eight boreholes in and immediately around the NW SSSI unit. Dipwell monitoring has also commenced to monitor water table levels at each SSSI unit and how these change over time.

On the basis of the data gathered at the time of writing in October 2018, a conceptual model has been produced for each SSSI Unit to illustrate how the hydrology of each site functions and how the grassland communities are maintained.

The NW SSSI unit appears to be most dependent on direct rainwater recharge to maintain its water table at a suitably high level in the winter and spring to support MG4 grass species. Low permeability Mercia Mudstone is at shallow depth around the periphery of the site and prevents any significant groundwater flow between the Proposed Link Road and the SSSI. Superficial deposits are also thinner than across the SE SSSI Unit with greater amounts of lower permeable clay and limited sands and gravels, which help to reduce infiltration and maintain surface saturation. Around 5% of the surface water catchment will be cut off by the development, but this portion of the catchment is not well connected to the SSSI Unit (as the main flow pathway would be subsurface flow) and so is unlikely to significantly alter the flow in the watercourse that flows occasionally through the Site. As no significant adverse effects on the Unit's hydrology are predicted no mitigation measures are proposed, although as a precautionary measure ongoing monitoring of vegetation and surface saturation conditions using dipwells will be continued.

The SE SSSI unit has deeper superficial deposits which stretch out in a wide 'bowl' around the site. There will be groundwater movement within the granular layers in these thicker superficial deposits, which will generally flow into the SSSI from the south, north, and west and then out towards the northeast. The water table at the Site is maintained through winter and spring by a combination of this groundwater flow, rainwater recharge and potentially recharge flows along the central watercourse. Analysis of the thickness and spatial extent of the superficial deposits indicates that they thin out towards the Proposed Link Road cutting. There is no evidence that the proposed cutting will intersect significant thicknesses of sand or gravel in the thin superficial deposits at this location, which could be contributing to groundwater recharge of the SSSI. The majority of the cutting will instead intersect the low permeability Mercia Mudstone, and so it is concluded that the cutting will have no significant adverse impact on the hydrogeological conditions of the SSSI.

More significant is the loss of around one fifth of the surface water catchment to the west of the Proposed Link Road. While the amount of water lost could be within that expected with natural climatic variability 'year on year', it cannot be confirmed that this would not have consequences for the sensitive grassland species in a given year or over a number of consecutive 'drier' years in terms of depressing the water table to the extent that surface conditions become drier, especially in the spring. As such, a mitigation

approach has been proposed whereby the water lost from the surface water catchment is collected adjacent to the Proposed Link Road and conveyed to the existing ditch that runs along the northwest border of the SSSI. Water would then seep from this ditch into the surface sand layers and drain through to the SSSI, thereby maintaining the full water supply to the grassland communities. Using this ditch rather than the central ditch is likely to allow greater recharge of the superficial deposits which it is considered will help the SSSI be more resilient during drier years.

It is proposed that the vegetation communities are monitored at both sites during construction and during initial operation to ensure that there is no detrimental impact resulting from the scheme. This will be augmented by the continued monitoring of water table levels. Should any adverse effects be discovered then further mitigation would need to be implemented. Further details on mitigation are described below.

14. Mitigation Hierarchy

During the site meeting with Natural England on 26/04/18 it was requested that options are presented for the approaches that may be taken in the event that the Scheme results in an adverse effect upon the SSSI. This may be the case at the SE SSSI unit due to the loss of approximately 21% of the surface water catchment. In accordance with best practice the mitigation options would follow the mitigation hierarchy, which seeks to avoid, reduce (i.e. mitigate) or offset (i.e. compensate) for any adverse impact.

At the current stage of design it is acknowledged that it is highly unlikely that the horizontal or vertical alignment of the proposed link road could be altered to avoid potential effects on the SSSI, as the road has already been moved as far east as possible as part of earlier optioneering work to maximise the distance from the NW SSSI unit. Accordingly, the approaches need to focus on options for mitigation and compensation.

A potentially significant adverse effect would comprise alterations to the type or extent of the grassland communities that are the interest features of the SSSI. This may occur as a result of changes to the existing hydrological regime. In the event that a significant impact to the interest features of the SSSI is considered likely then options for mitigation or compensation may include the following, which are listed below in Table 2 in order of preference with regards to Natural England’s hierarchy of mitigation approach:

Table 2 Mitigation Options for the SSSI Units in hierarchical order

Option (in order of preference)	Mitigation Type	Mitigation Description
1	Avoid and Reduce	Measures to maintain the existing hydrological regime of the SSSI. This may include the pumping of water across the cutting to replicate the existing natural water supply to the SSSI. This is the best outcome for the SSSI as water supply would be maintained.
2	Reduce	Physical changes within the SSSI to extend the existing habitat types. This would involve carefully planned and localised changes to the topography of the SSSI, and would be based on detailed modelling of the existing vegetation communities. As an example, the approach could seek to extend the topographical variations (such as deeper depressions and furrows) that have established the existing pattern of vegetation communities, to compensate for potential reduction in groundwater and surface water inflows.
3	Offset	Establish habitats similar to the interest features in land immediately adjacent to the SSSI (or otherwise at another location entirely). The aim would be to create a parcel of land with a varied topography and a related hydrological regime, and to establish grassland using green hay from the SSSI. This is an offsetting solution and so is the worst case for the existing SSSI.

All of the approaches above would be informed by ongoing monitoring of the SSSI grasslands to ensure that they are effective. An options appraisal for these various approaches is provided in Table 3. At the time of writing (October 2018) the options listed apply to both SSSI units. As discussed above, the

conceptual model indicates that the northwest SSSI unit would likely be unaffected by the Scheme, but ongoing monitoring will be continued.

A further mitigation option was previously proposed in discussion with Natural England. This was to implement measures to re-store natural flow along streams flowing through the SSSI units by re-routing each stream through the low point of each valley and restoring a more natural planform. However, there are limitations as to what could be done within the application boundary, and after further consideration and appraisal of the conceptual model it is thought that improved drainage could potentially cause the sites to dry out further. As such, the option has not been included in the options appraisal.

For the SE SSSI unit, the conceptual model indicates that a bowl of superficial deposits extends between the SSSI unit and the Proposed Link Road, but that the new cutting will not intersect significant superficial deposits that would hold significant groundwater. However, a significant portion of the surface water catchment would be intersected by the new road. The preferred mitigation scenario is to maintain the existing hydrological regime of the SSSI unit using an engineered solution to pump water to an existing ditch on the northwestern boundary of the SSSI.

The remedial measures should be designed to maintain as far as possible the water conditions in the SSSI. In this circumstance, this solution should include the following measures:

- Installation of a collection drain to capture the surface water from the portion of catchment that is being cut off by the Scheme (i.e. collecting surface flows between the Proposed Link Road and Catherine de Barnes Lane to the west). The collected water would drain via gravity beneath the road to a sump, and then be pumped from the sump to the northwestern ditch, adjacent to Shadowbrook Lane. Approaches for extending residence time of water in the ditch would be considered (e.g. baffles), thereby allowing the water to drain through to the sand layer within the SSSI; and
- Regular groundwater level monitoring of the boreholes and dipwells in and around the SSSI should be carried out prior to, during and following construction of the cutting and the implementation of any mitigation measures to assess the effectiveness of the measures.

Table 3 Potential Hydrological Impacts on Bickenhill Meadows SSSI – Mitigation Options Appraisal

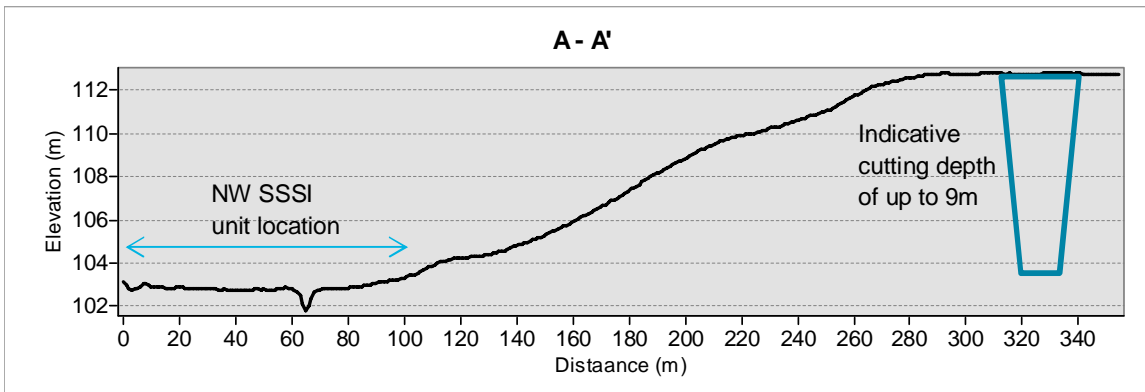
Mitigation Option (in order of preference)	Description	Mitigation Type	Implications				
			Design	Third Party and Land Ownership	Planning and Deliverability	Future Maintenance	Cost
<p>1. Maintain the existing hydrological regime of the SSSI.</p>	<p>This may include the pumping of water to the SSSI units. For the SE unit the ditch on the northwestern border of the site would be used to maintain existing 'natural' water supply that has been interrupted by the cutting</p>	<p>Reduction of impact</p>	<p>This option would require new infrastructure to collect water from the catchment area that has been lost and to pump it up to an existing ditch running alongside the SSSI. Access would also be required.</p>	<p>The location of new infrastructure is yet to be determined and may require land take currently outside of the application boundary.</p>	<p>The application boundary and scheme description would potentially need to be amended to ensure any infrastructure associated with this measure could be constructed, operated and access provided for long term maintenance purposes.</p>	<p>The new pumping network and soakaway would need to be regularly maintained with access provided.</p>	<p>Capital costs associated with the new infrastructure and operating costs associated with operating and maintaining it.</p>
<p>2. Physical changes within the SSSI to extend the existing habitat types.</p>	<p>This would involve carefully planned and localised changes to the topography of the SSSI, and would be based on detailed modelling of the existing vegetation communities. As an example, the approach could seek to extend the topographical variations (such as deeper depressions and furrows) that have established the existing pattern of vegetation communities, to compensate for potential reduction in groundwater and surface water inflows.</p>	<p>Offsetting impact</p>	<p>Unlikely to require any changes to the infrastructure design. A detailed Habitat Enhancement Plan would need to be prepared.</p>	<p>The greatest opportunity would be on the NW site that is owned by BAA. There may be some options for the SE Unit that is owned and managed by WWT, although less so. Other landowners may be affected. Both BAA and WWT (as well as NE) would need to be carefully consulted on the Habitat Enhancement Plan to ensure it can be agreed and delivered.</p>	<p>The current application boundary incorporates the extents of land designated within the boundary of the SSSI, within which it is expected that these measures could be delivered and managed without requiring additional land beyond that already identified.</p> <p>Scheme description would need to be amended to incorporate these measures.</p> <p>Although works may be of a soft nature, the use of some equipment and small plant cannot be ruled out. This would require Assent from NE and permission from the landowners. Experience with BAA to date is that this may not be straight forward and could even be objected to or require acceptance of unreasonable levels of liability.</p>	<p>It would be expected that any changes to the SSSIs would need to be carefully monitored for 3 years +.</p>	<p>Costs associated with the development of the Habitat Enhancement Plan and its implementation including monitoring.</p>

Table 3 Potential Hydrological Impacts on Bickenhill Meadows SSSI – Mitigation Options Appraisal

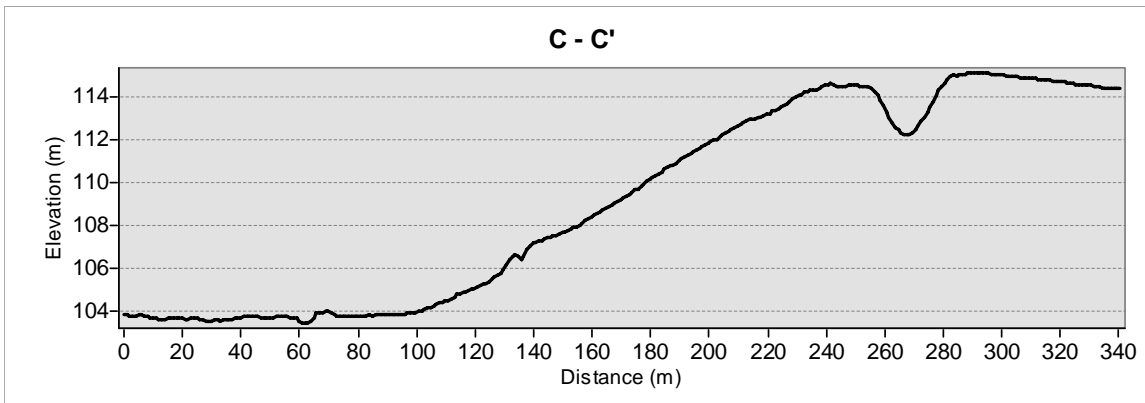
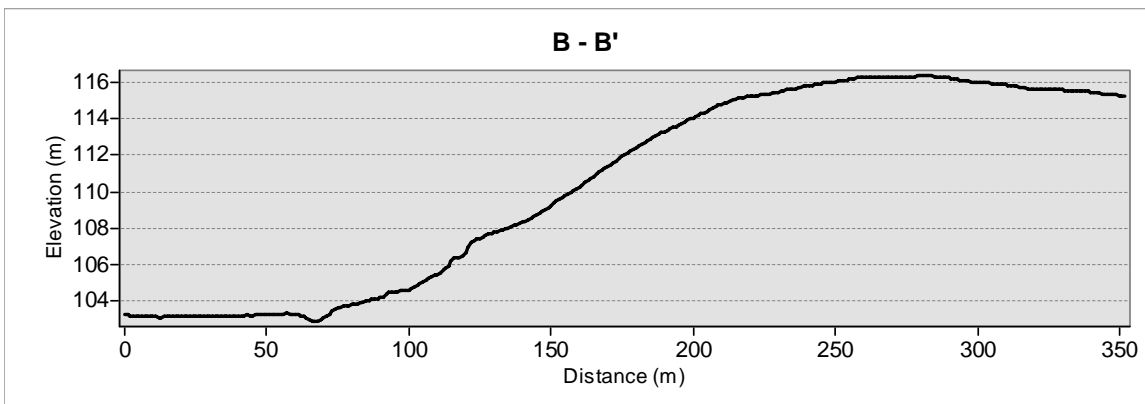
Mitigation Option (in order of preference)	Description	Mitigation Type	Implications				
			Design	Third Party and Land Ownership	Planning and Deliverability	Future Maintenance	Cost
<p>3. Establish habitats similar to the interest features, either in land immediately adjacent to the SSSI or at a new site.</p>	<p>This would include creating a parcel of land with a varied topography and a related hydrological regime, and establishing grassland using green hay from the SSSI.</p>	<p>Offsetting impact</p>	<p>The conditions of the SSSI would be re-created, ideally from land parcels flanking the brooks in/out of the SSSI, while avoiding significant risk of impacts from the proposed link road. Requires careful design, alterations to topography and specialised planting in consultation with NE.</p> <p>A detailed Habitat Management Plan would likely be required to demonstrate to the relevant bodies how these habitats would be established and managed in the long term.</p>	<p>Discussions with landowners would need to be advanced, as their land would either need to be secured by way of prior agreed purchase to implement these measures, or via the DCO as essential land take for mitigation purposes.</p> <p>Utilising the NW Unit, and assuming some tasks will require the use of equipment and plant, discussions with BAA would be required to understand any safeguarding issues that may limit how the work is undertaken.</p>	<p>The application boundary and scheme description would need to be amended to ensure this mitigation could be implemented.</p> <p>Although works may be of a soft nature, the use of some equipment and small plant cannot be ruled out. Permission will be required from the landowners. Experience with BAA to date is that this may not be straight forward and could even be objected to or require acceptance of unreasonable levels of liability.</p>	<p>Maintenance of site would be undertaken on an annual basis under a management / legal agreement that would be needed in perpetuity. This could be adopted by the land-owner or a third party via the legal agreement</p>	<p>Cost associated with the compulsory purchase of land, development of a Habitats Enhancement Plan and its implementation and any post works monitoring.</p>

