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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix CT-008-00000

Cross-topic

Borrow pit report

M108

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

Telephone: 08081 434 434

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.hs2.org.uk

A report prepared for High Speed Two (HS2) Limited:

ARUP+ ERM | FOSTER + PARTNERS | JACOBS
RAMBOLL | TYPSA | COSTAIN

MWJV
Mott MacDonald | WSP

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1 Introduction

1.1.1 The Phase 2b Western Leg of High Speed Two (HS2) is referred to in this report as the Proposed Scheme. To construct the Proposed Scheme the aim of HS2 Ltd is to maximise the reuse of excavated materials, limit the import of materials from other sources and reduce the export of surplus materials. This report considers the use of alternative sources, such as borrow pits, where the amount of acceptable material available through reuse is insufficient.

1.1.2 A borrow pit is an area where acceptable engineering material is extracted for use in the construction of infrastructure projects. Unlike commercial quarries, a borrow pit is dedicated to supply material to one particular project only. Four borrow pits are proposed for the construction of the Proposed Scheme. This report provides details of the volume of engineering material required, it considers potential alternative sources for those materials and provides information about the selection of areas to act as borrow pits.

1.1.3 The presence of natural halite (salt) deposits within the geological bedrock crossed by the Proposed Scheme between Warmingham and Hoo Green has informed a design decision to minimise the number of cuttings within this area. This has resulted in a significant deficit of acceptable engineering material in the Wimboldsley to Lostock Gralam area (MA02) and to an overall deficit throughout the Proposed Scheme. The location of a limited number of borrow pits within the MA02 area will provide the acceptable materials required to support the construction of the Proposed Scheme.

1.1.4 Engagement has taken place with a number of statutory stakeholders as well as those parties that will be directly impacted by the borrow pits, including local authorities, landowners and local residents. This involved initial discussion on the broad topic of borrow pits, followed by detailed consultations around specific potential borrow pit locations and potential impacts. Further information regarding stakeholder engagement can be found in Volume 2 Community Area report: Wimboldsley to Lostock Gralam (MA02). A summary of the engagement undertaken to date is included in Annex A – Stakeholder of this report.

1.1.5 In deciding whether borrow pits should be used, HS2 Ltd has considered whether there is a compelling case in the public interest for interference with the property rights of affected landowners and other occupiers on a case by case basis. In addition HS2 Ltd has considered the engineering advantages and disadvantages and potential environmental impacts of the use of borrow pits and has also reviewed the feasibility of using other alternative sources of supply for the required construction materials.

1.1.6 The subsequent sections of this report present the following:

- Section 2 describes the demand for cohesive and granular material for the Proposed Scheme;
- Section 3 gives an assessment of potential sources of cohesive and granular material;
- Section 4 describes the methodology of assessing the suitability of land for borrow pits;
- Section 5 gives an appraisal of potential cohesive borrow pit locations;

- Section 6 gives an appraisal of potential granular borrow pit locations;
- Section 7 gives assessments of traffic and transport impacts, with and without borrow pits (use of external sources such as quarries);
- Section 8 gives an outline of the planned borrow pit operations; and
- Section 9 gives an outline of the restoration strategy to be adopted for the borrow pits.

1.2 Background

1.2.1 The route of the Proposed Scheme will comprise tunnels, viaducts, embankments and cuttings. Additionally, new or modified bridges, embankments and cuttings will be required to support other infrastructure such as highway modifications that are also part of the Proposed Scheme. Embankments, cuttings, and any associated improvement of the existing supporting ground are referred to as earthworks, because they are constructed from geological materials. Acceptable materials excavated from cuttings will be reused, where reasonably practicable, to construct embankments, noise bunds and landscape earthworks.

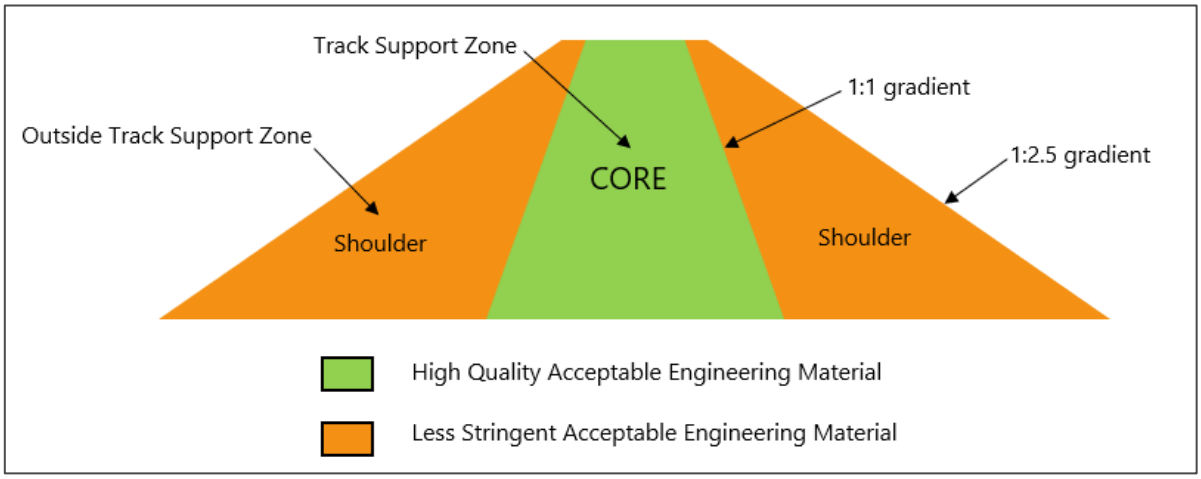
1.2.2 Construction features related to the Proposed Scheme are shown in maps in the Volume 2, MA02 Map Book: maps CT-05-301 to CT-05-365b.

1.2.3 The construction of the Proposed Scheme will require approximately 10 million m^3 of acceptable engineering materials. Most of these acceptable engineering materials (approximately 6 million m^3) will be provided through the excavation of cuttings along the route of the Proposed Scheme. However, it is anticipated that additional high-quality acceptable engineering materials will be required at some locations to construct parts of the Proposed Scheme. In particular, this is driven by the requirement for embankments in the MA02 area, a consequence of local geological constraints.

1.2.4 There are natural halite (salt) deposits within the geological bedrock in MA02. Long-term ground subsidence can occur as a result of the natural dissolution of salt deposits through the movement and flow of groundwater within the bedrock. This is known to cause localised ground subsidence. The presence of these natural halite deposits has influenced the alignment of the Proposed Scheme which is designed to be located on embankments through the MA02 area. By following this approach the Proposed Scheme will avoid the need to form large excavated cuttings which would have the potential to alter the groundwater flow regime and could result in ground subsidence issues associated with the dissolution of halite from the bedrock.

1.2.5 To maximise the reuse of site-won materials and reduce the quantity of high quality engineering material needed for construction, zoned embankments have been introduced into the design of the Proposed Scheme where reasonably practicable, see Figure 1. Zoned embankments only require high quality acceptable granular or stabilised cohesive materials within the track support zone (the core). In the shoulders (outside the track support zone) acceptable materials, with less stringent structural requirements can be used.

Figure 1: Indicative material composition of a HS2 zoned embankment



1.2.6 Other earthworks materials, such as those needed for landscaping or environmental mitigation do not have to conform to the stringent requirements that apply to structural embankments but will also be engineered from excavations of cuttings and other structures within the land required for the construction of the Proposed Scheme.

1.2.7 Earthworks are designed to achieve the engineering performance required for the Proposed Scheme. They also classify materials according to their physical properties and specify the purpose for which these materials can be used. The highest quality materials (typically those with highest strength, stiffness and durability) are used where the engineering requirements are highest (e.g. railway embankments). For the purposes of this report, 'acceptable engineering materials' are materials whose properties are acceptable for the purpose of constructing earthworks for both the route of the Proposed Scheme and associated highway crossings. The technical requirements of the design of these features of the Proposed Scheme relate to soil movement and stiffness after placement.

1.2.8 Table 1 is a summary of the engineering classification of all excavated materials expected to be used during construction of the Proposed Scheme. It is likely that all classes of materials in Table 1 will be excavated as part of the construction of the Proposed Scheme. The core of the embankments for the Proposed Scheme will need to be constructed from acceptable engineering materials comprising, general fill (Class 1 and Class 2), high quality granular fill (Class 6) or treated cohesive fill (Class 9) materials, defined as high quality acceptable engineering material in Figure 1.

Table 1: Classification of engineering materials

Type	Material class	Typical description	Example end use
Unacceptable materials	U1A	Geotechnically unsuitable materials which can be treated for use as general/landscaping fill	Treat and use as general/landscaping fill or remove from works
	U1B	Materials that are unsuitable for reuse by virtue of an excess concentration of contaminants that render the material 'contaminated' (as defined	Treat as necessary to achieve site specific threshold criteria for the receiving location and

Type	Material class	Typical description	Example end use
		by statutory regulation or HS2 Ltd project requirements) at the place and environmental setting of its final deposition	use as general/landscaping fill or remove from works
General fill	1	Granular fill such as sand, gravel, and crushed rock e.g. sandstone	High speed railway embankment fill Other fill e.g. highway fill
	2	Cohesive fill – clay	High speed railway embankment shoulder fill. Other fill e.g. highways embankment fill or landscape areas
Landscape fill	4	Various fill for use in environmental mitigation earthworks	Landscape and environmental mitigation earthworks
Topsoil	5	Topsoil or turf	Topsoiling/landscaping
Subsoil	5s	Agricultural subsoil	Subsoil underlying topsoil
High quality granular fill	6	Selected granular fill such as sand, natural gravel, crushed gravel and crushed rock (but typically excludes rocks such as mudstones)	High speed railway embankment fill High quality granular fill such as capping layers, structural backfill, and fill below water
Treated cohesive fill	9	Stabilised cohesive materials (Class 2)	Use in high speed rail embankment cores

Note: The classification of materials is based upon the Design Manual for Roads and Bridges (DMRB), Volume 1, Specification for Highways Works, Series 600, Earthworks classification. There are sub-classes to each of the material classes identified above. The table provides a generic description for the purposes of this report.

1.3 Geology of the land required for the Proposed Scheme

1.3.1 Details of the geology and hydrogeology can be found in Volume 2, Community Area reports, Section 10, Land Quality, and Section 15, Water Resources; Volume 5, Land quality Map Book; and Volume 5: Water resources and flood risk Map Book.

1.3.2 The natural geology of the land required for construction of the Proposed Scheme within the MA02 area is summarised as:

- bedrock - primarily Mercia Mudstone Group (comprising the Sidmouth Mudstone Formation and the Northwich and Wilkesley Halite Member within the MA02 area; and
- superficial deposits – broadly separated into glacial and postglacial/recent soils. There may also be older superficial deposits present at depth that are of non-glacial origin:
  - glacial till: a group of sediments deposited directly from glacial ice. Variable lithology, usually sandy, silty clay with gravel, but can contain gravel-rich, or laminated sand layers;

- glaciofluvial deposits: sand and gravel: locally with lenses of silt, clay or organic material;
- glaciofluvial sheet deposits: sand and gravel: locally with lenses of silt, clay or organic material and clay, laminated, commonly rich in organic matter, locally with interbedded peat;
- Shirdley Hill Sand Formation: the formation comprises moderately to well sorted, typically fine grained silica sands;
- river terrace deposits: generally comprise stratified sequences of sands and gravels; and
- alluvium: generally comprising sequences of silt and organic-rich clay. Within those deposits are lenses or beds of sand, gravel and peat. These are in limited quantities along the route typically found adjacent to and along rivers and streams.

1.3.3 Further details are given in Volume 5: Appendix LQ-001-0MA02 and presented in maps LQ-01-304b to LQ-01-309a (Volume 5, Land quality Map Book).

1.4 Hydrogeology

1.4.1 The hydrogeology within MA02 is characterised by the aquifers[1] within the superficial deposits and bedrock, which are:

- the alluvium, river terrace deposits, glaciofluvial deposits and glaciofluvial sheet deposits which are all designated as Secondary A aquifers;
- the glacial till which is designated as a Secondary (Undifferentiated) aquifer;
- the Sidmouth Mudstone Formation of the Mercia Mudstone Group which is classified as a Secondary B aquifer; and
- the Northwich Halite Member of the Sidmouth Mudstone Formation (Mercia Mudstone Group) which is classified as unproductive strata.

1.5 Related reports

1.5.1 Other reports published as part of the Environmental Statement (ES) contain information about borrow pits. In particular:

- Volume 1, Introduction and methodology regarding the construction of the Proposed Scheme;
- Volume 2 Community Area Report: Wimboldsley to Lostock Gralam (MA02), including the following sections:
  - Section 2, Overview of the area and description of the Proposed Scheme;

[1] UK Government (2017), *Protect groundwater and prevent groundwater pollution*. Available online at: https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution.

  - Section 3, Stakeholder engagement;
  - Sections 4 to 15, comprising environmental topic assessments of the Proposed Scheme (including the borrow pits as relevant); and
- Volume 5, Water resources assessment, Appendix WR-003-0MA02.

2 Material requirement and potential sources

2.1 Introduction

2.1.1 This section describes the types and approximate volumes of materials required to construct the Proposed Scheme. The primary source of materials needed to construct the Proposed Scheme will be site-won material generated from construction operations. Maximising the reuse of these site-won materials will ensure that the need for disposal of materials off-site is reduced. Work undertaken has identified a substantial deficit of acceptable engineering materials once the site-won material has been taken into account. Therefore, other potential sources have been considered for use in the construction of the Proposed Scheme. These other sources of materials comprise:

- recycled aggregates;
- dredged materials;
- commercial quarries; and
- borrow pits.

2.2 Material demand and availability

2.2.1 The total volume of acceptable engineering materials required to construct the Proposed Scheme is currently estimated to be 10 million m^3 comprising approximately:

- 2.4 million m^3 of high-quality granular material for constructing the core of the high-speed railway embankments, core of the highway embankments, prepared subgrade, for ground improvement (dig and replace) and the transitions between structures and earthworks;
- 0.3 million m^3 of granular material required for embankment fill and ground treatment; and
- 7.3 million m^3 of cohesive material of which:
  - 4.7 million m^3 is required for the construction of high-speed railway embankments;
  - 1.1 million m^3 for the construction of highways embankments; and
  - 1.5 million m^3 of suitable fill for use in landscape mitigation earthworks.

2.2.2 Table 2 provides a summary of the quantity of acceptable engineering materials required, the estimated quantity of site-won material that excavations along the route corridor may yield and be available for reuse along with the material deficit volumes. This material deficit volume equates to the supply of acceptable engineering material the construction of the Proposed Scheme will require from other sources.

2.2.3 The summary in Table 2 does not take into consideration:

- the location of the excavated material in relation to the location required for its reuse;

- the timing of excavation in relation to the need for material at a particular location; or
- the requirements for fill materials sourced from the Proposed Scheme to meet the engineering suitability parameters prior to reuse.

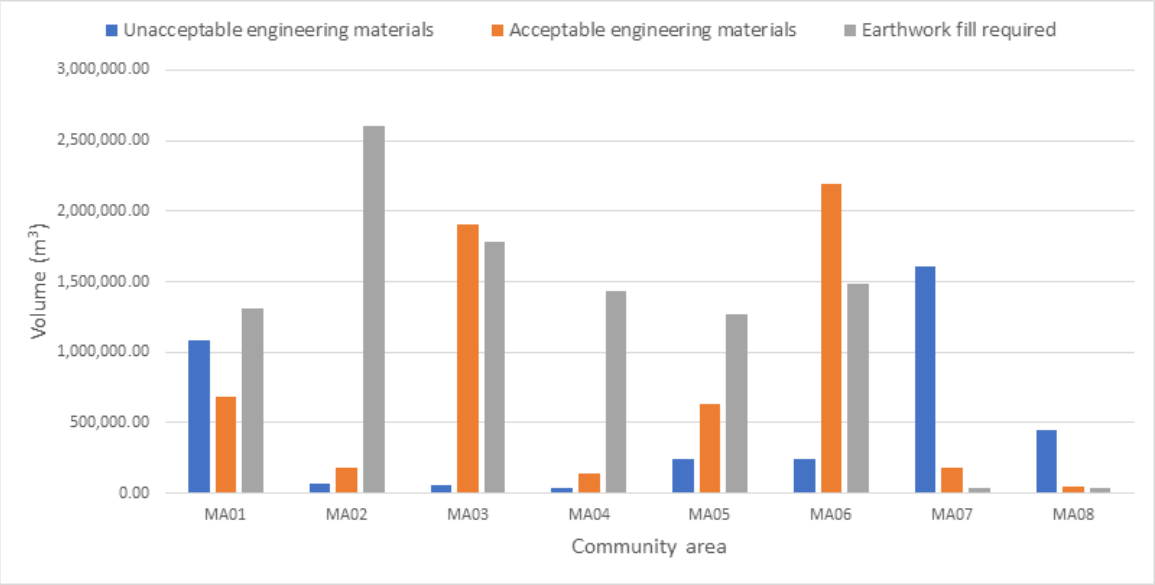
Table 2: Volumes of acceptable engineering fill required for construction of the Proposed Scheme

	Volume of high quality granular fill class 6 (m^3)	Volume of general fill – granular class 1 (m^3)	Volume of general fill – cohesive class 2 (m^3)	Total volume (m^3)
Fill required	2,383,130	308,730	7,279,570	9,971,410
Site-won	0	176,000	5,797,000	5,973,000
Deficit	2,383,130	132,730	1,482,570	3,998,410

2.2.4 Earthworks along the route of the Proposed Scheme from Pickmere to Agden and Hulseheath (MA03) to Risley to Bamfurlong (MA05) and Manchester Piccadilly Station (MA08) will generate site-won excavated materials (see Figure 2 and Figure 3). These excavated materials will be reused to meet the demand for acceptable engineering material in those areas where materials are required.

2.2.5 The balance of acceptable site-won material relative to the requirement for acceptable earthworks fill in each community area is shown on Figure 2. Figure 2 also shows volumes of anticipated unacceptable engineering materials that will be generated by community area. The unacceptable engineering materials are likely to require further analysis to determine their potential for reuse within the Proposed Scheme in areas where less stringent engineering conditions are required for the materials. Among possible reuses are as general fill, landscape fill material or for the restoration of borrow pits.

Figure 2: Summary of material availability within the community areas



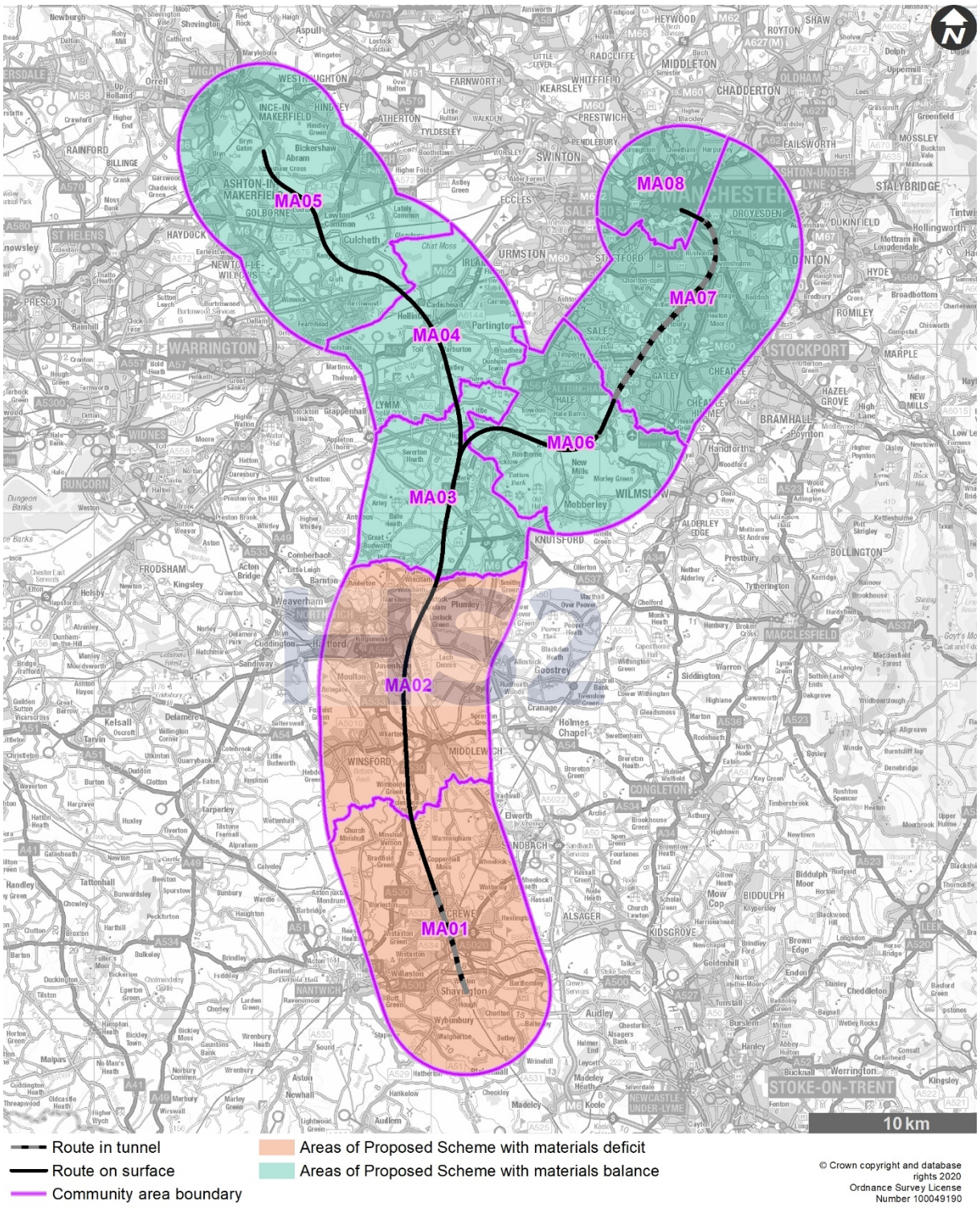
2.2.6 All excavated materials from the construction of the Proposed Scheme will be subject to additional geotechnical suitability testing and classification. Once classified the excavated

materials would be reused according to its confirmed class. A proportion of the excavated materials may need to be treated or undergo processing to render it suitable for reuse as a particular class of material.