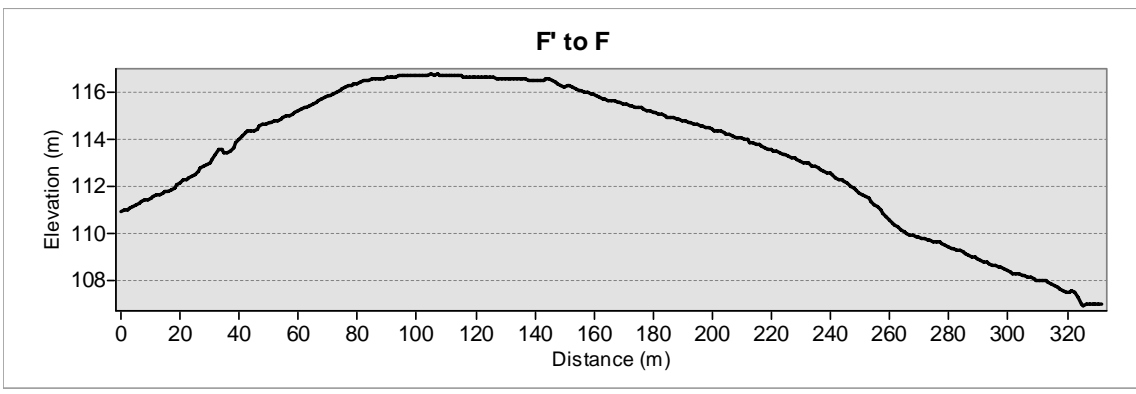
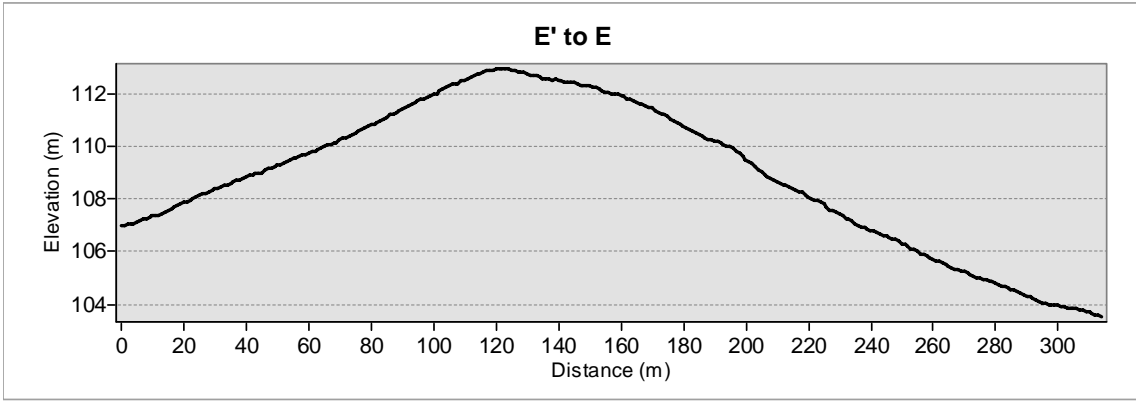
Appendix A: Sections

NW SSSI unit

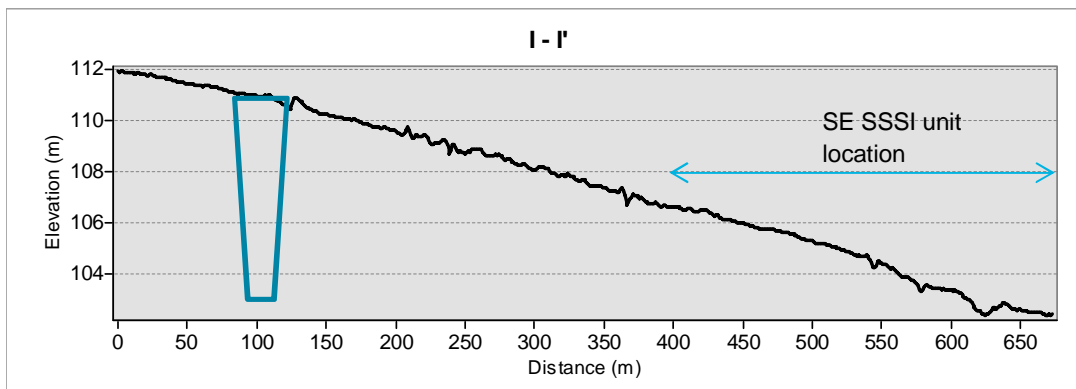
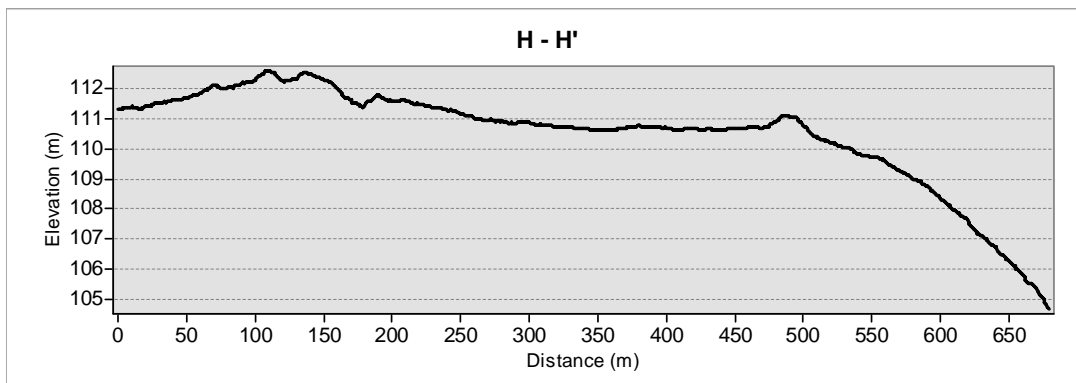
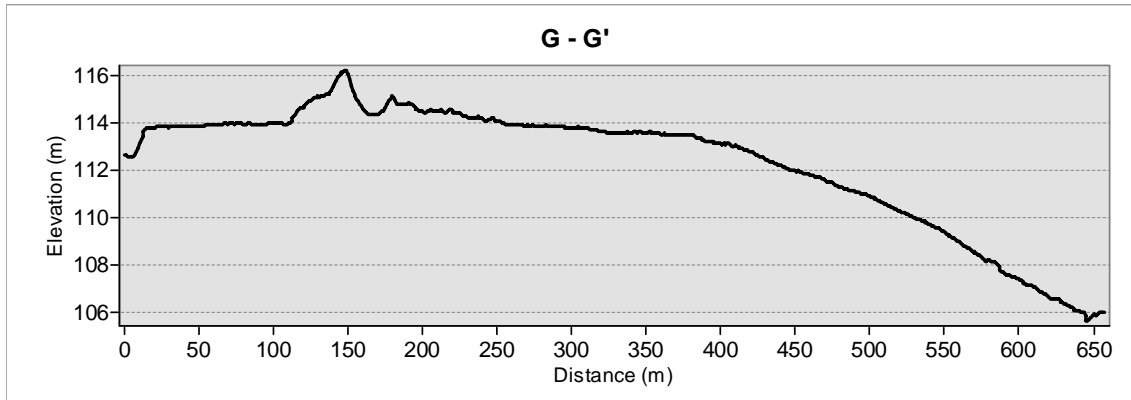


Note. Indicative cutting of up to 9m depth shown in blue.

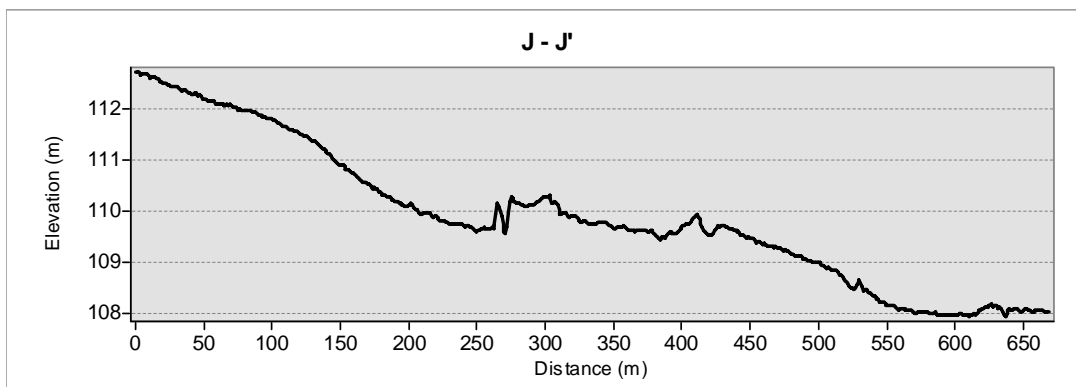


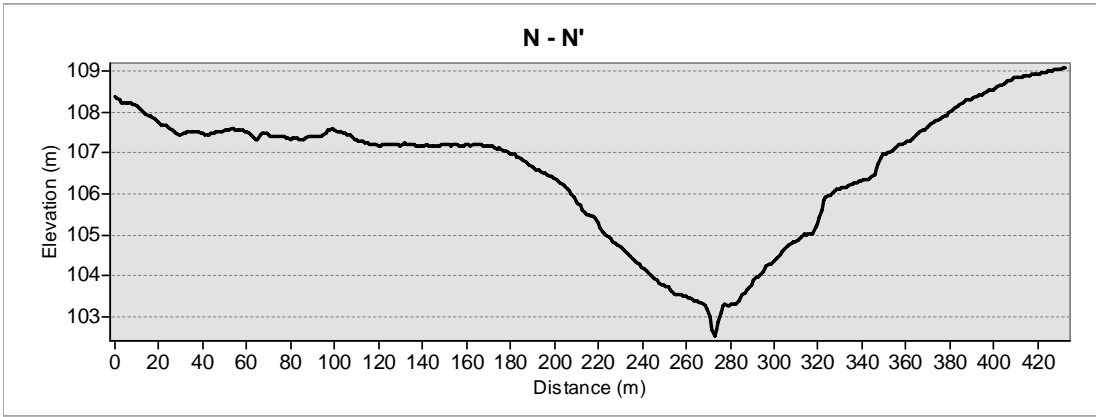
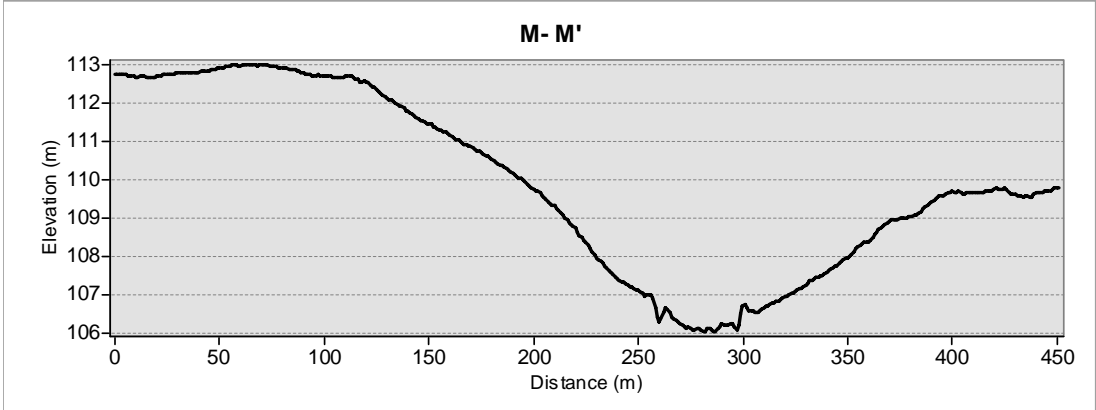
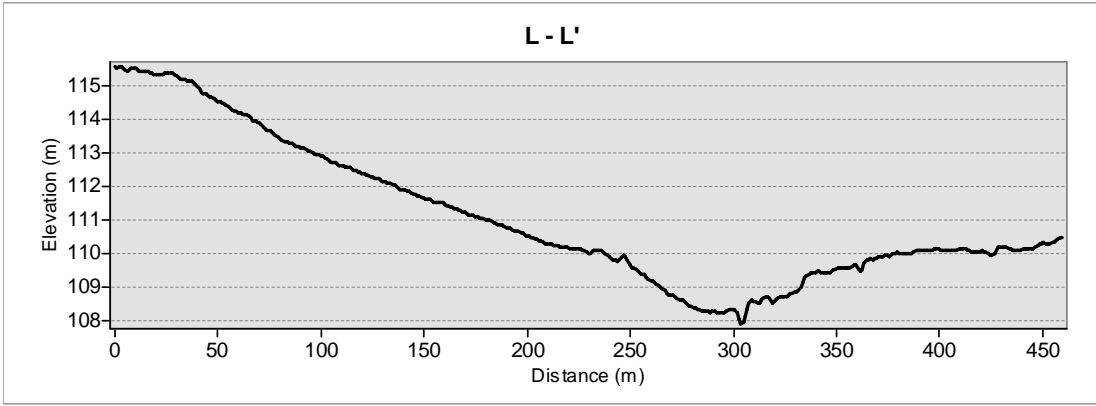
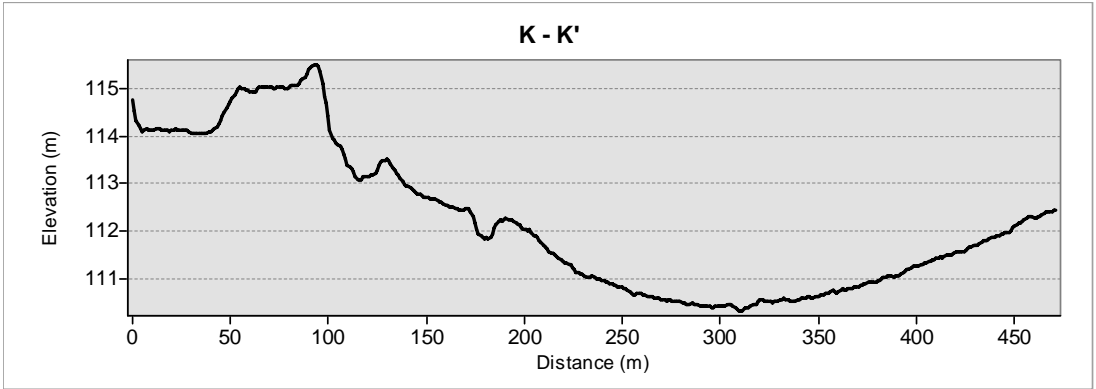


SE SSSI unit



Note. Indicative cutting of up to 8m depth shown in blue in this topographic section.