2.2.7 Figure 3 shows a balanced distribution of excavated materials across the MA03 to MA08 areas and a deficit of materials within MA01 and MA02. The exceptions to the balanced distribution of site-won excavated materials are:

- the demand for high quality granular fill (Class 6) that cannot be sourced from within the works; and
- the required disposal of unacceptable (U1A) materials generated from construction of the Manchester tunnels.

Figure 3: Excavated material balance for the Proposed Scheme



2.2.8 The total deficit volume of acceptable engineering materials that cannot be sourced from site-won excavated material is approximately 4 million m^3 (see Table 2). The majority of the demand for acceptable engineering material is required for the construction of embankments in the MA02 area but other areas of the Proposed Scheme will also require acceptable earthworks materials that cannot be sourced solely from site-won materials.

2.3 Materials acquisition strategy for the Proposed Scheme

2.3.1 Table 2 demonstrates a deficit in the materials needed for the construction of the Proposed Scheme. To address this shortfall HS2 Ltd has adopted an earthworks strategy that seeks to:

- maximise the direct reuse of acceptable site-won material where it meets the engineering requirements and is reasonably practicable considering the constraints imposed by engineering and construction logistics;
- where direct reuse is not possible, use treatment (e.g. modification or stabilisation) of site-won material to meet the engineering requirements where reasonably practicable;
- where acceptable site-won materials cannot be used practicably or where volumes are insufficient, alternative sources of materials considered in this report are:
  - import of material from alternative/sustainable sources (e.g. secondary aggregates or marine dredged material etc);
  - import from quarries;
  - use of borrow pits within the land required for the construction of the Proposed Scheme or adjacent to it and accessed via a short haul route; and
  - use of borrow pits more remote from the land required for the construction of the Proposed Scheme and accessed via the public highway.

2.3.2 In deciding whether a particular borrow pit should be used, HS2 Ltd has considered whether there is a compelling case in the public interest for interference with property rights of affected landowners and occupiers on a case by case basis having regard to the engineering and environmental advantages and disadvantages and any reasonably practical alternative sources of material supply.

2.4 Reuse of excavated material along the route of the Proposed Scheme

2.4.1 An integrated design approach has been developed that seeks to reuse excavated material to satisfy the necessary engineering and environmental mitigation earthworks for the Proposed Scheme. This approach seeks to reduce the quantity of surplus material generated from excavations along the route of the Proposed Scheme and reduce off-site disposal to landfill.

2.4.2 The reuse of excavated material will generally be undertaken in accordance with the guidance outlined in the Contaminated Land: Applications in Real Environments Definition of

Waste: Development Industry Code of Practice, Version 2[2], which sets out best practice for assessing whether excavated materials can be reused as a non-waste.

2.4.3 To decide on the right earthworks strategy for any project it is necessary to balance engineering, construction logistics, construction programme, economic, environmental and stakeholder interests. A combination of all three sources of acceptable engineering material outlined in Section 2.2 including maximising the reuse of site won material and minimising imported materials is proposed. The assessment of the appropriateness of all sources is based on currently available desk-based information.

2.5 Direct reuse of excavated materials

2.5.1 Where excavated materials from the construction of the Proposed Scheme are classified as acceptable engineering materials, their direct reuse within a project is the optimum approach because this reduces:

- the area of land required for construction as additional land is not needed for excavation;
- the quantity of material to be imported;
- the quantity of material to be exported;
- the unreliability of available supply of materials at the time when they are needed; and
- the traffic and transport related impacts on local communities or highway networks as materials are generally moved in large off-road dump trucks operating solely within the boundaries of the construction site.

2.5.2 The principal factors that could inhibit the potential for the reuse of site-won excavated materials as engineering fill include:

- geology: the excavation of materials for the Proposed Scheme may not yield sufficient quantities of acceptable engineering materials. This is particularly the case for the highest quality granular materials (Class 6) where a zero volume of site-won material is anticipated to be generated due to the nature of the geology across the Proposed Scheme;
- alignment: alignments are managed as far as reasonably practicable to balance the earthworks demands (excavation volumes against required fill volumes). However, as discussed in Section 1.2, a large proportion of the alignment of the Proposed Scheme within the MA02 area, is required to be constructed on raised embankment due to the geological constraints and this will result in a large deficit of fill material in this area; and
- obstructions: major obstructions which the route of the Proposed Scheme needs to cross such as main rivers, strategic highways, motorways and railways. It would not be reasonably practicable to move large quantities of excavated materials over long

[2] CL:AIRE (2011), *The Definition of Waste: Development Industry Code of Practice Version 2*. Available online at: https://www.claire.co.uk/projects-and-initiatives/dow-cop.

distances within construction sites until temporary crossing structures are installed. For the MA02 area major physical crossing constraints of note include; the Shropshire Union Canal and Trent and Mersey canal, the A54 Middlewich Road, the River Dane, Puddinglake Brook, Gad Brook, Wade Brook, the West Coast Main Line and mid-Cheshire railway line. These obstructions and the construction sequencing will necessitate the movement of excavated materials onto local highways networks, with associated impacts.

2.6 Reuse of excavated cohesive materials following stabilisation

2.6.1 Soil stabilisation is the process of improving the engineering properties of the soil before construction. Stabilisation is undertaken to improve the strength of the soil and shrink/arrest the welling potential to improve the load bearing capacity and overall performance of in-situ soils. To produce the required type of engineering materials a large proportion of the cohesive fill to be used to construct high-speed railway embankments is likely to require stabilisation with lime/cement and/or other additives.

2.6.2 The process of stabilisation can significantly increase the volume of excavated materials suitable for use as acceptable engineering fill. This reduces the demand for imported materials, whilst also reducing the volume of these excavated materials that might otherwise need to be disposed off-site. There will be a requirement to import the lime/cement materials required to undertake the stabilisation which will have traffic impacts. Other advantages of soil stabilisation are:

- it would take place within the land required for construction of the Proposed Scheme and will avoid the requirement for additional land;
- creates opportunities to significantly reduce haulage distances; and
- by reducing haulage distances, can result in programme efficiencies.

2.6.3 The combination of lime/cement and naturally occurring sulphates in the ground can lead to post-construction, expansive chemical reactions and potential heave. This could have an adverse impact on long term track stability. Based on available historic geological desk study information and in the absence of ground investigations (GI) information, it has been assumed that bedrock from the Mercia Mudstone that contains high levels of halite and sulphate would be classed as unsuitable for stabilisation treatment. All cohesive glacial till is assumed as suitable for stabilisation given the sulphate content levels reported within published geological data for the area. This assumption will be subject to confirmation through targeted GI, testing and assessment as variations could have a significant impact on the earthworks balance, quantities of acceptable engineering materials and movement of excavated material.

2.6.4 The requirement to treat materials will add additional time for the treatment process, costs for the haulage of treatment materials and this will result in additional complexity to the

construction process. Building earthworks using stabilised cohesive materials is more complex and slower than using high quality granular materials that do not require stabilisation. Any impact on programme duration depends on the proportion of stabilised material used within a given embankment and the overall size of the embankment and the effects of inclement weather on the stabilisation process.

2.7 Alternative sources of supply

2.7.1 The deficit of acceptable engineering materials identified in Table 2 will need to be addressed using sources other than site-won materials. In this section, a high level appraisal has been undertaken of potential alternative sources of material to determine whether they could be suitable for use in the Proposed Scheme.

Recycled aggregates

2.7.2 A review of the availability of recycled crushed concrete or other recycled materials has indicated that there is unlikely to be sufficient volumes of high quality material available and it will be unlikely to comply with the engineering material specification. As such this option is not considered further at this stage for use in the Proposed Scheme.

Dredged materials

2.7.3 An appraisal has been undertaken into the potential use of dredged material as a high grade fill in Proposed Scheme embankments. The appraisal included reviewing existing dredging operations and licences in the north-west of England.

2.7.4 The appraisal confirmed that dredged materials are available in the north-west, predominantly in the Merseyside area. The bulk of these materials are from maintenance dredging for navigational purposes with the majority being silts and of poor quality. There are some licences providing marine aggregates to mineral and concrete suppliers. However, the licenced volumes generated each year are low compared to potential demands for construction of the Proposed Scheme, particularly in the MA02 area.

2.7.5 Accordingly, marine dredged material was not considered appropriate for use as acceptable engineering material due to:

- the travel distances for supply of this material (being more than one hour travel distance, or within a 45km radius, to the locations within the Proposed Scheme where it would be required);
- the seasonal nature of dredging, the lack of certainty of supply and the low volumes of potential suitable material;
- the potential soluble salt content within dredged materials that might compromise the ability to adhere to high standards within HS2 Ltd's earthworks specifications for railway embankments; and

- the potential impacts on the existing supplies to the concrete industry, which when the material is intensively washed, is able to utilise this material for concrete production.

Commercial quarries

2.7.6 There will be a need to source high quality engineering materials from specific geologies (typically crushed hard rocks) available only from commercial quarries. The use of quarries to source general fill however has many limitations which are discussed in Section 3.

2.7.7 Typically, rock quarries supply materials to precise engineering specifications as a quality assured product (e.g. high quality granular fill (Class 6), highway aggregates, concrete aggregates, drainage aggregates) which command a premium price. Quarries are not routinely used as a primary source for general fills (e.g. Class 1) because, in general, the majority of infrastructure projects will try to maximise the reuse of excavated materials from the project or will source required engineering materials from borrow pits. In addition, the cost premium for sourcing materials from quarries cannot be justified for general fill materials. A review into potential quarries to supply both high quality granular fill (Class 6), and general fill (Class 1) granular materials for the Proposed Scheme is presented in Section 3 of this report.

Borrow pits

2.7.8 A borrow pit is an area where acceptable engineering materials are extracted for use in the construction of infrastructure and building projects. Unlike commercial quarries, a borrow pit is dedicated to supply material to a specific infrastructure project. They are usually located close to the locations where the materials are required and where the geology is favourable so they yield appropriate materials which require the minimum amount of processing or treatment (although this could include stabilisation).

2.7.9 Compared to the importation of material from quarries and other more distant sites, the use of borrow pits may reduce the impacts of vehicle movements on local highways and communities. Where it is possible to locate borrow pits within or close to the land required for construction and close to where the material is needed, this will have substantially less air quality impacts from construction traffic using the public highway network. In addition, there is likely to be significant cost savings associated with the sourcing of high quality materials from borrow pits when these costs are compared with those associated with importing high quality materials from quarries.

2.7.10 For use in the Proposed Scheme, borrow pits can be divided into three categories. They can either be:

(a) adjacent to the route of the Proposed Scheme;

(b) directly accessed via a site haul route (temporary roads provided within the area of land required for construction of the Proposed Scheme); or

(c) remote from the route of the Proposed Scheme, and rely upon the local road network for connecting to the construction of the Proposed Scheme.

(a) Borrow pits adjacent to the route of the Proposed Scheme

2.7.11 Borrow pits that are located adjacent to the route of the Proposed Scheme would provide the opportunity to reduce the volume of materials that are required to be transported to or from the site from quarries or other sources using the public highway network. The majority of materials can be transported using articulated dump trucks (ADT) within the construction site thereby reducing the need to use public highways for the transportation of excavated materials. Use of the public highway network would be more limited and associated with particular circumstances. Typically these would occur where excavated materials cannot be moved from its source to its destination directly along the route of the Proposed Scheme because of particular physical obstruction such as a major road, river or railway that would require a temporary crossing. However, the principal objective would be to avoid use of the public highway network helping to reduce the number of construction vehicles, duration of journey times and travel distances and will have substantially less air quality impacts from construction traffic using the public highway network.

(b) Borrow pits directly accessed via a site haul route

2.7.12 Material excavated from borrow pits that can be accessed directly via site haul routes would be transported directly via a dedicated site haul route (a temporary route dedicated for use by the Proposed Scheme). This would reduce the potential impacts on the local public highways. As with (a) above, it is possible that minimal use of the local public highway network would be required in specific circumstances.

(c) Borrow pits remote from the route of the Proposed Scheme

2.7.13 In circumstances where the natural geology would not provide the required type and quantity of high quality engineering fill borrow pits may also need to be located remote from the route of the Proposed Scheme. In these instances excavated materials will generally first need to be transported from the borrow pit on the public highway network to a materials transfer point, or transfer node. At the transfer node excavated materials would be transferred onto ADT for onward movement via site haul routes.

2.7.14 Use of remote locations results in less efficient materials handling when compared to borrow pits either adjacent to, or with direct access to land required for the construction of the Proposed Scheme. Remote borrow pits may give rise to new or increased traffic and transport impacts on local public highways as a result of the requirement to transport borrow pit restoration materials, either through the import of materials excavated from the Proposed Scheme or from off-site sources. This would also have greater impacts on air

quality than borrow pits located adjacent to the route of the Proposed Scheme as in (a) or borrow pits directly accessed via a site haul route as in (b).

3 Assessment of potential sources of material

3.1 Introduction

3.1.0 This section provides an appraisal of the potential sources of acceptable engineering material that can be sourced and used for the construction of the Proposed Scheme within the MA02 area. As discussed in Section 2.7, the use of recycled aggregates and dredged materials to address the deficit of acceptable engineering materials is not considered viable and will not be considered further in this report.

3.2 Reuse of excavated materials

3.2.1 Excavations required for the construction of the Proposed Scheme are not predicted to provide a sufficient quantity of acceptable engineering materials for reuse either with or without treatment due to the nature of the natural geology across the route of the Proposed Scheme and the demand for high quality engineering materials for construction of high speed rail embankments.

3.2.2 There is likely to be a requirement to undertake stabilisation treatment of a proportion of the excavated materials to render them suitable for use as acceptable fill material. The precise volume of excavated materials that may require stabilisation treatment prior to reuse will be assessed following the completion of GI along the Proposed Scheme.

3.2.3 Where excavated materials are suitable for general use as backfill but are not suitable for use as acceptable engineering fills for the construction of the Proposed Scheme, they may be used as fills for the restoration of borrow pits, where required. Further detail of the approach for restoring borrow pits can be found in Section 9.

3.2.4 It may not be possible to reuse all the excavated materials when required due to physical obstructions and other constraints associated with the construction sequencing of the Proposed Scheme.

3.2.5 The transport of materials using site haul routes to the point of use along the Proposed Scheme can be inhibited by the presence of major physical obstructions (such as rivers, rail and road crossings etc). The existence of these physical obstructions could have an adverse impact on the programme for the construction of the Proposed Scheme. As a result it may not be reasonably practical to reuse all excavated materials.

3.3 Demand for imported materials

Importation of high quality granular fill from quarries

3.3.1 The potential for importation of acceptable engineering fill from commercial quarries has been assessed. A high-level appraisal and desk-based survey was undertaken of potential quarries in the vicinity of the Proposed Scheme. The work included identifying quarries and operators, contacting the quarry operator and undertaking a survey of the key information on that facility.

3.3.2 If exclusively sourced from quarries, the total demand for high quality granular fill over and above site-won quantities across the Proposed Scheme, would be approximately 2.4 million m^3. The breakdown of demand for the materials by community area would be approximately as follows:

- Hough to Walley's Green area (MA01): 661,000m^3;
- Wimboldsley to Lostock Gralam area (MA02): 546,000m^3;
- Pickmere to Agden and Hulseheath area (MA03): 385,000m^3;
- Broomedge to Glazebrook area (MA04): 272,000m^3;
- Risley to Bamfurlong area (MA05): 319,000m^3;
- Hulseheath to Manchester Airport area (MA06): 320,000m^3;
- Davenport Green to Ardwick area (MA07): 4,100m^3; and
- Manchester Piccadilly Station area (MA08): 12,000m^3.

3.3.3 The potential for a quarry to supply this type of high quality granular fill for the Proposed Scheme was assessed by reference to the following factors:

- its production rate;
- the type and suitability of the material produced;
- the current status of the environmental permit for operation;
- working hours restrictions;
- traffic volume restrictions; and
- distance/journey times.

3.3.4 To calculate journey times and define material densities the following parameter values have been assumed:

- average speed on routes: 40km/h; and
- volume capacity for heavy goods vehicle (HGV) tipper: 8.5m^3.

3.3.5 A review and more detailed study of the available information reveals that there are five quarries which have the potential capacity to yield the types of materials at sufficient volumes required to meet the estimated deficit shown above. The MA02 area has the

biggest demand for high quality granular fill to be imported due to the absence of this type of material that can be sourced from the area, see Section 2.3.

3.3.6 The quarries that have the potential to supply materials to the Proposed Scheme are detailed in Table 3.

Table 3: Summary of quarries within a 45km radius of the Proposed Scheme

Quarry name	Postcode	Traffic route distance by road (km)	Journey time (one -way)	Number of journeys per day per HGV	Current production rate (volume (m^3)/year)
Topley Pike	SK17 9TE	77.3	2hr	2	125,800 limestone (2018)
Hindlow	SK17 0EL	76.1	1hr 54min	2	40,909 limestone
					22,727 stabilised clay
Wood Lane	SY12 0HY	54.4	1hr 22min	3	136,363 Sand and Gravel
Croxden	ST10 1RF	59.6	1hr 30min	3	Information not available. Likely sand and gravel
Caldon Low	ST10 3EW	69.8	1hr 44min	2	279,367 limestone (2018)
Average distance per journey (by road)		67			
Average journey time per one-way trip			1hr 42min		

3.3.7 Although these quarries are within a 45km radius, the actual average journey distance by road is 67km, with an average journey time of 1 hour and 42 minutes. If the five identified quarries were unable to supply the required volumes of general fill material, the actual average distance to suitable quarries with the ability to supply the materials would likely be greater than 67km. Available information allows for the assumption that these quarries have the potential to supply and their actual availability to supply would depend on the final supply chain arrangements.

3.3.8 The review was undertaken based on distances to the transfer node (TN02) at Crewe North rolling stock depot (RSD) satellite compound 3. This would be the main transfer node where imported material from quarries would be handled before being distributed to their required locations. Based on the average distance of 67km, in a typical day, taking into consideration loading, unloading, dispatch, arrival (booking out/in), wheel cleaning and any incidental waiting time, any single HGV would make no more than three return journeys in any one day. The use of these quarries would therefore require a large number of HGV to meet the required quantities.

3.3.9 Based on the current assessment, none of the five quarries are expected in themselves to yield excavated material in sufficient quantity to satisfy total demand for the Proposed Scheme. A combination of several quarries would be needed to source the overall requirement for high quality granular materials across the Proposed Scheme. In addition, more than one quarry would be required to meet the demand in the MA02 area which has the greatest requirement for the import of high quality granular materials.

3.3.10 Quarries will also have existing customers and so are unlikely to be able to meet the demand for the Proposed Scheme whilst maintaining a reliable supply of materials to other customers. The use of the quarries to supply all the materials required to construct the Proposed Scheme would severely limit the availability of this type of material required for other construction purposes and may completely exhaust supplies from a quarry over time.

3.3.11 It is likely that there are other quarries that are located outside the 45km radius used in the appraisal that may be able to provide the required volume of materials for construction of the Proposed Scheme. However, the likely significant increase in travel distance and travel times together with the increased traffic on the highway network and the associated increases in carbon emissions makes this option unacceptable.

Traffic routes to/from potential quarries

3.3.12 The potential quarries that could supply the required high quality fill materials are principally located to the east of the Proposed Scheme in Derbyshire and Staffordshire and to the south-west in the Shropshire area. The locations of these quarries means that there is limited opportunity to use the strategic road network, motorways and major 'trunk' A-roads. Therefore, there would be significantly increased levels of construction traffic between the quarries and the Proposed Scheme.