Appendix B: Dipwell Details and Soil Descriptions

Table A1 Location, depth, soil description and initial data from the dipwell installation and monitoring

SE SSSI Unit									
Site	Latitude, Longitude	Soil Description / Notes	Depth (m bgl)	Grassland	Manual/Logger	14/08/2018	16/08/2018	31/08/2018	13/09/2018
T1A	52.432467, -1.724967	Top soil silty sand dark brown to light brown, semi-fibrous. Gradual transition to lighter grey sand less fibrous and becoming much drier at 50cm, where it was not possible to penetrate with handheld equipment.	0.50	MG4	Manual	Dry	Dry	Dry	Dry
T1B	52.4326, -1.72465	Topsoil is dark grey semi-fibrous fine silt continuing to 35cm depth, then trending to stiff dark grey (mottled with brown) clay without roots which continues to 45cm depth. Sandy clay from 45cm-50cm with some large cobbles up to 10cm diameter. This layer could not be penetrated.	0.90	MG4	Manual	Dry	Dry	Dry	Dry
T1C	52.432733, -1.72425	Dark brown silty sand with a few small cobbles and slightly moist to 45-50cm, here it becomes a drier, greyer layer of silty sand. At 80cm becomes dark grey-black slightly mottled moist sand, and at 90cm black sandy clay. Various cobbles (mix of rounded and angular) throughout the 90cm, from 2-7cm diameter.	0.90	MG5	Logger	Dry	Dry	Dry	Dry
T1D	52.432817, -1.72415	Dark brown silty sand with abundant cobbles (mix of rounded and angular), semi-fibrous to 40-50cm. Then transitions to sandy clay with a fewer, larger cobbles. Sand becomes light grey/white from 55cm before transitioning to orange. Becomes more clay dominated and mottled from 80cm.	0.90	MG4/MG5 transition	Manual	Dry	Dry	Dry	Dry
T1E	52.43305, -1.7231	Brown sandy silt topsoil to 20cm, before becoming greyish mottled clay with brown specks. Surface of ground much damper here compared to elsewhere with more clay near the surface. Hit light grey pure sand at 55cm turning to orange sand at 60cm. Became moister again at around 75cm.	0.90	MG5	Manual	Dry	Dry	0.88 m bgl	Dry
T2A	52.432583, -1.7251	Grey to brown dry silty sand, semi-fibrous, compact to 35cm. Drier, greyer, semi-fibrous compact coarse sand from 35-46cm	0.50	MG5	Manual	Dry	Dry	Dry	Dry

Table A1 Location, depth, soil description and initial data from the dipwell installation and monitoring - continued

SE SSSI Unit									
Site	Latitude, Longitude	Soil Description / Notes	Depth (m bgl)	Grassland	Manual/Logger	14/08/2018	16/08/2018	31/08/2018	13/09/2018
T2B	52.432717, -1.72475	Brown silty sand, very dry and containing cobbles (3-5cm). Extremely compact sand at 45cm, impenetrable with hand tools.	0.45	MG5	Manual	Dry	Dry	Dry	Dry
T2C	52.432817, -1.724333	Dark brown silty sand, very dry and semi-fibrous to 30cm, before transitioning to compact and very solid sand that could not be penetrated.	0.50	MG4	Manual	Dry	Dry	Dry	Dry
T2D	52.432933, -1.724033	Brown silty sand topsoil, dry and semi-fibrous. Distinct layer of large rounded cobbles of 5-12cm diameter at 30-40cm depth. Then becomes dark brown sand at 55cm. Gradually becomes clayey at 70cm, this is blue grey clay mottled with brown strands and very cobbly.	0.90	MG4/MG5 boundary	Manual	Dry	Dry	Dry	Dry
T2E	52.433133, -1.723183	Brown sandy silt, semi-fibrous, dry with big cobbles (rounded and up to 10cm diameter) to 25-30cm where it becomes clayey. Trends to light grey coarse sand at 45cm, still with cobbles (4-5cm diameter). At 65cm transitions to light grey sand with cobbles and then to silvery blue sandy clay from 75cm.	0.90	MG4	Manual	Dry	Dry	0.86 m bgl	Dry

NW SSSI Unit									
Site	Latitude, Longitude	Soil Description / Notes	Depth (m bgl)	Grassland	Manual/Logger	14/08/2018	16/08/2018	31/08/2018	
N1A	52.436970, -1.7336798	Topsoil is dry, dark brown semi-fibrous fine silt continuing to 40cm depth, then trending to stiff dark grey silty clay without roots. Small cobbles of maximum 3-4cm in diameter at 45cm depth, then trending to lighter grey clay towards the base of the dipwell at 70cm.	0.70		Manual	n/a	n/a	n/a	Dry
N1B	52.436772, -1.7337987	Topsoil is dry, dark brown semi-fibrous fine silt continuing to 35cm depth, then trending to stiff dark grey (mottled with brown) clay without roots which continues to 45cm depth. Sandy clay from 45cm-50cm depth with some large cobbles up to 10cm diameter. This layer could not be penetrated.	0.50		Manual	n/a	n/a	n/a	Dry

Table A1 Location, depth, soil description and initial data from the dipwell installation and monitoring - continued

NW SSSI Unit									
Site	Latitude, Longitude	Soil Description / Notes	Depth (m bgl)	Grassland	Manual/Logger	14/08/2018	16/08/2018	31/08/2018	13/09/2018
N1C	52.436503, -1.7339474	Topsoil is dry, dark brown semi-fibrous fine silt with cobbles of 3-4 cm in diameter. Topsoil transitions to red-brown sandy clay at 25cm, which continues through to the base of the dipwell at 90cm. Some cobbles of up to 5cm diameter found throughout the sandy clay.	0.90		Manual	n/a	n/a	n/a	Dry
N1D	52.436349, -1.7337130	Topsoil is dry, dark brown semi-fibrous fine silt with cobbles of 3-4 cm in diameter. Topsoil transitions to very stiff, mottled grey-brown clay at 30cm. The clay continues but contains angular cobbles of up to 7-8cm diameter from 60cm, with an impenetrable layer (potentially a very large rock) at 70cm depth.	0.70		Manual	n/a	n/a	n/a	Dry
N1E	52.436169, -1.7336258	Topsoil is dry, dark brown semi-fibrous fine silt with cobbles of 3-4 cm in diameter. Transitions to extremely stiff thick dark grey-brown clay at 20cm, which continues to the base at 60cm, which was a solid impenetrable layer.	0.60		Manual	n/a	n/a	n/a	Dry
N2A	52.436950, -1.7330327	Topsoil is dry, dark brown semi-fibrous fine silt with some angular cobbles of 4-5cm diameter. At 15cm depth it transitions to a stiff, dry, dark brown clay layer. This continues to 60cm depth where there is dark brown sandy clay which is extremely stiff. This continues to the base at 90cm.	0.90		Manual	n/a	n/a	n/a	Dry
N2B	52.436527, -1.7329470	Topsoil is dry, dark brown semi-fibrous fine silt. At 25cm depth it transitions to a stiff semi-moist, dark brown clay layer. From 32cm depth there are small infrequent gravel stones of less than 1cm diameter. These gravels are increasingly frequent from 50cm and increase in size to between 2-5cm in diameter. Clay transitions to light grey fine sandy clay from 60cm, with increasingly coarse sand at 75-80cm. From 80cm-90cm the sand content decreases and there is light grey stiff clay.	0.90		Logger	n/a	n/a	n/a	Dry

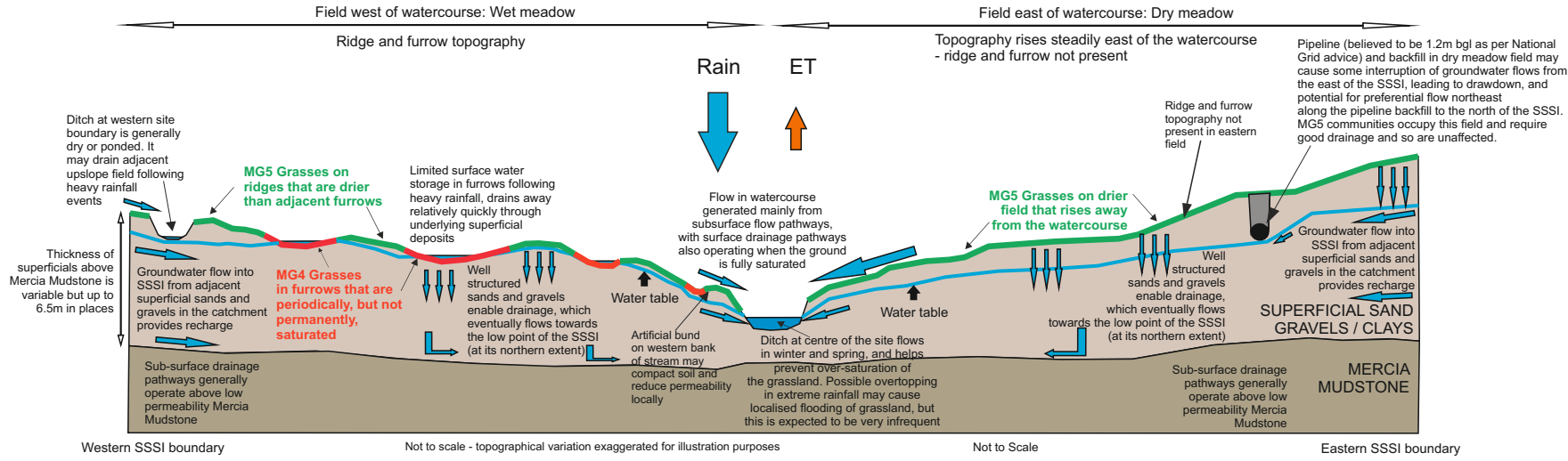
Table A1 Location, depth, soil description and initial data from the dipwell installation and monitoring - continued

NW SSSI Unit									
Site	Latitude, Longitude	Soil Description / Notes	Depth (m bgl)	Grassland	Manual/Logger	14/08/2018	16/08/2018	31/08/2018	13/09/2018
N2C	52.436663, -1.7332404	Topsoil is semi-moist, dark brown semi-fibrous fine silt. Transitions to moist mottled grey clay at 24cm depth with red lines along root lines. Small gravels appearing from 30cm depth, around 2-3cm in diameter. Larger gravels from 40cm, with a mix varying between 1 and 10cm diameter. More sand gradually mixed with the clay before it transitions to blue sandy clay with gravel at 50cm depth. At 60cm depth there is another blue clay section without sands and gravels, before becoming increasingly sandy again from 75cm. It remains semi-moist blue sandy clay until the base at 90cm.	0.90		Manual	n/a	n/a	n/a	Dry
N2D	52.436312, -1.7330807	Topsoil is dry, dark brown semi-fibrous very fine silt. Transitions to extremely stiff thick dark grey-brown clay at 10cm. This continues to 43cm which was the base of the dipwell due to a hardened layer (which could be rock) that could not be penetrated.	0.43		Manual	n/a	n/a	n/a	Dry
N2E	52.436105, -1.7330966	Topsoil is dry, dark brown semi-fibrous very fine silt. Transitions to extremely stiff thick dark grey-brown clay at 15cm. Clay changes to light grey at 60cm, and continues to the base of the dipwell where it was too hardened and compact to break through.	0.66		Manual	n/a	n/a	n/a	Dry