3.3.13 To transport fill materials from quarries located in the Derbyshire area would result in significantly increased traffic levels on local routes near Congleton and on the A54 highway approaching the M6 junction 18 from the east. Traffic to/from the Staffordshire area would likely have to use the public highway and the A500 Alsager Road at the M6 junction 16. For quarries in the Shropshire area, traffic would be required to use the A495 Ellesmere Road, the A49 Tarporley Road, and the A534 Wrexham Road before joining the A530 Nantwich Road to in order to access the Crewe North RSD satellite compounds and other transfer nodes in MA02 (refer to Annex C – Transfer node assignments).

3.3.14 Taking into account all the factors that have been considered in the sections above, it is considered that the use of quarries to supply the entire deficit of acceptable engineering fill material for construction of the Proposed Scheme is not feasible for the following principal reasons:

- the identified quarries, within 45km radius of the Proposed Scheme, would not be able to supply the total quantity of acceptable materials required for the construction of the Proposed Scheme. In addition, using these quarries as a primary source of acceptable materials for construction of the Proposed Scheme will have a large impact on the

quarries future ability to supply other customers over a period of time and could exhaust supplies in those areas;

- the distance to potentially suitable quarries, outside the 45km radius, that may be able to supply the required materials is considered to be too great to be a viable source for use in the Proposed Scheme, primarily due to substantial increases in HGV traffic to the local highway network and along the routes that would be used to the Proposed Scheme, the journey distance and travel times between the quarries and the Proposed Scheme and the increase in carbon emissions;
- there would be a significant increase in the cost of construction if all fill materials were solely sourced from quarries; and
- the cost and availability of materials for use in other construction schemes could also be adversely affected by a shortage in supply caused by the high level of demand from the construction of the Proposed Scheme.

3.3.15 As previously highlighted in Section 2.2, there will still be a requirement to source large quantities of high quality granular materials that cannot be sourced directly from the construction of the Proposed Scheme, regardless of the use of borrow pits which is discussed in the following section.

3.4 Use of borrow pits

3.4.1 The total volume of acceptable engineering materials that cannot be sourced (site-won) from within the land required for construction of the Proposed Scheme or from quarries is approximately 1.6 million m^3. As such, borrow pits that are located close to the route of the Proposed Scheme have been considered as a potential alternative source for the acceptable engineering (granular and cohesive) materials.

3.4.2 The use of borrow pits may increase the land required for the construction of the Proposed Scheme depending on the location of the proposed borrow pits that are selected. The use of borrow pits would:

- provide a certainty of supply and will reduce the reliance on external sources for the supply of large quantities of acceptable engineering materials;
- ensure that the supply of high quality materials from quarries is not exhausted by the Proposed Scheme alone and remains a valuable resource to be used for other construction schemes;
- substantially reduce the net impacts of vehicle movements on local communities and associated air quality impacts when compared with the import of acceptable fill materials from several remote quarries;
- provide the opportunity of a potential fill location for unacceptable excavation materials generated during earthworks that cannot be reused within the Proposed Scheme and may require disposal to landfill. This would reduce the filling up of the limited landfill space available in north-west England; and

- provide a significant cost saving associated with the inclusion of borrow pits in the Proposed Scheme as the material sourced from borrow pits will have a lower cost to the project than the costs associated with importing high quality materials from other external sources, such as quarries.

3.4.3 As a result of the above, borrow pit sites are proposed to support the construction of the Proposed Scheme. These are to be located as close as reasonably practicable to where the excavated material would be used, and/or to the relevant transport transfer node. This would help to reduce traffic related impacts arising from the haulage of materials over relatively long distances, particularly when using the local highway network.

3.4.4 There is a degree of uncertainty over the precise required volumes that would need to be sourced from borrow pits due to the Proposed Scheme being at an early stage in the design process. As a result, conservative assumptions have been used regarding the requirement and capacity of borrow pits. If there is a greater demand for materials from borrow pits following detailed design, there would be sufficient headroom to ensure that the selected borrow pits would have the volume of material required to satisfy the additional demand.

3.4.5 Dedicated site haul routes would be used for the transport of material from borrow pits located within the land required for construction of the Proposed Scheme in order reduce environmental impacts as far as reasonably practicable (e.g. impacts on communities, designated ecological sites, cultural heritage assets, rivers and agricultural land).

3.5 Summary of sources

3.5.1 Acceptable engineering materials are required to meet the shortfall of high quality fills for construction of the Proposed Scheme. Materials will be used within the works on the basis of the highest grade of excavated material being allocated to the most appropriate demand for engineering fill. Once demand is met locally, materials will then be distributed to the next location requiring a high quality of fill. Surpluses of higher quality excavated materials will then be cascaded to the next best use, that being the engineering function of a lower quality fill to maximise the direct reuse of excavated materials, reducing the volume of material that needs to be disposed off-site.

3.5.2 In the MA02 area, this cascade of materials will not prevent a shortfall of high quality materials needed for the construction of the Proposed Scheme. The quality of materials that will be encountered during excavations are not anticipated to meet the engineering criteria for railway embankment fills resulting in a substantial deficit. As presented in Table 2, there will be a deficit of approximately 2.4 million m^3 of acceptable engineering fill material, 0.1 million m^3 of general granular fill material and 1.5 million m^3 general cohesive fill material.

3.5.3 The option of importing materials from quarries to satisfy the whole of the demand for acceptable engineering materials has been outlined in Section 3.3. Information provided by quarry operators, the distance of quarries from the identified areas of demand and the potential impacts of traffic on local highways and communities means that the use of quarries to fulfil the whole demand in the MA02 area is considered unfeasible due to the

available quantities, traffic impacts and exhausting material supplies for other potential users.

4 Methodology for selection of borrow pit locations

4.1 Town Planning Framework

4.1.1 The consideration of the use of borrow pits for the construction the Proposed Scheme has been undertaken with regard to relevant national and local planning policy and related guidance. This section sets out the planning policy framework that supports the approach for the borrow pits and has helped inform HS2 Ltd's approach to including them within the Proposed Scheme.

4.1.2 Approval and powers to construct and operate the Proposed Scheme are being sought through the hybrid Bill.

4.1.3 The extraction of material from a borrow pit cannot commence until schemes for working and restoration of the land have been approved by the local planning authority pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill. These schemes would include detailed designs, specifications and schedules for implementation of the working of the borrow pits, their subsequent restoration and where appropriate, a description of any aftercare measures.

4.1.4 Following extraction of the required material from the borrow pits, the land would be restored to its former use, as far as reasonably practicable and with the requisite agreement with all relevant stakeholders. If any other future uses are proposed, these may require separate planning applications and environmental assessment, as necessary.

4.2 National Planning Policy Framework and other national policy guidance

4.2.1 The National Planning Policy Framework[3] (NPPF) sets out the Government's approach to planning matters. Paragraphs 209 to 217 of the NPPF set out the approach to facilitating the sustainable use of minerals and for maintaining supply. The NPPF requires that, when considering proposals for minerals extraction, there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality are taken into account. It also requires control, mitigation or removal at source of unavoidable noise, dust and particle emissions and any blasting vibrations. Appropriate

[3] Department for Communities and Local Government (2021), *National Planning Policy Framework: 17. Facilitating the sustainable use of minerals*. Available online at: https://www.gov.uk/guidance/national-planning-policy-framework/17-facilitating-the-sustainable-use-of-minerals.

noise limits for extraction in proximity to noise sensitive properties should also be established.

4.2.2 Paragraph 210, part (h) of the NPPF recognises that mineral sites should be restored at the earliest opportunity to high environmental standards. This is a central tenet of HS2 Ltd's Borrow Pit Restoration Strategy (see Section 9). The nature of the restoration of each borrow pit will depend on the approval given by the local planning authority pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill.

4.2.3 The NPPF is supported by the National Planning Policy Guidance (NPPG). The guidance within the NPPG that relates to minerals was last updated in October 2014.

4.2.4 Paragraph 8[4] states that 'Mineral planning authorities should plan for the steady and adequate supply of minerals in one or more of the following ways; 1. Designating Specific Sites; 2. Designating Preferred Area, and 3. Designating Areas of Search'. This allows mineral planning authorities to highlight areas where mineral extraction is expected to take place, as well as managing potentially conflicting objectives for the use of the land.

4.2.5 Paragraph 40[4] states that the 'level of detail required on restoration and aftercare will depend on the circumstances of each specific site including the expected duration of operations on the site. It must be sufficient to clearly demonstrate that the overall objectives of the scheme are practically achievable'. This provides the flexibility that for long-term proposals, a restoration strategy may be sufficient to demonstrate that the proposals are practically achievable. In such circumstances detailed restoration plans are required to be submitted at a later stage. This approach accords with the provisions in the High Speed Rail (Crewe – Manchester) Bill.

4.3 Local planning policy and guidance

4.3.1 The first consideration in the methodology for assessing the suitability of land for borrow pits is an understanding of the relevant minerals local plans and policies to the area under consideration. For the MA02 area relevant policies and guidance are found in:

- Cheshire West and Chester Council:
  - Local Plan (Part One) (2015)[4] - ENV9: Mineral Supply and Safeguarding (mineral safeguarding area for salt); and
  - Local Plan (Part Two) (2019)[5] – Policy M1: Future Sand and Gravel Workings (area of search for sand and gravel); Policy M2: Mineral Safeguarding Areas - Prior Extraction of Minerals supports the extraction of minerals prior to development within Mineral

[4] Department for Communities and Local Government (2014), *National Planning Policy Guidance; Revision date: 06.03.2014.* Available online at: https://www.gov.uk/guidance/minerals.

[5] Cheshire West and Chester Council (2019), *Local Plan (Part two) Land allocations and detailed policies*. Available online at: https://cheshirewestandchester.objective.co.uk/portal/cwc_ldf/adopted_cwac_lp/parttwo_adopted?pointId=5428432.

Safeguarding Areas and Policy M3: Proposals for minerals working and Policy M6: Salt and Brine Working (preferred area for controlled brine extraction).

- Cheshire East:
  - Saved Policy 6 (Prior Extraction) of the 'Cheshire Replacement Minerals Local Plan[6] (1999)' supports the prior extraction of minerals to prevent sterilisation; and
  - Cheshire Replacement Minerals Local Plan (1999) – Policy 45: Sand and Gravel Landbank; Policy 46: Future Sand and Gravel extraction; Policy 47: Sand and Gravel area of search; Policy 51: Future rock salt extraction and Policy 52: Future Controlled Brine Extraction (location considered suitable for future salt extraction).

4.3.2 The local mineral planning policy and guidance outline the provision for the adequate, steady and sustainable supply of sand, gravel, salt and brine, contributing to the sub-national guidelines for aggregate land-won sand and gravel, whilst ensuring the prudent use of important finite resources. The key policies to achieve this include:

- maintaining a minimum seven year landbank for aggregate land-won sand and gravel, making provision for a steady supply;
- ensuring the sustainable and prudent use of all natural mineral resources, including salt and brine; and
- requiring all proposals for minerals development to include high quality restoration and aftercare proposals in keeping with surrounding land uses.

4.3.3 For the purposes of the minerals required for construction of the Proposed Scheme and referred to in the local minerals plans, the minerals planning terminology covers the following:

- cohesive – silt and clay; and
- granular – sand and gravel (aggregates).

4.4 Technical appraisal methodology

4.4.1 The technical appraisal methodology used in the process of determining suitable locations for borrow pits initially focussed on the provision of sufficient quantities of acceptable engineering material as close to the point of need as reasonably practicable. It comprised an initial screening assessment whereby all land within 6km of the route of the Proposed Scheme was used to define a search area from which potential sites were identified. This was considered to be the distance within which borrow pits of sufficient size to be efficiently

[6] Cheshire East Council (2017), *The Cheshire Replacement Minerals Local Plan*. Available online at: https://www.cheshireeast.gov.uk/planning/spatial-planning/saved_and_other_policies/cheshire_minerals_local_plan/cheshire_minerals_local_plan.aspx#:~:text=The%20Cheshire%20Replacement%20Minerals%20Local%20Plan%20was%20adopted%20in%201999,Cheshire%20West%20and%20Chester%20Boroughs.&text=All%20policies%20in%20the%20Minerals,of%20State's%20Direction%20in%202007.

worked could be established with short haulage distances to the location in which the material will be required.

4.4.2 Possible sites identified from the screening assessment were then shortlisted based on an assessment of several factors, including:

- useable volume likely to be provided by each possible site;
- limitations to the route for access from the possible site to those design elements requiring acceptable engineering material;
- existing land use and local community factors;
- engineering and environmental considerations;
- the need for acceptable engineering materials close to the areas it will be required; and
- other factors such as thickness of overburden[7].

4.4.3 All material proposed for extraction from borrow pits in proximity to the Proposed Scheme would be moved on site haul routes and/or by the use of conveyors. However, fill material would also be required to be moved greater distances on both site haul routes and the public road network. Borrow pit restoration materials would also be transported using site haul routes and conveyors, as far as is reasonably practicable.

4.4.4 Material proposed for extraction from borrow pits remote from the land required for the operation of the Proposed Scheme would be moved on the local highway network and the strategic road network to transfer nodes before being transported via site haul routes to the required destination. Materials required for restoration of the borrow pits would use the same construction traffic routes.

4.5 Appraisal criteria

4.5.1 Table 4 sets out the criteria applied in the appraisal of different borrow pit location options. The appraisal sought to balance these factors and was based on informed qualitative decisions made with input from specialists in different environmental and engineering disciplines. The data used in the assessment is subject to confirmation following site-specific GI and other relevant site surveys.

Table 4: Appraisal criteria for assessment of potential borrow pit locations

Topic	Criteria
Strategic goals and HS2 Ltd's programme benefits (strategic fit)	Capture whether an option meets the Project Requirements Specification Capture the impact on the Proposed Scheme's programme benefits and strategic goals
Construction feasibility	Assess the relative complexity of construction, the construction programme and disruption to existing infrastructure
Maintenance	Assess the relative maintenance and servicing arrangements
Costs	Estimated whole life cycle costs to give relative assessment

[7] Overburden is defined as soil (including topsoil and subsoil) or rock overlying a mineral deposit.

Topic	Criteria
	Estimated initial construction capital cost to give relative assessment Estimate initial land and compensation costs to give relative assessments
Health and safety	Assess the relative risks to health and safety during construction Assess the relative risks to health and safety during operation, maintenance, decommissioning and emergency access
Environment	Use the principal environment assessment topic areas focussing in particular on the key determining factors of traffic and transport (access and traffic routes), land quality (geology), ecology and biodiversity and historic environment but also taking into consideration of the following: • Agriculture, forestry and soils; • Air quality; • Community; • Landscape and visual; • Socio-economics; • Sound, noise and vibration; and • Water resources and flood risk assessment
Planning	Refer to the relevant local minerals policy and review the committed developments (if any) at the proposed site

4.6 Key assumptions

4.6.1 The appraisal of the suitability of potential borrow pit locations was based on a number of assumptions, including:

- that topsoil and subsoil would normally be stripped and stored separately within the footprint of the respective borrow pit for use in site restoration, so sufficient space for long-term stockpiling would be needed;
- each borrow pit location would be accessible from the public highway network;
- aggregate screening and possibly crushing and blending may be required on site. If washing is necessary, provision for settlement ponds is likely to be required within the footprint; and
- borrow pits would be restored using material predominantly generated from excavations (including tunnel arisings) from the Proposed Scheme so proximity to the main source of arisings is preferable.

4.6.2 It is assumed that site-specific GI would confirm the following:

- the potential for land contamination to be present within the deposits targeted for extraction;
- the depth and thickness of the suitable deposit at the proposed borrow pit locations. This data would confirm the required depth (and therefore area) of borrow pits needed, which would also need to be adjusted to ensure that only the mineral required is extracted without sterilising remaining deposits;
- the physical and chemical suitability of the materials that could be extracted; and
- the depth to groundwater and hydrological constraints.

4.7 Limitations

4.7.1 The appraisal had a number of limitations, including:

- availability of detailed geological mapping at an appropriate scale and historical borehole logs;
- Geographic Information System data for local authority mineral plans was only available for Wigan Metropolitan Borough Council, Cheshire West and Chester Council, Cheshire East Council and Trafford Metropolitan Borough Council;
- no detailed assessment of traffic junction capacity was undertaken at the option selection stage; and
- at the time of preparing the report no site specific GI had been undertaken at the borrow pit sites.

5 Selection of potential cohesive borrow pit locations

5.1 Introduction

5.1.1 This section explains the process by which potential borrow pit locations for providing cohesive material were identified. It explains how an initial 23 potential cohesive borrow pit locations were appraised and sifted before a shortlist of five locations were shortlisted for further consideration to arrive at the final selected potential borrow pit locations for inclusion within the Proposed Scheme.

5.2 Initial selection of potential cohesive borrow pit locations

5.2.1 The geology of the potential borrow pit locations is shown in Volume 5, CT-32 Map Book: maps series CT-32-301 to CT-32-303.

5.2.2 A total of 23 potential locations were initially identified. Each location was located within an 6km search area and was considered to have the potential to provide a sizeable quantity of acceptable engineering material. Following a change in the vertical alignment of the Proposed Scheme, eighteen of these locations were scoped out of further consideration principally because the material demand from the borrow pits would be concentrated within MA02 only. The shortlist of potential cohesive borrow pit locations taken forward for further assessment was based on the location of the material demand.

5.3 Shortlist of potential cohesive borrow pit locations

5.3.1 This section describes each of the potential cohesive borrow pit locations and provides a comparative assessment before explaining the final choice of location for the potential cohesive borrow pits.

5.3.2 The initial appraisal indicated that there would be a requirement to select a combination of cohesive borrow pits in order to meet the required demand for acceptable engineering cohesive material specifically for construction of embankments in the MA02 area.

5.3.3 Volume 5, CT-32 Map Book: maps CT-32-301 to CT-32-303 show the location of the shortlisted cohesive borrow pits together with identified relevant superficial and bedrock geological resources, flood zones and the route of the Proposed Scheme.

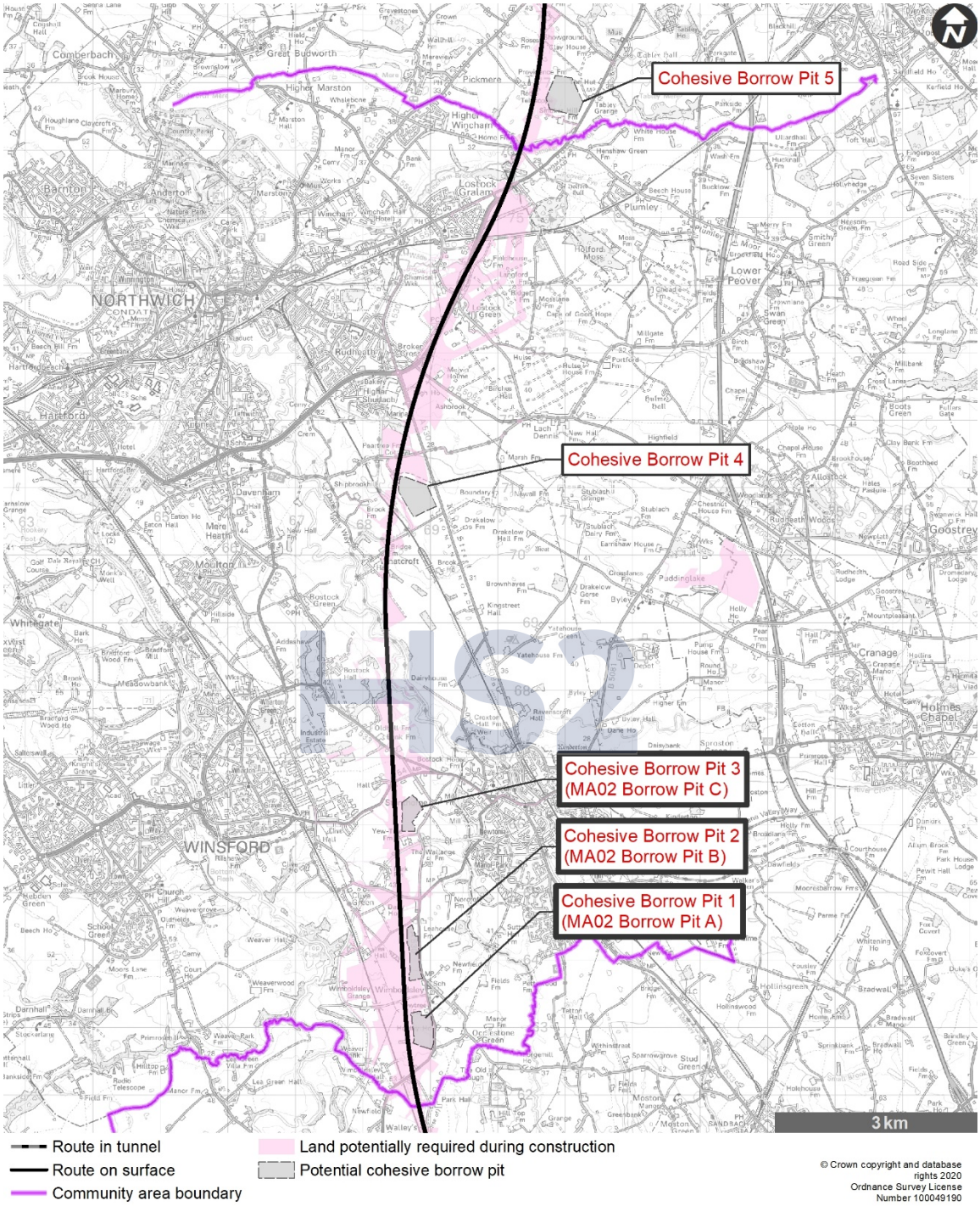
Table 5: Shortlist of potential cohesive borrow pit locations