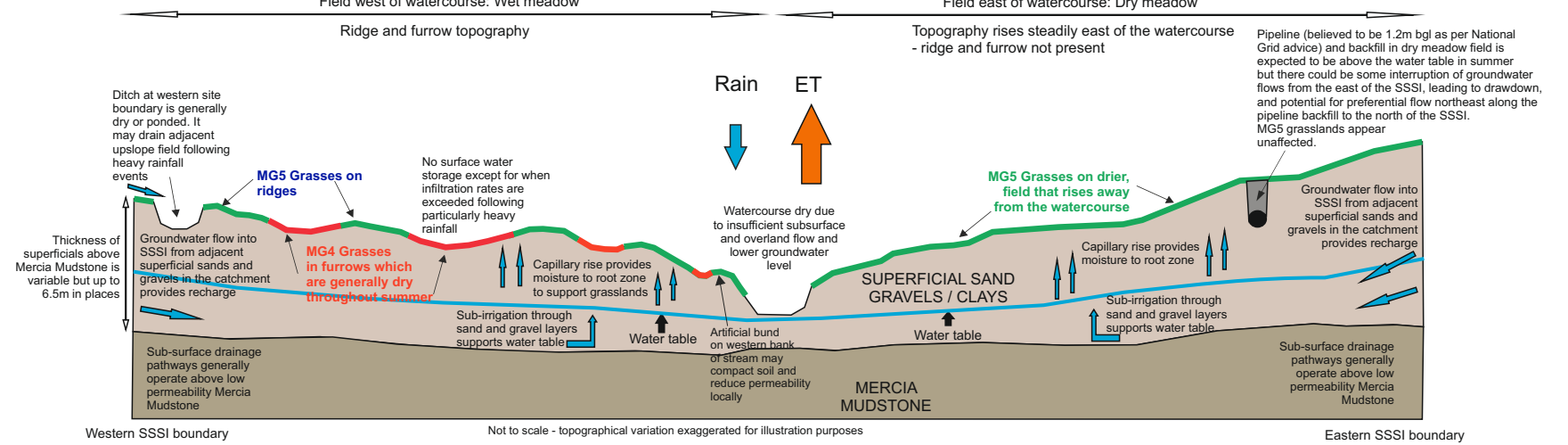
Appendix C: Conceptual Models

A. SE SSSI CONCEPTUAL MODEL

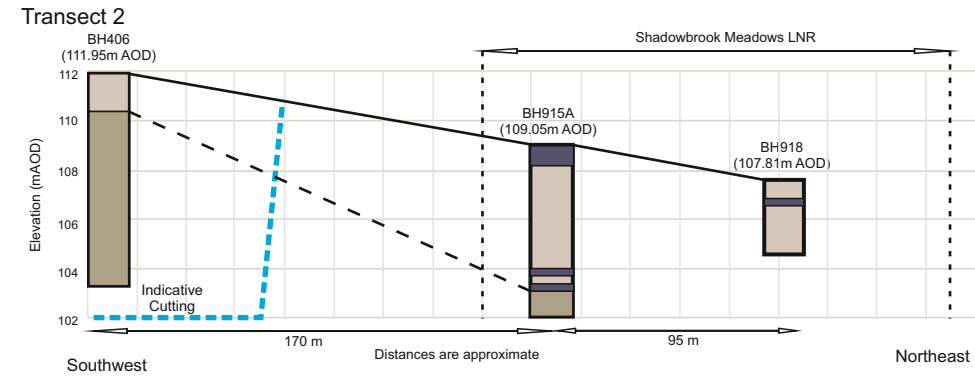
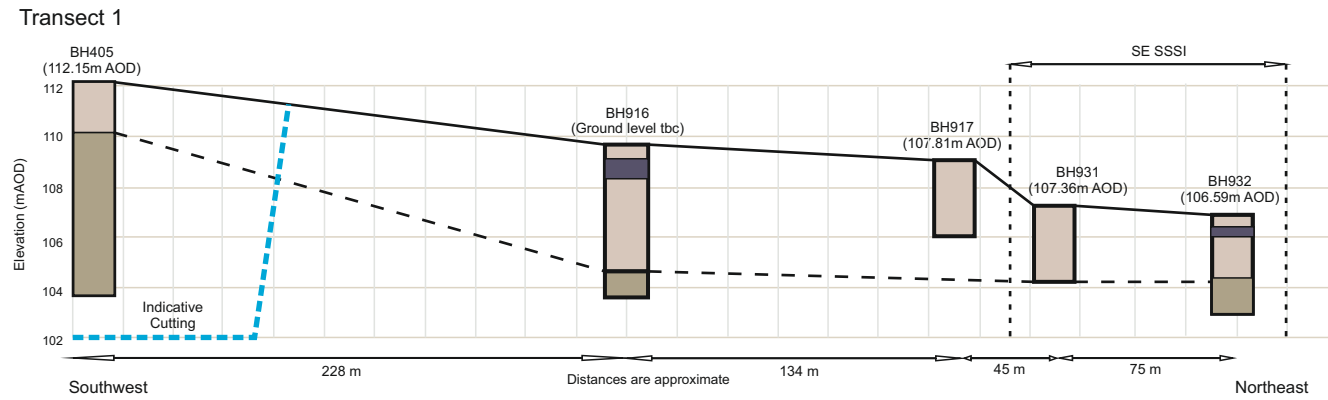
WINTER / SPRING



SUMMER / AUTUMN



B. SE SSSI GEOLOGY CROSS SECTIONS



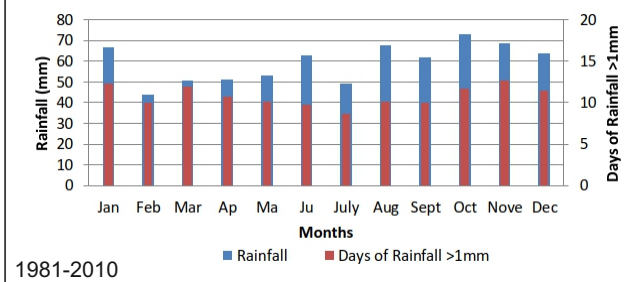
WET MEADOW - SE SSSI



CENTRAL DITCHCOURSE - SE SSSI



C. COLESHILL RAINFALL



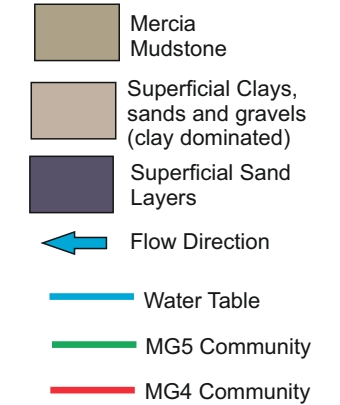
D. CATCHMENT LOSS



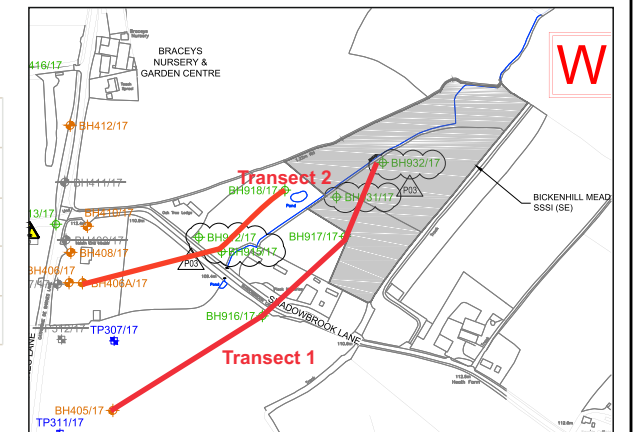
E. DIPWELL MONITORING LOCATIONS



CONCEPTUAL MODEL & CROSS SECTION LEGEND



GI & TRANSECT LOCATIONS



Purpose of Issue	PURPOSE OF ISSUE
Client	Highways England Major Projects Rge Cube 199 Wharfside Street Birmingham B1 1RN
Working on behalf of	

Project Title	M42 JUNCTION 6
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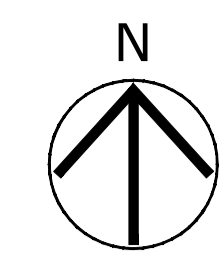
Drawing Title	BICKENHILL MEADOWS SE SSSI UNIT CONCEPTUAL MODEL
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Designed	TJ	Drawn	TJ	Checked	OT	Approved	GC	Date	03/10/18
Internal Project No	60543032		Suitability						
Scale	@ A3	Zone		X					
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HE551485 -ACM		-EGN		P01
M42_SW_ZZ_ZZ		DR_HD_001		
Location		IType	T Role	TNumber

Appendix D: Proposed Mitigation Design for SE SSSI Unit

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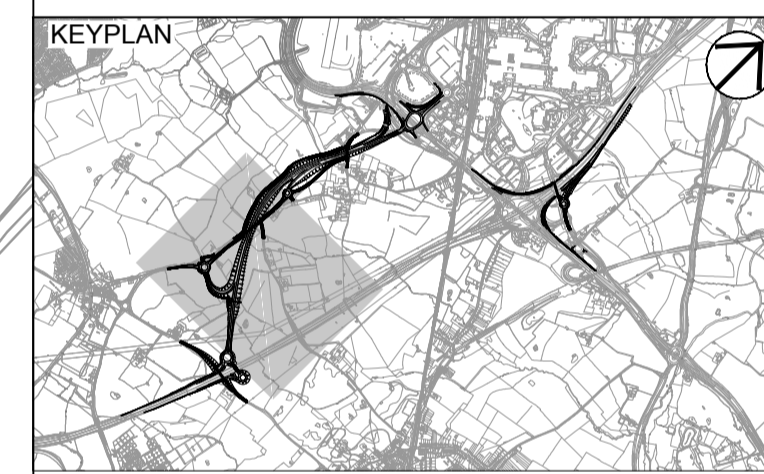
1. Installation of a cut-off drain located near the base of the slope but above the road drainage to intercept surface water runoff from the west of the road that would otherwise have flowed towards the SSSI. The intercept water would collect in a sealed sump at the base of the cutting, which conveys water beneath the carriageway to a sealed pumping sump on the eastern side of the cutting. The sumps should be sealed to prevent the ingress of road runoff and should be separate from the road drainage, the quality of which could impact on the quality of the SSSI.

2. Water accumulating in the sump should be pumped to discharge to an existing trench located immediately north west of the SSSI.

3. Existing ditch to be retained acting as a recharge trench. This existing ditch would return water to the wet meadow field within the SSSI. No physical works to the ditch is currently envisaged.

LEGEND

	EXTENT OF SCHEME
	EXTENT OF SSSI
	ASSUMED SSSI DRAINAGE CATCHMENT
	APPROXIMATE CATCHMENT AREA CUTOFF BY NEW ROAD
	CUTOFF DRAIN
	SEALED SUMP
	PUMPED WATER
	EXISTING DITCH



Revision Details	By	Date	Suffix
	Check		

FOR INFORMATION

Client: Highways England
 The Cube
 199 Wharfside Street
 Birmingham
 B1 1RN
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Working on behalf of

Project Title
M42 JUNCTION 6 IMPROVEMENTS

Drawing Title
BICKENHILL MEADOWS SSSI PUMPING SOLUTION SKETCH OPTION 2

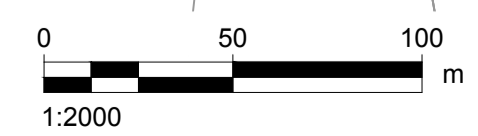
Designed PC	Drawn OM	Checked	Approved	Date 12/09/18
Internal Project No. 60543032	Suitability S2	Scale @ A1 Zone 1:2000 M42		

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Drawing Number Highways England PIN HE551485	1 Originator -ACM	1 Volume -HGN-	Rev P01
Location M42_GEN_ZZ_ZZ			1 Type 1 Role 1 Number -DR-SK-0075



Plot Date: 11 October 2018 09:43:32
 File Name: C:\P\WORKING\AECOM\EU\MATTHEW.HARDY\3747\HE551485-ACM-HGN-M42_GEN_ZZ_SK-CH-0075

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Appendix B - Technical Note HE551485-ACM-HML-Z1_JN_J5_ZZ-TN-CH-0002

TECHNICAL NOTE

Project:	M42 Junction 6 Improvement				
Title:	M42 Junction 5A Location Assessment				
Doc ID:	HE551485-ACM-HML-Z1_JN_J5_ZZ-TN-CH-0002				
Date:	October 2018	Version:	P01	Status:	S2

Revision	Date	Prepared by	Reviewed by	Approved by
P01 S1	October 2018	M. Edroos	J. Farooq	I. Bamforth
P01 S2	October 2018	M. Edroos	J. Farooq	I. Bamforth

1 Introduction

- 1.1 As part of the M42 Junction 6 Improvement Scheme a new junction, Junction 5A, is to be constructed on the M42 motorway **south** of Junction 6. This technical note discusses the assessment undertaken to confirm the location of proposed Junction 5A is in the optimum position balancing, design, environmental and buildability constraints.
- 1.2 The existing Junction 6 on the M42 motorway is currently operating near capacity and experiences significant congestion and journey reliability issues. M42 Junction 6 lies at the heart of an area of dynamic growth and is surrounded by a unique mix of key strategic economic assets for both the local and wider community. It is located north of Solihull and provides the main access to an expanding Birmingham Airport, Jaguar Land Rover, Birmingham International Railway Station, the National Exhibition Centre (NEC) and Birmingham Business Park.
- 1.3 Junction 6 will also be used by additional traffic generated by the proposed High Speed Two (HS2), Birmingham Interchange Station and the proposed UK Central (UKC) development to the immediate north-east of the junction being promoted by Solihull Metropolitan Borough Council (SMBC).
- 1.4 Current levels of congestion would constrain the future planned developments. Under its current condition, it is unlikely to accommodate any additional traffic generated through the forecasted growth and planned developments in the region without incurring delays and significant congestion.
- 1.5 The Scheme is currently progressing through Stage 3 of Highways England's (HE) Project Control Framework (PCF) and the preliminary design is being produced in preparation for the Development Consent Order (DCO) application.

2 Scheme Background

Options Development and Selection Process

- 2.1 Prior to PCF Stage 3, the Scheme had been subject to a phased development process including the development of concept options, initial options and options assessment. A total of 40 options were developed by Highways England, which included seeking the views of stakeholders including Solihull MBC as local highway authority.
- 2.2 The development and assessment of these options is described in the PCF Stage 2 Technical Appraisal Report. The conclusion of the assessment process was the identification of 3 options to present to non-statutory consultation which took place between December 2016 and January 2017.
- 2.3 A further detailed assessment of the three non-statutory consultation options and a summary of the consultation process is contained in the PCF Stage 2 Scheme Assessment Report. The preferred route is shown on **Figure 1** below.
- 2.4 Following non-statutory consultation Highways England announced the Preferred Route for the M42 Junction 6 Improvement Scheme in August 2017. The preferred route announcement defines a corridor for the scheme and provides protection against future developments. The preferred route corridor there limits the scope for changes to the scheme location.