Cohesive borrow pit name	Location
Cohesive borrow pit 1 (CBP 1) (MA02 Borrow Pit A)*	Located immediately to the east of the route of the Proposed Scheme, immediately west of the A530 Nantwich Road and to the south of Wimboldsley
Cohesive borrow pit 2 (CBP 2) (MA02 Borrow Pit B)*	Located immediately to the east of the route of the Proposed Scheme, west of the A530 Nantwich Road and north of Wimboldsley
Cohesive borrow pit 3 (CBP 3) (MA02 Borrow Pit C)*	Located immediately to the east of the route of the Proposed Scheme, west of Coalpit Lane and north of Yew-Tree Farm
Cohesive borrow pit 4 (CBP 4)	Located immediately to the east of the route of the Proposed Scheme, immediately north of Trent and Mersey Canal and south of Bridge Farm and Dairy Farm
Cohesive borrow pit 5 (CBP 5)	Located immediately to the east of the route of the Proposed Scheme, west of A556 Chester Road and immediately north of Smokers Hill Cottage

**name of borrow pit as presented within Section 2 of Environmental Statement Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02).*

5.3.4 Figure 4 indicates the locations of the potential cohesive borrow pits assessed suitable to meet the demand for cohesive material for the Proposed Scheme in the MA02 area.

Figure 4: Location of potential cohesive borrow pits



Potential CBP 1 (MA02 Borrow Pit A) and Potential CBP 2 (MA02 Borrow Pit B)

5.3.5 Potential CBP 1 (MA02 Borrow Pit A) and CBP 2 (MA02 Borrow Pit B) are both located close to the east of the route of the Proposed Scheme, immediately west of the A530 Nantwich Road, with CBP 1 (MA02 Borrow Pit A) to the south of Wimboldsley and CBP 2 (MA02 Borrow Pit B) to the north of Wimboldsley. Access would initially be taken from the A530 Nantwich Road for both sites.

5.3.6 CBP 1 (MA02 Borrow Pit A), is conservatively assessed as having a minimum of 2m thickness of recoverable deposit covering an area of approximately 136,000m^2 and is predicted to be able to yield a minimum volume of 272,000m^3 of Class 2 cohesive material towards meeting the overall fill requirements of the Proposed Scheme.

5.3.7 CBP 2 (MA02 Borrow Pit B) is conservatively assessed as having a minimum of 2m thickness of recoverable deposit covering an area of approximately 105,000m^2 and is predicted to be able to yield a minimum volume of 210,000m^3 of Class 2 cohesive material towards meeting the overall fill requirements of the Proposed Scheme.

5.3.8 The restoration of these two CBP would be achieved by the use of excavated materials generated from construction of the Crewe tunnel and associated assets and these deposits would be moved along the route of the Proposed Scheme via a conveyor system directly from the tunnel to the borrow pits. Once on site, the backfill materials would be transported using ADT to the point of deposition for backfilling of the borrow pit.

5.3.9 Figure 5 and Figure 6 show the locations of potential CBP 1 (MA02 Borrow Pit A) and potential CBP 2 (MA02 Borrow Pit B).

Figure 5: Location of Potential CBP 1 (MA02 Borrow Pit A)

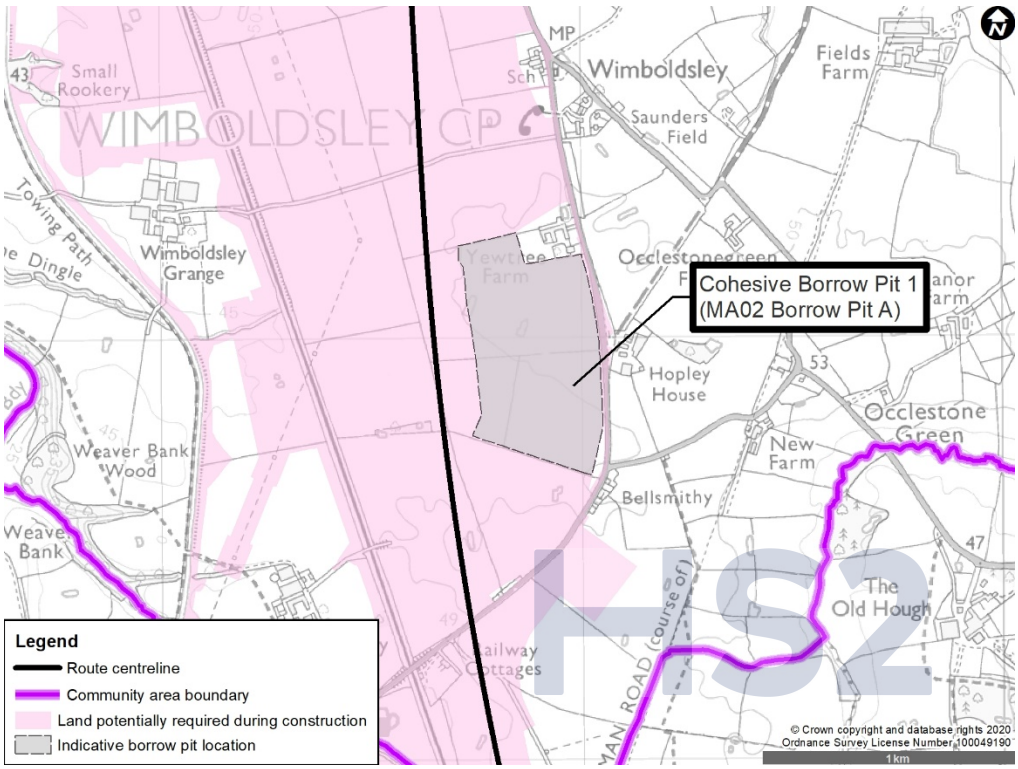
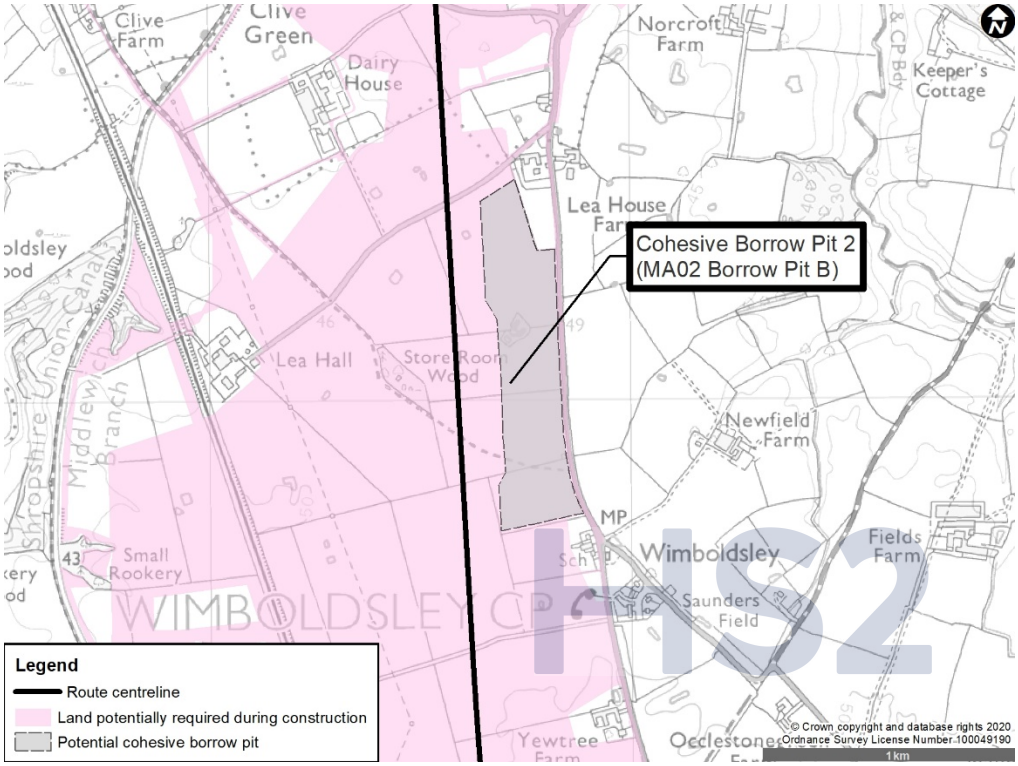


Figure 6: Location of potential CBP 2 (MA02 Borrow Pit B)



Potential CBP 3 (MA02 Borrow Pit C)

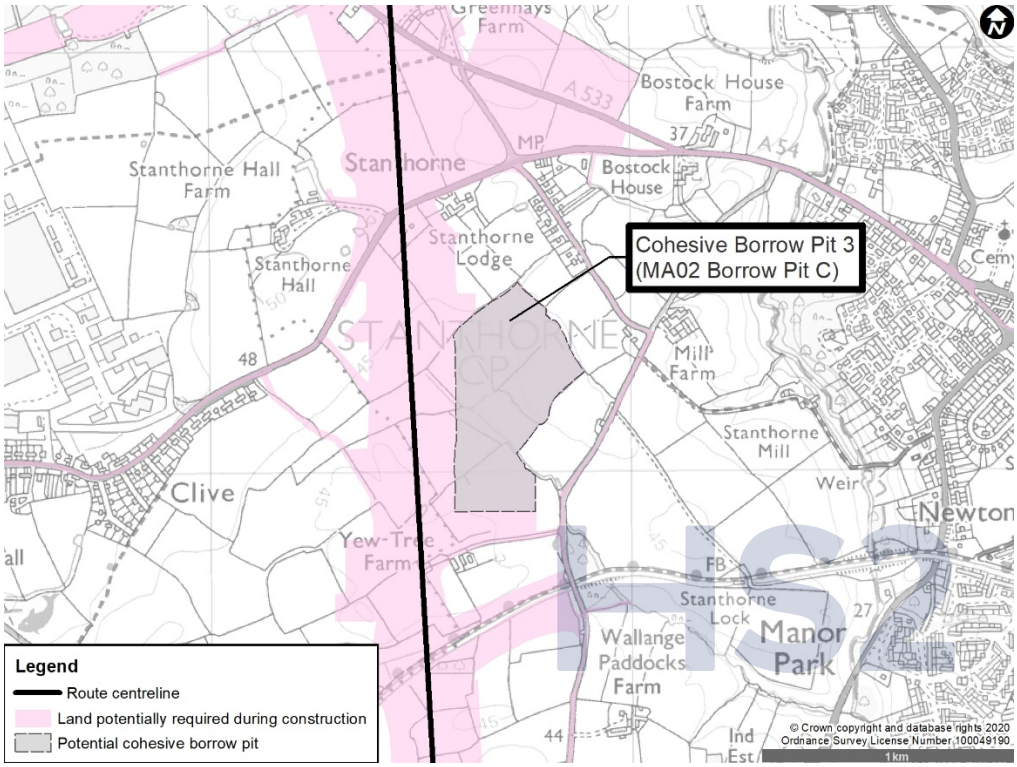
5.3.10 Potential CBP 3 (MA02 Borrow Pit C) is located immediately to the east of the route of the Proposed Scheme, west of Coalpit Lane and north of Yew-Tree Farm. Access would initially be taken from Coalpit Lane.