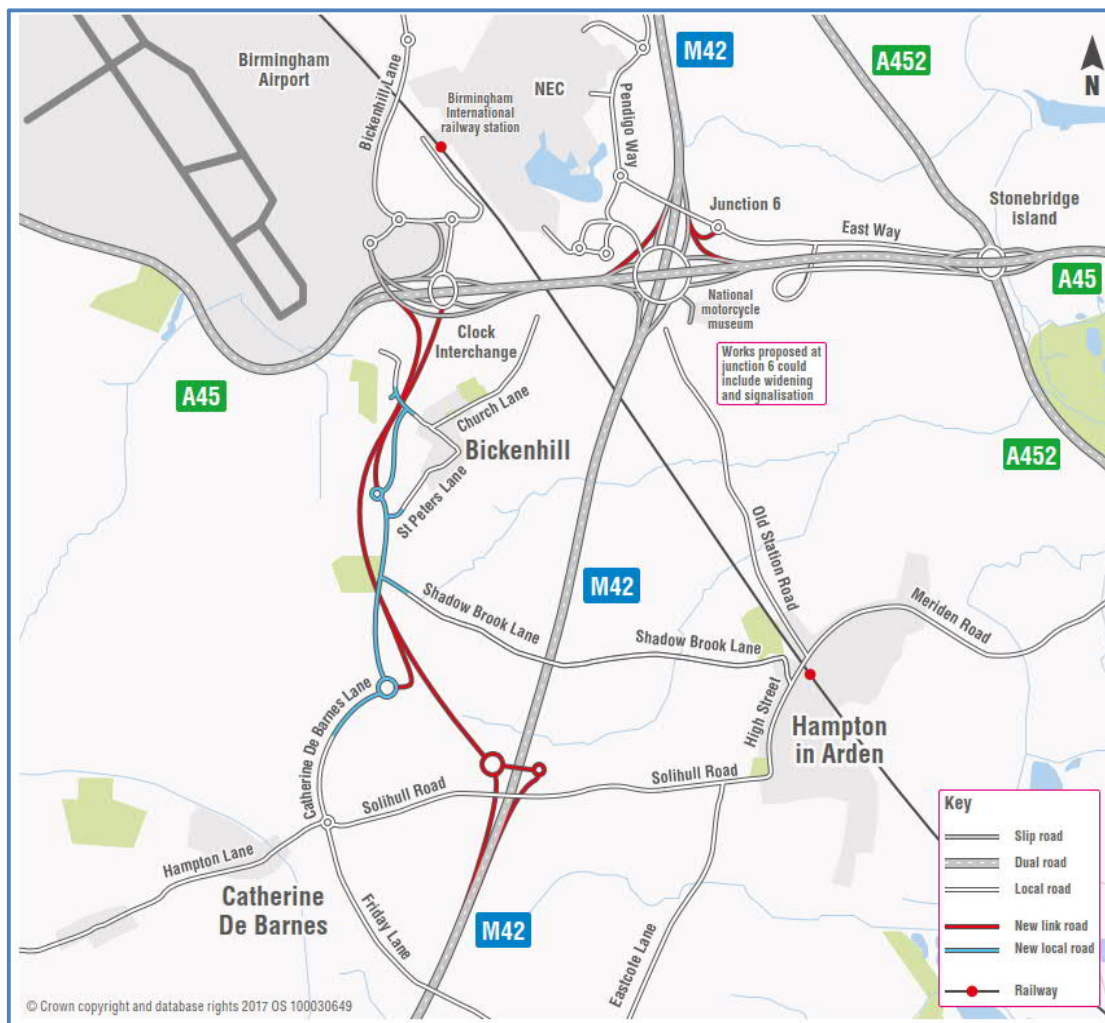


Figure 1 Highways England Preferred Route published August 2017

Constraints

2.5 The assessment of the options leading up to the preferred route announcement identified a number of key constraints that influence the location of Junction 5A including:

- i. Ancient woodland at Aspbury's Copse, located south of the existing Solihull road and adjacent to the northbound and southbound carriageways of the M42 motorway,
- ii. Green Belt, south of Bickenhill Village,
- iii. A potential Motorway Service Area (MSA), which is proposed to be south-west of the existing Solihull Road overbridge crossing the M42 motorway and west of the ancient woodland adjacent to the northbound carriageway of the M42 motorway (see Appendix B of this technical note for further details of its location).

-
- iv. In order to accommodate headroom clearances to the proposed Junction 5A south facing slip roads, Solihull Road overbridge would require demolition and reconstruction.
 - v. Proximity to Junction 5 and 6 and the consequential reduction in safe weaving distances between successive merge and diverge slip roads would require departures from Highways England design standards,
 - vi. Existing 132kV overhead powerlines which cross above the existing Solihull Road in a direction from south-west to north-east before running approximately 125m away from and parallel to, the M42 motorway at approximately 275m north of the current Junction 5A overbridge.
- 2.6 An Outline application for a MSA was submitted to Solihull Metropolitan Borough Council on 30th June 2015 (reference: PL/2015/51409/PPOL). The works include construction of a new service station, a new grade separated Junction on the M42 motorway with north and south facing slips and an access road from the proposed junction to the MSA including an underpass beneath Solihull Road, demolition of the existing Solihull Road bridge across the M42 and its replacement with a new bridge and associated works. Highways England submitted a holding objection to the proposal because of the potential impact that the MSA would have on one of the three options presented at non-statutory consultation and impact on the M42 Smart Motorway operational regime. Following the announcement of the preferred route the holding objection was withdrawn. Highways England stated that the preferred route would not preclude the delivery of the MSA and that should the MSA receive planning consent the two schemes would be managed to ensure both could be delivered.
- 2.7 The key stakeholders that represent an interest the location of the Junction 5A include:
- Natural England and other environmental bodies – has an interest due to impact of the new Junction 5A on the adjacent ancient woodland area of Aspbury's Copse.
 - Road users and road workers – These stakeholders would have an interest in key safety related decisions. Including the effect of reduced weaving length on the M42 between the Junctions 5 and 5A and between Junctions 5A and 6.
 - Solihull MBC as local highway authority
 - Impacted landowners and commercial organisations with land interests.

3 PCF Stage 3 Assessment

- 3.1 As part of the PCF stage 3 preliminary design the AECOM design team has undertaken a review of the preferred route as a whole and the Junction 5A in particular.
- 3.2 The objective of the Junction 5A review as to location of proposed Junction 5A is in the optimum position and minimises the schemes impact on Aspbury's Copse ancient woodland, while taking regard of appropriate design standards and operational safety of road users and road works.

- 3.3 The review confirmed the main constraints identified in Section 2 and in addition identified that the approach and takeoff surfaces from Birmingham Airport could also place restrictions on the form of the junction, particularly during construction.
- 3.4 The paragraphs below describe the assessment of four options for the junction that have been evaluated:
- Option A Baseline Assessment with Junction 5A as Preferred Route Announcement
 - Option B Junction 5A as Preferred Route but with reduction in stopping sight distance (SSD) (295m to 215m) on northbound diverge slip road.
 - Option C Junction 5A relocated north by 50m with compliant 295m SSD on northbound diverge slip road.
 - Option D Junction 5A relocated north by 50m but with reduction in stopping sight distance (SSD) (295m to 215m) on northbound diverge slip road.

General Considerations

- 3.5 **Weaving Distance:** The current distance between Junctions 5 and 6 is approximately 4km. The minimum weaving length between a successive merges and diverges is 2km on the motorway network (DMRB, TD22/06 – Layout of Grade Separated Junctions, section 4.35).
- 3.6 The location of the junction in the preferred route announcement is broadly midway between Junctions 5 and 6, with slightly greater weaving distance between junctions 5 and 5A to move the junction roundabouts to the north of the existing Solihull Road.
- 3.7 **Geometric Alignment of the Mainline Line:** Moving Junction 5A beyond 50m north of its current location would have a knock on effect on the geometric alignment of the new mainline link road resulting in:
- i. Potentially greater social and environmental impact on the residents of the village of Bickenhill and its immediate surroundings.
 - ii. Increased scheme footprint (reduced horizontal radius requiring greater widening for visibility-note the mainline link road horizontal curvature is already one step below desirable minimum radius (TD9/93)) would increase landtake within an area of Green Belt.
 - iii. Being moved closer towards the Bickenhill Meadows SSSI south east unit located south-east of Bickenhill Village; potentially incurring a greater impact on the SSSI and the catchment area which drains surface water towards it.
 - iv. The potential diversion of the south-west to north-east alignment of the existing 132kV overhead power line. Moving the roundabout further north would mean the western roundabout of Junction 5A would have to be raised on an embankment to maintain sufficient headroom clearance over the motorway for the Junction overbridge. The new mainline link road would initially connect to this roundabout on a raised embankment, however a safe and gradual lowering

of the link road will not be sufficient to cross beneath the overhead powerline without resulting in this incurring significant diversion costs to the Scheme.

- 3.8 **Junction Capacity:** The traffic assessments have confirmed that the proposed dumb-bell junction arrangement would have sufficient capacity to accommodate the forecasted traffic growth through the design life of the Scheme.
- 3.9 In addition to complying with design standards, the following parameters and constraints also influence the location and design of the new Junction 5A.
- 3.10 **Ancient Woodland:** Junction 5A cannot be moved any further south from its current location as this would place the roundabouts closer to, and require significantly more land take within Aspbury's Copse, resulting in a greater impact on the ancient woodland.
- 3.11 **Birmingham Airport Safeguarding Zone:** Birmingham Airport is located to the east of Clock Interchange, and a large swathe of land between the M42 motorway and the airport lies beneath the take-off and landing safeguarding zones. The safeguarding zone is a horizontal and vertical three dimensional surface which constrains infrastructure in order to protect aircraft.
- 3.12 Birmingham Airport has informed Highways England that any design solutions should take into consideration the requirements for safeguarding the flight path surface through the project life cycle and during the operations phase.
- 3.13 **Land and Property Owners:** Any adjustments to the geometry on the new dual carriageway link roads would also require assessing the impact of the overall road footprint on adjacent land and properties.
- 3.14 **Proposed Motorway Service Area:** A planning application has been submitted to Solihull Metropolitan Borough Council (SMBC) (June 2015) to construct a Motorway Service Area (MSA) south west of Solihull Road and is currently pending determination. This planning application included a junction in broadly the same location to that which is proposed within the scheme. The MSA application includes north facing slip roads which do not form part of the proposed Scheme.
- 3.15 The MSA north facing slip roads join the M42 immediately south of Shadowbrook Lane overbridge. Moving the junction further to the north could require the demolition and reconstruction of Shadowbrook Lane overbridge as its current span would not be sufficient to accommodate the cross section of the north facing slip roads. Reconstruction of Shadowbrook Lane overbridge would add additional cost the MSA scheme and may require revisions to the planning application and environmental assessment.
- 3.16 Additionally, the provision of north facing slip roads would introduce an additional operational weaving constraint between Junction 5A and Junction 6. The MSA developer has had approval in principle from Highways England for a departure from

standards to reduce in weaving length from 2km to approximately 1.1km as shown in **Figure 2** below. The developer would also convert the current smart motorway dynamic hard shoulder running operational regime to all lanes running in order to minimise the weaving impacts. There is no guarantee that the developer would be able to secure further reductions in weaving through the departure process and therefore be unable to implement their proposal.

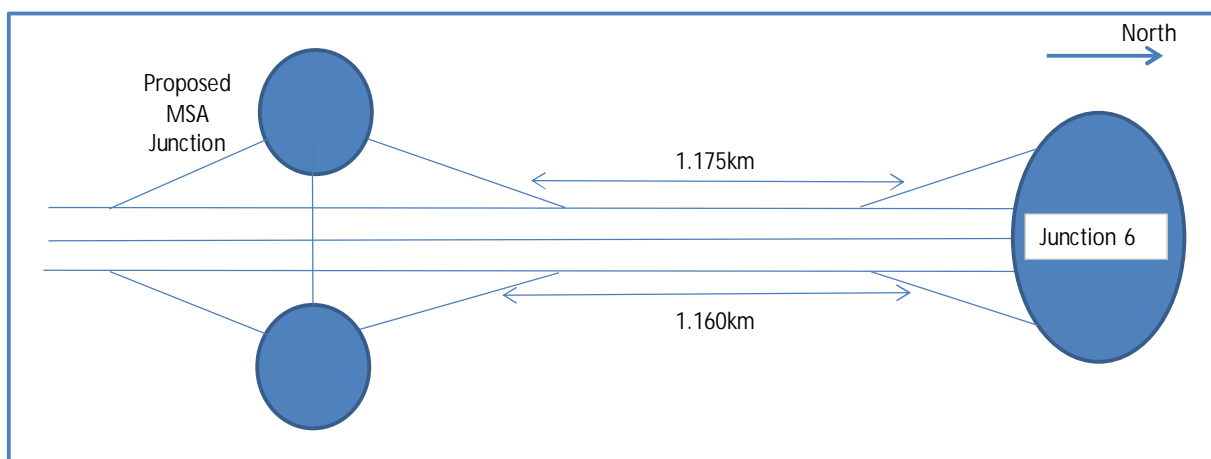


Figure 2 – Proposed MSA Junction and Weaving Lengths on M42 Motorway (Derived from Stage 2 technical Note based on MSA Planning Application Documents)

- 3.17 The application for planning consent for the MSA was submitted to Solihull Metropolitan Borough Council in June 2015. This precedes the M42 Junction 6 Improvement Scheme non-statutory consultation which began in December 2016. It is therefore an objective to ensure that, where practicable, the design of Junction 5A would not preclude the MSA scheme from being delivered if authorised, following the implementation of the Scheme.

Option A; Full Geometric Standard Compliant Junction design near the Proposed MSA Development

- 3.18 A fully compliant design would incorporate a standard 295m stopping sight distance up to the back of the nosing (SSD) on both the slip roads. This would increase the footprint of the slip roads with widened verges for visibility requiring the length of the re-profiled Solihull Road overbridge to be extended from 112m to a span of 135m across the slip roads. Consequently additional land take would be required. The 295m SSD is represented by the outer blue dashed line in **Figure 3.1** below, which indicates the larger footprint for the layout of the M42 northbound diverge slip road for junction 5A.
- 3.19 The implementation of a fully compliant design would have significant environmental impact on the area of ancient woodland. To achieve 295m SSD from the back of the nosing, the effect on the woodland area would be in region of 5330m² (3988 m² to the west and 1342m² to the east).

3.20 The weaving length falls below the minimum weaving length requirement by approximately 100m. It is unlikely that a reduction in weaving length by 100m would result in any operational safety issues particularly as the section of motorway operates under dynamic hard shoulder running (DHSR) and the sub-standard weaving length is still sufficient to include all directional signs and signals infrastructure on the approach to the new Junction 5A slip road.

3.21 The increased land-take, longer span of the Solihull Road overbridge and widened verges would contribute to higher environmental impact and costs for the overall Scheme.

Option B; Same as Option A but with Sub-Standard SSD on Northbound Diverge to J5A Roundabout

3.22 A sub-standard SSD of 215m from the back of the nosing onto the slip road is provided for the M42 northbound diverge slip instead of the standard compliant 295m SSD; see inner blue dashed line in figure 2 below. The narrower verge widths as a consequence of the reduction in SSD results in a more compact footprint, consequently reducing the length of the Solihull Road overbridge crossing the M42 motorway.

3.23 The compact footprint of the Junction would reduce the impact on the adjacent Aspbury's Copse ancient woodland to 1946m², a 51% reduction in the land take for the northbound diverge slip road from that required for Option A. In addition, there would be less construction works so less material would be required to complete the works with a benefit of a reduction in haulage.

3.24 Similarly to option A, the weaving length falls beneath the minimum weaving length requirement by approximately 100m. It is unlikely that a reduction in weaving length by 100m would incur any operational safety issues particularly as the section of motorway operates under DHSR and the sub-standard weaving length is still sufficient to include all directional signs and signals infrastructure on approach to the new Junction 5A slip road.

3.25 The reduced road footprint and shorter span of the Solihull Road overbridge would minimise the impact on the environment and result in a saving of approximately £700,000 in structure construction cost, as compared to option A.

3.26 A departure from standard would be required to implement the sub-standard SSD on the M42 northbound diverge slip road which has already been approved.

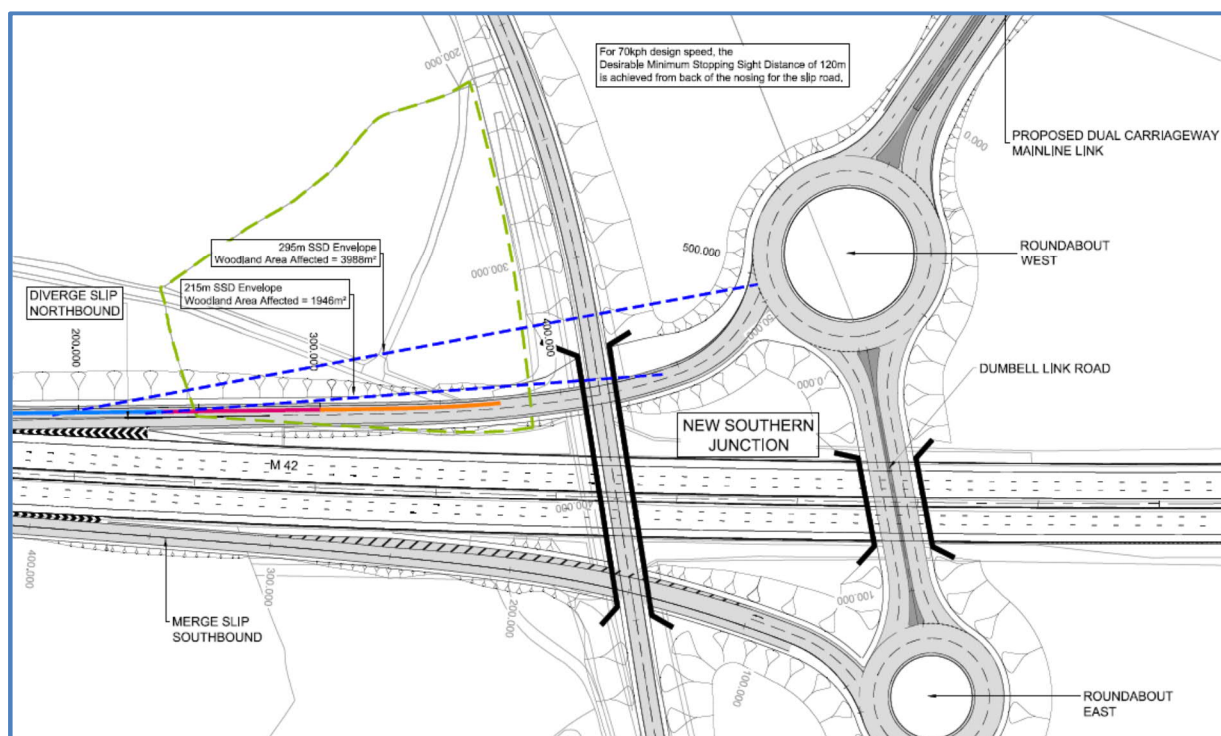


Figure 3.1 – Junction 5A Current Location Option with 295m SSD and 215m SSD

Option C; Same as Option A but with the Junction Moved North by 50m

- 3.27 A fully compliant design would incorporate a standard 295m SSD on both the slip roads. This would result in slightly lower footprint as compared to Option A. The reduction in the footprint would be observed due to reduced levels of the re-profiled Solihull Road overbridge as it can cross the slip roads over the M42 at a lower level. The reduced footprint would require less land take compared to Option A. The 295m SSD is represented by the outer blue dashed line in **Figure 3.2** below, which indicates the larger footprint for the layout of the junction compared to a 215m SSD which is represented on the inner line.
- 3.28 Moving the junction 50m north would reduce the impact on the adjacent Asbury's Copse ancient woodland. Approximately 3652m² (2335m² to the west and 1317m² to the east) of ancient woodland would be affected by this junction arrangement. Whilst this option is an improvement to option A but it still has a greater impact on the ancient woodland than option B.
- 3.29 There is a slight improvement to the weaving length as the junction has shifted further north by 50m. However, the weaving length falls beneath the minimum weaving length requirement by approximately 50m. It is unlikely that a reduction in weaving length by 50m would incur any operational safety issues particularly as the section of motorway operates under DHSR and the sub-standard weaving length is still sufficient to include all directional signs and signals infrastructure on approach to the new Junction 5A slip road.

3.30 The reduced road footprint and lowered height of the Solihull Road overbridge would result in lower costs as compared to Option A due to the reduction in land take.

Option D; Same as Option C but with Sub-Standard SSD on Northbound Diverge to J5A Roundabout

3.31 A sub-standard SSD of 215m is provided from the back of the nosing onto the slip road for the M42 northbound diverge slip instead of the standard compliant 295m SSD; see inner blue dashed line in **Figure 3.2** below. This would result in a more compact footprint similar to option B, consequently this would lead to a reduction in the length of the Solihull Road overbridge crossing the M42 motorway.

3.32 By moving the junction 50m north and providing a sub-standard SSD on the northbound diverge, this would further reduce the impact on the adjacent Aspbury's Copse ancient woodland as compared to option C. Approximately 3089 m² (1772m² to the west and 1317m² to the east) of ancient woodland would be affected by this junction arrangement. This is a 55% reduction of ancient woodland that is impacted compared to option A.

3.33 Similar to Option C, there is a slight improvement to the weaving length as the junction has shifted further north by 50m. However, the weaving length falls beneath the minimum weaving length requirement by approximately 50m. It is unlikely that a reduction in weaving length by 100m would incur any operational safety issues particularly as the section of motorway operates under DHSR and the sub-standard weaving length is still sufficient to include all signals and directional signs infrastructure on approach to the new Junction 5A slip road.

3.34 The reduced road footprint and shorter span of and height of the Solihull Road overbridge would result in lower costs as compared to Option A.

3.35 A departure from standard would be required to implement the sub-standard SSD on the slip road.

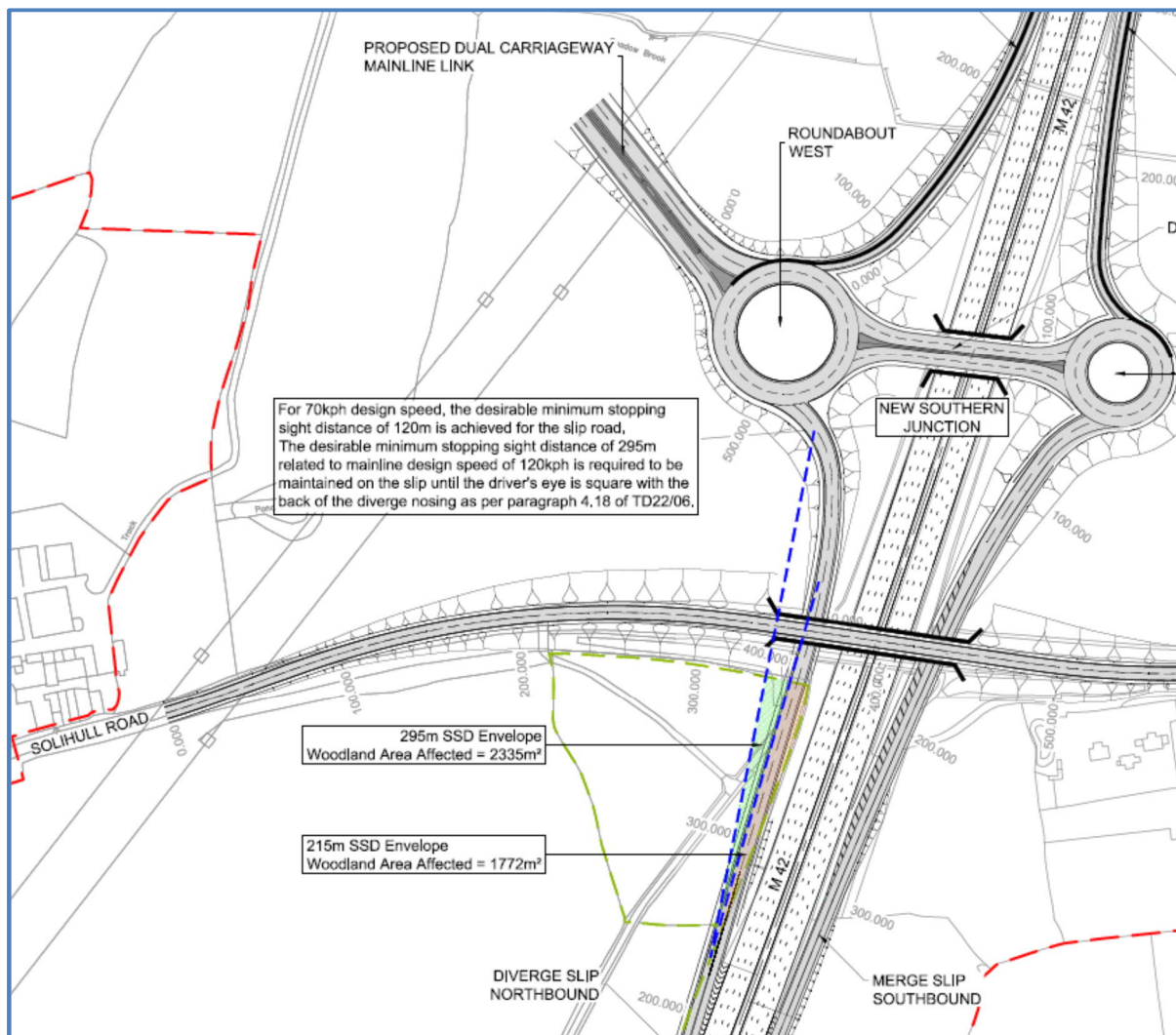


Figure 3.2 – Junction 5A Moved 50m North with 295m SSD and 215m SSD

4 Options Evaluation and Selection

- 4.1 Following an evaluation of each option, the key parameter influencing the junction location is the environmental impact on the adjacent Asbury's Copse.
- 4.2 **Table 1** below summarises the options and its implications on ancient woodland. The quoted areas are based on a comparable estimate of the engineering footprint of each option.

Option	Environmental
Option A	A fully compliant design would impact an area of 5330m ² of the ancient woodland with 3988m ² to the west and 1342m ² to the east being impacted.
Option B	An approved departure for 215m SSD shall reduce the impact on the ancient woodland to the west to 1946m ² . This constitutes a 51% reduction in impact on the western parcel of ancient woodland as compared to Option A. The impact on the eastern parcel would remain 1342m ² .
Option C	By moving the junction 50m north, a fully compliant design would result in 3652m ² of ancient woodland being affected. With 2335 m ² to the west and 1317 m ² to the east being impacted. This constitutes a 8% reduction in impact on the western parcel of ancient woodland as compared to Option A.
Option D	By moving the junction 50m to the north and gaining a departure for 215m SSD, the Option D shall reduce the impact on the ancient woodland to the west to 1772m ² . This constitutes a 55% reduction in impact on the western parcel of ancient woodland as compared to Option A. The impact on the eastern parcel would remain 1317m ² .

Table 1 – Summary of design options for Junction 5A

- 4.3 In addition to the above assessment, a design rationale has been produced which provides assessment of the above options considering different criteria. A scoring system has been used to evaluate the preferred option. A copy of the Design Rationale is attached in **Appendix A**.
- 4.4 The final assessment phase requires evaluating the options from a planning perspective. This parameter is deemed quite important as a planning application for the MSA development is submitted to SMBC and awaiting decision.

5 Influence of Legal Requirements on Junction Design Selection

- 5.1 A concern for pursuing options C and D was that these options would preclude the future development of the MSA from constructing any north facing slip roads, should such a MSA scheme be deemed acceptable in principle. To eliminate this risk, Option B was selected as the preferred solution on the basis that it had the least environmental impact compared to Option A. Option B would affect an additional 174m² of ancient woodland as compared to Option D.
- 5.2 Whilst the MSA planning application is currently pending with SMBC for decision, there is a risk that if MSA application gets approval before the start of the M42 Junction 6 Improvement scheme, significant design changes would be required for the Junction 5A of the M42 scheme to make it consistent with MSA proposals. This possibility

raises a risk that any option other than option B would require rework and a re-evaluation of the MSA planning documents.

6 Modification Works Required for MSA Connection to Junction 5A

- 6.1 Should the planned MSA be authorised after the M42 Junction 6 Improvement Scheme is operational, the western roundabout at Junction 5A and approach and departure arms would require geometric modifications, this would include the following works:
- The junction would be altered from a dumb-bell arrangement to a 'Dog Bone' layout. This would mean extending the central reserve island on the link road between the two roundabouts to connect with the roundabout island, subsequently severing the gyratory at each roundabout.
 - A segregated left-turn lane would be required from the M42 northbound diverge slip road into the MSA.
 - The M42 northbound diverge slip road would be widened to 3 lanes from 2 lanes 80m before the give way line.
 - The western side of the roundabout would be widened to 3 lanes from 2 lanes to accommodate the 3 lanes traffic movements from the south at the M42 diverge slip road travelling north at the main line.
 - The New Link Road would be widened at exit from the roundabout to three lanes before merging into two lanes downstream of the junction
- 6.2 An indicative layout of the proposed Junction 5A with the MSA in operation is provided in **Figure 4** below.
- 6.3 The proposed modifications have been assessed and validated through traffic assessments.
- 6.4 Whilst these modification works would be required and undertaken by the MSA, it does confirm that the current M42 Junction 6 Improvement Scheme does not preclude the planned MSA development.

-
- 7.5 The proposed option selected is Option B, this option will be prepared as part of the DCO application.

Appendix A DESIGN RATIONALE

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
MAIN DESIGN TEAM	Highways	SUPPORT TEAM 1	Environment	SUPPORT TEAM 2 Structures
LOCATION	The proposed Junction 5A is located north of existing Solihull Road Overbridge and south of Shadowbrook Lane Overbridge. Proposed junction is situated in close proximity to Asbury's Copse and a Proposed Motorway Service Area (MSA).		MAIN DISCIPLINE	
	The proposed junction will become Junction 5A of the M42 Strategic Road Network.		Highways	
DESCRIPTION	<p>This design rationale has been prepared to evaluate a range of options with regards to the position and alignment of the Junction 5A. To provide a robust design at DCO Application, AECOM must as far as reasonably practicable minimise the impact of the Junction 5A on Asbury's Copse, which is a designated Scheduled Ancient Woodland. These options also need to consider the wider legal impacts with regards to the proposed Motorway Service Area (MSA) at this junction for which the planning application has been submitted to Solihull Metropolitan Borough Council for consideration. The M42 J6 improvement works must not be seen to preclude this design as it would most likely result in an objection being lodged by the MSA developer at DCO application. Both of these factors need to be considered in parallel with operational, safety and maintenance aspects as defined by DMRB Design Standards. The following options have been assessed:</p> <p>Option A - The proposed Junction maintains its current position with the desirable minimum 295m SSD.</p> <p>Option B - The proposed Junction maintains its current position with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.</p> <p>Option C - The proposed Junction is moved 50m north and maintains the desirable minimum 295m SSD.</p> <p>Option D - The proposed Junction is moved 50m north with a departure with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.</p>			
REFERENCES		APPENDICES		
OPTION SELECTED	Option B - The proposed Junction 5A is kept at its current location with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.		AECOM APPROVER'S COMMENTS	
SUMMARY OF REASONS	Option B provides the best balance between mitigating the Schemes impact on ancient woodland while complying with current design standards. Significantly this option would not preclude the MSA application from coming forward nor would it require that application to revised or require further reduction in design standards.			
APPROVALS	ROLE	SIGNED	DATE	REQUIREMENT
	AECOM PROJECT MANAGER	Ian Bamforth	10/07/2018	review and approve
	MAIN DESIGN TEAM LEADER	Javaid Farooq	10/07/2018	review and approve
	PRINCIPAL DESIGNER	N/A		review and agree
	CLIENT REPRESENTATIVE	Chris Harris	10/07/2018	review and agree
	CONTRACTOR REPRESENTATIVE	N/A		review and agree
	MAINTAINER REPRESENTATIVE	N/A		review and agree

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
OPTION	A	SCORE	B	SCORE
Description	The proposed Junction 5A is maintained at its current position with a the desirable minimum stopping sight distance of 295m in accordance with TD22/06 & TD9/93. This design does not preclude the MSA proposals.	6	The proposed Junction 5A is maintained at its current position with a departure submitted to provide a one step below desirable SSD of 215m. This departure will provide a one step relaxation in the stopping sight distance in accordance with TD22/06 & TD9/93. This design does not preclude the MSA Proposals.	6
Safety Assessment (detail on following Designer's Risk Assessment)		6		6
Design Effects	Option A would constitute a fully compliant design for Junction 5A. Weaving departure on mainline would be required but this departure has already been approved by Highways England.	5	Option B would require a departure from Standard for reduced SSD from the back of the nosing along the diverge slip to 215m. This departure has already been approved by Highways England. Weaving departure on mainline would still be required but this departure has also been approved by Highways England.	5
Proposed Construction Methodology and Effects	No impact to the proposed construction methodology. Construction works would need to minimise so far as reasonably practicable any temporary land take into the Scheduled Ancient Woodland.	6	No impact to the proposed construction methodology. Construction works would need to minimise so far as reasonably practicable any temporary land take into the Scheduled Ancient Woodland.	6
Operational Effects	Fully compliant junction design, no significant operational impacts.	6	A reduction in stopping sight distance provides a marginal increase in the risk of vehicle collisions. This risk has been assessed in the GD04 risk assessment produced as part of the departure application.	5
Maintenance Effects	Fully compliant junction design, no significant maintenance impacts.	6	No significant maintenance impacts introduced by the departure to 215m SSD. Verge width reduction shall minimise maintenance activities.	5

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
OPTION	A	SCORE	B	SCORE
Environmental Effects	A fully compliant design will result in 5330m ² of Scheduled Ancient Woodland being affected. With 3988m ² to the west and 1342m ² to the east being impacted. Replanting of any impacted woodland will be provided at a ratio of 3:1 (minimum) to compensate the environmental impact however the replanted woodland will not have Scheduled Ancient Woodland designation.	2	An approved departure for 215m SSD shall reduce the impact on the Scheduled Ancient Woodland to the west to 1946m ² . This constitutes a 51% reduction to the impact of Scheduled Ancient Woodland from Option A. Replanting of any impacted woodland will be provided at a ratio of 3:1 (minimum) to compensate the environmental impact however the replanted woodland will not have Scheduled Ancient Woodland designation	4
Customer Effects	N/A	6	N/A	6
Legal Effects	This design will be difficult to justify during DCO application as the design has not mitigated the impact to the environment so far as reasonably practicable in accordance with the NNNPS. This design does not preclude the MSA which has submitted a planning application to SMBC.	2	A 51% reduction in the impact to the Scheduled Ancient Woodland adjacent to the Junction 5A will provide justifiable evidence of mitigation during the DCO process. However Option B does not constitute the maximum that can be achieved versus Option D. This design does not preclude the MSA which has submitted a planning application to SMBC.	5
Quality Effects	N/A	6	N/A	6
Cost Effects	Additional land take and replanting required to offset the impact to the Scheduled Ancient Woodland. Moreover, the span of the proposed Solihull Road overbridge is increased by approximately 25m. The cost of the project will be increased by approximately £600,000 due to increased length of the Solihull Overbridge, widened verge, impact on the ancient woodland and additional landtake.	4	Reduction in land take and replanting required due to reduction in verge extents provided by the departure. Moreover, the span of the proposed Solihull Road overbridge is reduced by approximately 25m. The cost of the project will be reduced by approximately £600,000 due to reduced Solihull Overbridge length, reduced verge width, impact on the ancient woodland and less landtake requirement.	7
Programme Effects	No change to programme.	6	Reduction in bridge span provides an opportunity to reduce construction time.	7

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
OPTION	A	SCORE	B	SCORE
Commercial Effects	N/A	6	N/A	6
Risk Effects	<p>Fully compliant design but there is a significant risk to the project that the environmental impacts would result in the DCO application being rejected.</p> <p>This design does not preclude the MSA and therefore does not impact any departures that have been agreed in principle with regards to weaving lengths in accordance with TD22/06 Clause 4.35.</p>	2	<p>Design introduces a Departure from Standard, however this option provides more confidence that the scheme will be accepted during the DCO process due to the mitigation of the environmental impact.</p> <p>This design does not preclude the MSA and therefore does not impact any departures that have been agreed in principle with regards to weaving lengths in accordance with TD22/06 Clause 4.35.</p>	5
Total Scores		69		79
Commentary				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	A
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
TRAFFIC (include GD04 Risk Assessment results where prepared)	Works adjacent to live traffic.	Vehicle impact on people or materials.	Approved Contractor to be provided under Lot 3B Framework, Contractor to work in accordance with Highways England and own safe work policies. Work behind vehicle safety barriers.	Medium
UTILITIES (include GD04 Risk Assessment results where prepared)	Presence of underground utilities adjacent to M42 carriageway affected by Slip Road construction	Electrocution VMS systems disabled	Services to be identified and located prior to undertaking works. All diversion/protection works to be agreed with affected Statutory Undertakers	Low
WORKING AT HEIGHT OR ON SLOPES (include GD04 Risk Assessment results where prepared)	Lifting Operations associated with Solihull Bridge	Being struck by falling objects	The principal contractor to prepare and work to a safe construction methodology.	Low
EXCAVATIONS (include GD04 Risk Assessment results where prepared)	Instability/collapse of excavation	People or plant falling into excavation	Works to adhere to practices outlined in method statements and adhere to the mitigation measures identified in task specific risk assessments.	Low

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT		OPTION	A	
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
TEMPORARY WORKS (include GD04 Risk Assessment results where prepared)				
CONFINED SPACES (include GD04 Risk Assessment results where prepared)	N/A			
WATER (include GD04 Risk Assessment results where prepared)				
MATERIALS (include GD04 Risk Assessment results where prepared)				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	A
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
DEMOLITION (include GD04 Risk Assessment results where prepared)	Demolition of existing Solihull Road Overbridge	Dust, noise, vibration, and impacts to operation of M42.	Safe demolition strategy to be agreed and approved by all parties prior to demolition works to be commenced.	Low
MAINTENANCE (include GD04 Risk Assessment results where prepared)	Bridge Inspection	Working at height and adjacent to live traffic	Safe work plan to be agreed for all maintenance activities association with inspections for Solihull Road Overbridge and Junction 5A overbridge. Use night time closures of M42 as part of a combined inspection programme for other structures and assets.	Low
	Drainage Inspection	Adjacent to live traffic	Safe work plan to be agreed for all drainage inspection activities.	Low
OPERATION (include GD04 Risk Assessment results where prepared)				
OVERALL RATING				Low

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	B
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
TRAFFIC (include GD04 Risk Assessment results where prepared)	Works adjacent to live traffic.	Vehicle impact on people or materials.	Approved Contractor to be provided under Lot 3B Framework, Contractor to work in accordance with Highways England and own safe work policies. Work behind vehicle safety barriers.	Medium
UTILITIES (include GD04 Risk Assessment results where prepared)	Presence of underground utilities adjacent to M42 carriageway affected by Slip Road construction	Electrocution VMS systems disabled	Services to be identified and located prior to undertaking works. All diversion/protection works to be agreed with affected Statutory Undertakers	Low
WORKING AT HEIGHT OR ON SLOPES (include GD04 Risk Assessment results where prepared)	Lifting Operations associated with Solihull Bridge	Being struck by falling objects	The principal contractor to prepare and work to a safe construction methodology.	Low
EXCAVATIONS (include GD04 Risk Assessment results where prepared)	Instability/collapse of excavation	People or plant falling into excavation	Works to adhere to practices outlined in method statements and adhere to the mitigation measures identified in task specific risk assessments.	Low
DESIGNERS RISK ASSESSMENT			OPTION	B
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING

DESIGN RATIONALE

PROJECT		M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT		New Southern Junction (Junction 5A) Assessment		
		APPROVAL DATE REQUIRED		
TEMPORARY WORKS (include GD04 Risk Assessment results where prepared)				
CONFINED SPACES (include GD04 Risk Assessment results where prepared)				
WATER (include GD04 Risk Assessment results where prepared)				
MATERIALS (include GD04 Risk Assessment results where prepared)				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	B
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
DEMOLITION (include GD04 Risk Assessment results where prepared)	Demolition of existing Solihull Road Overbridge	Dust, noise, vibration, and impacts to operation of M42.	Safe demolition strategy to be agreed and approved by all parties prior to demolition works to be commenced.	Low
MAINTENANCE (include GD04 Risk Assessment results where prepared)	Bridge Inspection	Working at height and adjacent to live traffic	Safe work plan to be agreed for all maintenance activities association with inspections for Solihull Road Overbridge and Junction 5A overbridge. Use night time closures of M42 as part of a combined inspection programme for other structures and assets.	Low
	Drainage Inspection	Adjacent to live traffic	Safe work plan to be agreed for all drainage inspection activities.	Low
OPERATION (include GD04 Risk Assessment results where prepared)				
OVERALL RATING				Low

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment		APPROVAL DATE REQUIRED	
MAIN DESIGN TEAM	Highways	SUPPORT TEAM 1	Environment	SUPPORT TEAM 2 Structures
LOCATION	The proposed Junction 5A is located north of existing Solihull Road Overbridge and south of Shadowbrook Lane Overbridge. Proposed junction is situated in close proximity to Asbury's Copse and a Proposed Motorway Service Area (MSA).		MAIN DISCIPLINE	
	The proposed junction will become Junction 5A of the M42 Strategic Road Network.		Highways	
DESCRIPTION	<p>This design rationale has been prepared to evaluate a range of options with regards to the position and alignment of the Junction 5A. To provide a robust design at DCO Application, AECOM must as far as reasonably practicable minimise the impact of the Junction 5A on Aspbury's Copse, which is a designated Scheduled Ancient Woodland. These options also need to consider the wider legal impacts with regards to the proposed Motorway Service Area (MSA) at this junction for which the planning application has been submitted to Solihull Metropolitan Borough Council for consideration. The M42 J6 improvement works must not be seen to preclude this design as it would most likely result in an objection being lodged by the MSA developer at DCO application. Both of these factors need to be considered in parallel with operational, safety and maintenance aspects as defined by DMRB Design Standards. The following options have been assessed:</p> <p>Option A - The proposed Junction maintains its current position with the desirable minimum 295m SSD.</p> <p>Option B - The proposed Junction maintains its current position with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.</p> <p>Option C - The proposed Junction is moved 50m north and maintains the desirable minimum 295m SSD.</p> <p>Option D - The proposed Junction is moved 50m north with a departure with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.</p>			
REFERENCES		APPENDICES		
OPTION SELECTED	Option B - The proposed Junction 5A is kept at its current location with a departure for reduced SSD from back of the nosing of one step below desirable of 215m.		AECOM APPROVER'S COMMENTS	
SUMMARY OF REASONS				
APPROVALS	ROLE	SIGNED	DATE	REQUIREMENT
	AECOM PROJECT MANAGER	Ian Bamforth		review and approve
	MAIN DESIGN TEAM LEADER	Javaid Farooq		review and approve
	PRINCIPAL DESIGNER	Paul Conley		prepare
	CLIENT REPRESENTATIVE	Chris Harris		review and agree
	CONTRACTOR REPRESENTATIVE	N/A		review and agree
MAINTAINER REPRESENTATIVE	N/A		review and agree	

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
OPTION	C	SCORE	D	SCORE
Description	Junction 5A position is moved 50m north with SSD of 295m in accordance with TD9/93. This option has the potential to impact the proposals for the MSA.	6	Junction 5A position to be moved 50m north with a departure submitted to provide a SSD of 215m in accordance with TD9/93. This departure will provide a one step relaxation in the Stopping Sight Distance. This option has the potential to impact the proposals for the MSA.	6
Safety Assessment (detail on following Designer's Risk Assessment)		6		6
Design Effects	Option C would constitute a fully compliant design. Moving the dumb-bell roundabouts 50m northwards reduces the resumption area of the ancient woodlands without the need for a Departure from Standards for stopping sight distance. It also allows Solihull Road levels to be reduced making access to the properties located east of the Solihull Road overbridge more convenient and direct. A consequence of moving the junction by 50m northwards is that existing Shadowbrook lane overbridge needs to be demolished to provide standard compliant future northern slip roads. Weaving departure on mainline would still be required.	5	Option D would require a one step reduction in Stopping Sight Distance to 215m which would require a departure to be submitted to Highways England with an accompanying GD04 Risk Assessment. Moving the dumb-bell roundabouts 50m northwards further reduces the resumption area of the ancient woodlands but requires a departure from Standard. This option allows Solihull Road levels to be reduced making access to the properties located east of the Solihull Road overbridge more convenient and direct. A consequence of moving the junction by 50m northwards is that existing Shadowbrook lane overbridge needs to be demolished to provide standard compliant future northern slip roads. Weaving departure on mainline would still be required but this	5
Proposed Construction Methodology and Effects	No change to proposed construction methodology. Construction works would need to minimise so far as reasonably practicable any temporary land take into the Scheduled Ancient Woodland.	6	No change to proposed construction methodology. Construction works would need to minimise so far as reasonably practicable any temporary land take into the Scheduled Ancient Woodland.	6
Operational Effects	Fully compliant junction design, no operational impacts.	6	A reduction in stopping sight distance provides a marginal increase in the risk of vehicle collisions. This risk will be assessed in the GD04 risk assessment produced as part of the departure application.	5
Maintenance Effects	Fully compliant junction design, no significant maintenance impacts.	6	No significant maintenance impacts introduced by the departure to 215m SSD. Verge width reduction shall minimise maintenance activities.	5

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment		APPROVAL DATE REQUIRED	
OPTION	C	SCORE	D	
Environmental Effects	<p>By moving the junction 50m north, a fully compliant design will result in 3652m² of Scheduled Ancient Woodland being affected. With 2335m² to the west and 1317m² to the east being impacted. This constitutes a 41% reduction to the impact of Scheduled Ancient Woodland from Option A.</p> <p>Replanting of any impacted woodland will be provided at a ratio of 3:1 (minimum) to compensate the environmental impact however the replanted woodland will not have Scheduled Ancient Woodland designation</p> <p>Provides the opportunity to reduce the visual impact of Solihull Overbridge on affected residents.</p>	3	<p>By moving the junction 50m to the north and gaining a departure for 215m SSD. Option D shall reduce the impact on the Scheduled Ancient Woodland to the west to 1772m². This constitutes a 55% reduction to the impact of Scheduled Ancient Woodland from Option A. The impact on the eastern parcel would be 1317m² as with Option C.</p> <p>Replanting of any impacted woodland will be provided at a ratio of 3:1 (minimum) to compensate the environmental impact however the replanted woodland will not have Scheduled Ancient Woodland designation</p> <p>Provides the opportunity to reduce the visual impact of Solihull Overbridge on affected residents.</p>	4
Customer Effects	<p>By moving the junction 50m north, the proposed Solihull Road Overbridge can be lowered and subsequently benefit adjacent residents.</p>	7	<p>By moving the junction 50m north, the proposed Solihull Road Overbridge can be lowered and subsequently benefit adjacent residents.</p>	7
Legal Effects	<p>By moving the junction 50m north, Option C provides a beneficial reduction in the environmental impact to the scheduled ancient woodland. However the magnitude of the impact is less than option B and D.</p> <p>A consequence of moving the junction by 50m northwards would mean that there would be insufficient space to provide compliant north facing slip roads at a later date without the removal and replacement of Shadowbrook Lane Overbridge. This would mean that future development of the MSA which would propose to include north facing slips would not be possible therefore expose Highways England to unacceptable level of legal risk for precluding the development. This will most likely result in an objection being raised by the MSA developer.</p>	2	<p>By moving the junction 50m north and gaining approval for a departure in the SSD to 215m, Option D provides the most beneficial reduction in the environmental impact to the scheduled ancient woodland.</p> <p>A consequence of moving the junction by 50m northwards would mean that there would be insufficient space to provide compliant north facing slip roads at a later date without the removal and replacement of Shadowbrook Lane Overbridge. This would mean that future development of the MSA which would propose to include north facing slips would not be possible therefore expose Highways England to unacceptable level of legal risk for precluding the development. This will most likely result in an objection being raised by the MSA developer.</p>	2
Quality Effects	N/A	6	N/A	6
Cost Effects	<p>In moving the junction north by 50m, there will be reduction in the cost of the project in the region of £700,000 due to reduction in the length and height of the Solihull Road Overbridge.</p> <p>There will be alterations to the land take that will need to be considered for this option.</p>	7	<p>In moving the junction north by 50m, there will be reduction in the cost of the project in the region of £700,000 due to reduction in the length and height of the Solihull Road Overbridge.</p> <p>there will be alterations to the land take that will need to be considered for this option.</p>	7

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement			
PROJECT No	HE551485	RATIONALE No	/	
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED		
OPTION	C	SCORE	D	SCORE
Programme Effects	Reduction in bridge span provides an opportunity to reduce construction time.	7	Reduction in bridge span provides an opportunity to reduce construction time.	7
Commercial Effects	N/A	6	N/A	6
Risk Effects	<p>Moving the junction 50m north will impact the current Departures from Standards agreed by MSA developer with Highways England and will necessitate new departures to be submitted by the MSA developer which puts their planning application at risk. The MSA developer will likely object to the proposals during the DCO process.</p> <p>There is a risk that Option C is not deemed sufficient during the DCO process for not mitigating the environmental impacts as far as reasonably practicable.</p>	2	<p>Moving the junction 50m north will impact the current Departures from Standards agreed by MSA developer with Highways England and will necessitate new departures to be submitted by the MSA developer which puts their planning application at risk. The MSA developer will likely object to the proposals during the DCO process.</p> <p>This option constitutes the maximum that can be undertaken to mitigate impacts to the scheduled ancient woodland.</p>	3
Total Scores		75		75
Commentary				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	C
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
TRAFFIC (include GD04 Risk Assessment results where prepared)	Works adjacent to live traffic.	Vehicle impact on people or materials.	Approved Contractor to be provided under Lot 3B Framework, Contractor to work in accordance with Highways England and own safe work policies. Work behind vehicle safety barriers.	Medium
UTILITIES (include GD04 Risk Assessment results where prepared)	Presence of underground utilities adjacent to m42 carriageway affected by Slip Road construction	Electrocution VMS systems disabled	Services to be identified and located prior to undertaking works. All diversion/protection works to be agreed with affected Statutory Undertakers	Low
WORKING AT HEIGHT OR ON SLOPES (include GD04 Risk Assessment results where prepared)	Lifting Operations associated with Solihull Bridge	Being struck by falling objects	AECOM and Skanska to work to agree a safe construction methodology.	Low
EXCAVATIONS (include GD04 Risk Assessment results where prepared)	Instability/collapse of excavation	People or plant falling into excavation	Works to adhere to practices outlined in method statements and adhere to the mitigation measures identified in task specific risk assessments.	Low

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	C
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK
TEMPORARY WORKS (include GD04 Risk Assessment results where prepared)				
CONFINED SPACES (include GD04 Risk Assessment results where prepared)				
WATER (include GD04 Risk Assessment results where prepared)				
MATERIALS (include GD04 Risk Assessment results where prepared)				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	C
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
DEMOLITION (include GD04 Risk Assessment results where prepared)	Demolition of existing Solihull Road Overbridge	Dust, noise, vibration, and impacts to operation of M42.	Safe demolition strategy to be agreed and approved by all parties prior to demolition works to be commenced.	Low
MAINTENANCE (include GD04 Risk Assessment results where prepared)	Bridge Inspection	Working at height and adjacent to live traffic	Safe work plan to be agreed for all maintenance activities association with inspections for Solihull Road Overbridge and Junction 5A overbridge. Use night time closures of M42 as part of a combined inspection programme for other structures and assets.	Low
	Drainage Inspection	Adjacent to live traffic	Safe work plan to be agreed for all drainage inspection activities.	Low
OPERATION (include GD04 Risk Assessment results where prepared)				
OVERALL RATING				Low

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	D
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
TRAFFIC (include GD04 Risk Assessment results where prepared)	Works adjacent to live traffic.	Vehicle impact on people or materials.	Approved Contractor to be provided under Lot 3B Framework, Contractor to work in accordance with Highways England and own safe work policies. Work behind vehicle safety barriers.	Medium
UTILITIES (include GD04 Risk Assessment results where prepared)	Presence of underground utilities adjacent to m42 carriageway affected by Slip Road construction	Electrocution VMS systems disabled	Services to be identified and located prior to undertaking works. All diversion/protection works to be agreed with affected Statutory Undertakers	Low
WORKING AT HEIGHT OR ON SLOPES (include GD04 Risk Assessment results where prepared)	Lifting Operations associated with Solihull Bridge	Being struck by falling objects	AECOM and Skanska to work to agree a safe construction methodology.	Low
EXCAVATIONS (include GD04 Risk Assessment results where prepared)	Instability/collapse of excavation	People or plant falling into excavation	Works to adhere to practices outlined in method statements and adhere to the mitigation measures identified in task specific risk assessments.	Low
DESIGNERS RISK ASSESSMENT			OPTION	D
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

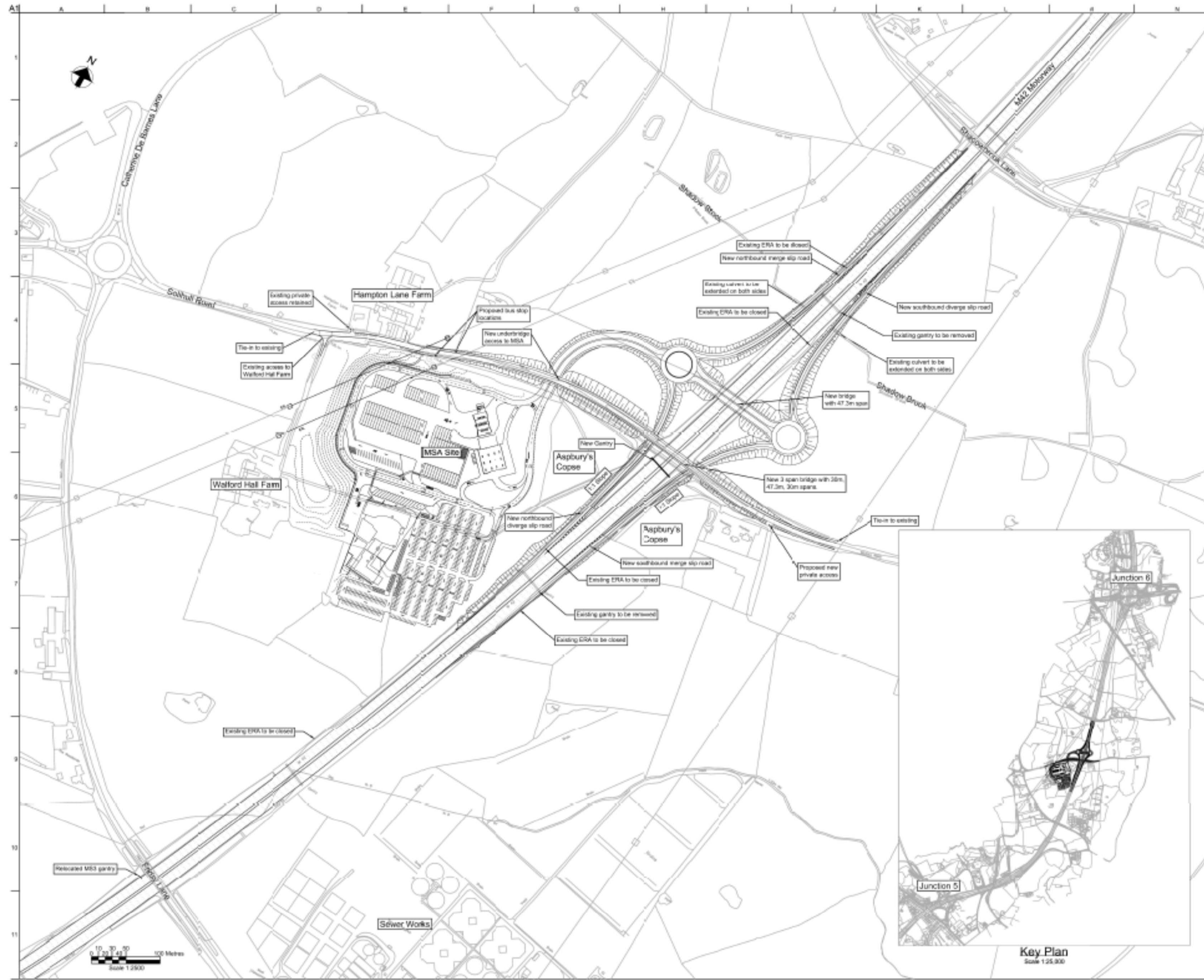
TEMPORARY WORKS (include GD04 Risk Assessment results where prepared)				
CONFINED SPACES (include GD04 Risk Assessment results where prepared)				
WATER (include GD04 Risk Assessment results where prepared)				
MATERIALS (include GD04 Risk Assessment results where prepared)				

DESIGN RATIONALE

PROJECT	M42 Junction 6 Improvement		
PROJECT No	HE551485	RATIONALE No	/
SUBJECT	New Southern Junction (Junction 5A) Assessment	APPROVAL DATE REQUIRED	

DESIGNERS RISK ASSESSMENT			OPTION	D
HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
DEMOLITION (include GD04 Risk Assessment results where prepared)	Demolition of existing Solihull Road Overbridge	Dust, noise, vibration, and impacts to operation of M42.	Safe demolition strategy to be agreed and approved by all parties prior to demolition works to be commenced.	Low
MAINTENANCE (include GD04 Risk Assessment results where prepared)	Bridge Inspection	Working at height and adjacent to live traffic	Safe work plan to be agreed for all maintenance activities association with inspections for Solihull Road Overbridge and Junction 5A overbridge. Use night time closures of M42 as part of a combined inspection programme for other structures and assets.	Low
	Drainage Inspection	Adjacent to live traffic	Safe work plan to be agreed for all drainage inspection activities.	Low
OPERATION (include GD04 Risk Assessment results where prepared)				
OVERALL RATING				Low

Appendix B **PROPOSED ACCESS PLAN FOR MSA
SUBMITTED AS PART OF PLANNING
APPLICATION**



- Notes**
- All slopes are drawn at 1:2 H and 1:3 V unless indicated on the drawing.
 - Where CRAs to be retained for merge with maintenance access.
 - Parking space provision:
 Cars: 870 (plus 38 disabled spaces)
 HGV's: 91
 Caravans: 20
 Buses: 18
 Motorcycles: 26
 Abnormal Load: 1
 - All proposed bridges have allowances for a future BM2 widening to a D4M cross section as current in TD2106 Highways Cross Sections.
 - M42 to be upgraded to All Lane Running configuration.

Rev	Date	By	Check	App'd
P05.1	04/06/2015	JHW	TEC	TEC

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Project Title
M42 Solihull MSA

Drawing Title
Proposed Parking and Access Plan

Scale of Drawing: 1:2500
 Title: Civil Engineer - Highways
 Discipline: SD - Initial non-constructive
 Drawing No: 223839-00
 File: P05.1
 Sheet: 223839-ARP-ZZ-ZZ-DR-CH-00101