5.3.11 CBP 3 (MA02 Borrow Pit C) is conservatively assessed as having a minimum of 2m thickness of recoverable deposit covering an area of approximately 112,000m^2 and is predicted to be able to yield a minimum volume of 224,000m^3 of Class 2 cohesive material towards meeting fill requirements for the Proposed Scheme in this area.

5.3.12 The restoration of CBP 3 (MA02 Borrow Pit C) would be achieved by the use of excavated materials generated from construction of the Crewe tunnel and associated assets. These deposits would be moved along the route of the Proposed Scheme via a conveyor system directly from the tunnel to the borrow pits. Once on site, the backfill materials would be transported using ADT to the point of deposition for backfilling of the borrow pit.

5.3.13 Figure 7 shows the location of potential CBP 3 (MA02 Borrow Pit C).

Figure 7: Location of potential CBP 3 (MA02 Borrow Pit C)



Potential CBP 4

5.3.14 Potential CBP 4 is located immediately to the east of the route of the Proposed Scheme, immediately north of Trent and Mersey Canal and south of Bridge Farm and Dairy Farm. It would be accessed from the A530 Middlewich Road/Nantwich Road/Croxton Lane/King

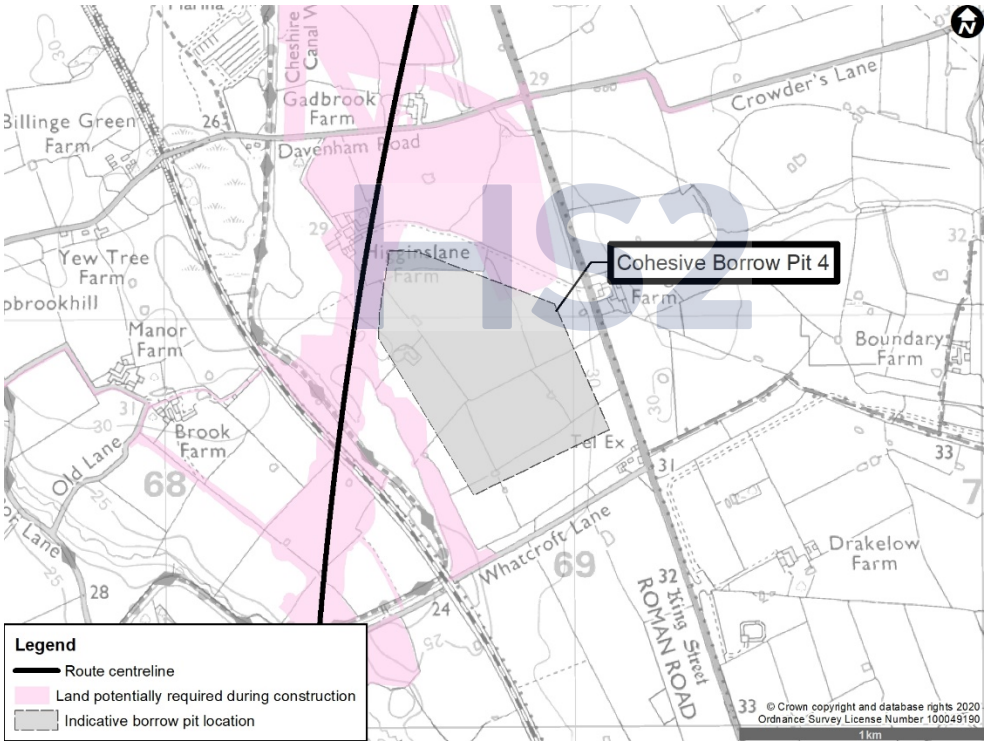
Street (also known locally as Roman Road)/Griffiths Road 400m to the east onto Whatcroft Lane to the south.

5.3.15 CBP 4 is conservatively assessed as having a minimum of 2m thickness of recoverable deposit and covering an area of approximately 206,000m^2 is predicted to be able to yield a minimum volume of 412,000m^3 of Class 2 cohesive material towards meeting the fill requirements for the Proposed Scheme in this area.

5.3.16 The restoration of CBP 4 would be achieved by the use of excavated materials generated from the construction of the Manchester tunnel south portal in the Hulseheath to Manchester Airport area (MA06) and these materials would be transported by the public highway network to the point of deposition for backfilling of the borrow pit.

5.3.17 Figure 8 shows the location of potential CBP 4.

Figure 8: Location of potential CBP 4



Potential CBP 5

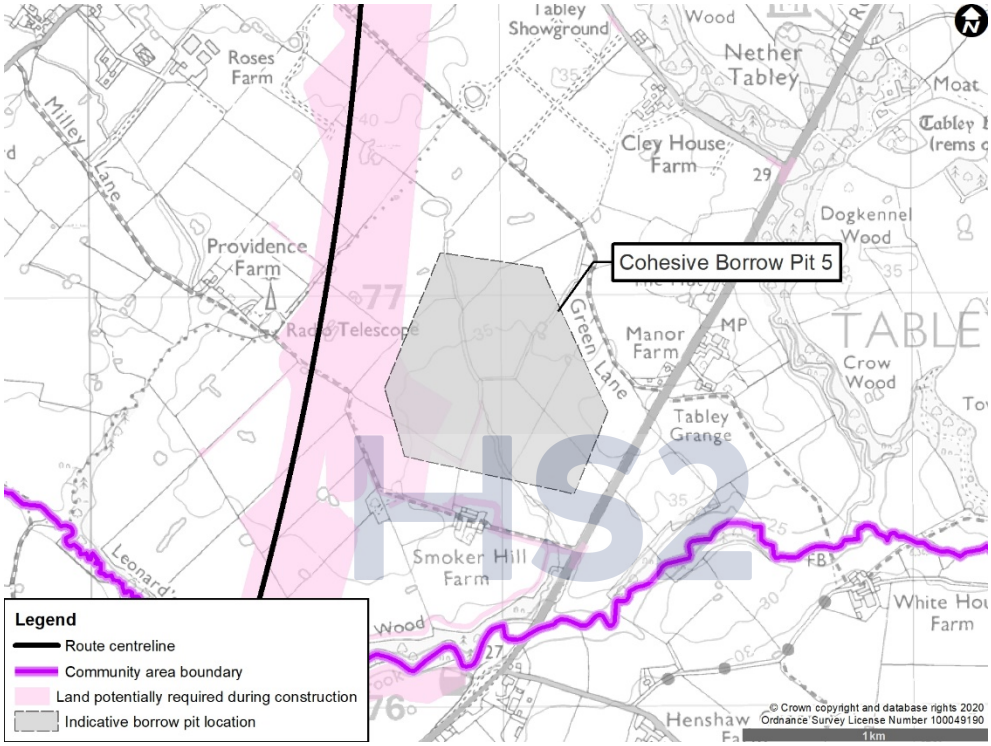
5.3.18 Potential CBP 5 is located immediately to the east of the route of the Proposed Scheme, west of A556 Chester Road and immediately north of Smokers Hill Cottage. Access would be from the A556 Chester Road to the east and south.

5.3.19 CBP 5 is conservatively assessed as having a minimum of 2m thickness of recoverable deposit and covering an area of approximately 235,000m^2 is predicted to be able to yield a minimum volume of 470,000m^3 of Class 2 cohesive material towards meeting fill requirements for the Proposed Scheme in this area.

5.3.20 The restoration of CBP 5 would be achieved by the use of excavated materials generated from the construction of the Manchester tunnel south portal in the Hulseheath to Manchester Airport area (MA06). These materials would be transported by the public and strategic highway network road (via the M56 to A556 north and across M6 junction 19 to the A556 Chester Road south) to the point of deposition for backfilling of the borrow pit.

5.3.21 Figure 9 shows the location of potential CBP 5.

Figure 9: Location of potential CBP 5



Comparison of shortlisted potential cohesive borrow pit locations

5.3.22 All the potential shortlisted cohesive borrow pit locations are located adjacent to the route of the Proposed Scheme. Therefore, the transport distance for excavated materials from the borrow pits by the public highway network would be limited to short distances and within the land required for construction of the Proposed Scheme. However, initial site set up and subsequent staff travel would require access and use of the existing public highway network.

5.3.23 The potential borrow pit locations CBP 1 (MA02 Borrow Pit A), CBP 2 (MA02 Borrow Pit B), and CBP 4 could all connect directly to the existing public highway network for access. The potential borrow pit locations CBP 3 (MA02 Borrow Pit C) and CBP 5 would require new access routes to be constructed to connect to the existing public highway network at Coalpit Lane and the A556 Chester Road respectively. All connections to the public highway network would be to points already on construction traffic routes identified for the Proposed Scheme. HGV could join the public highway network at Coalpit Lane and either drive south

for 750m before joining the identified construction route near the junction with Clive Green Lane; or drive north for 1km joining the identified construction route at the A54 Chester Road.

5.3.24 Due to their smaller individual size, potential borrow pits CBP 1 (MA02 Borrow Pit A), CBP 2 (MA02 Borrow Pit B) and CBP 3 (MA02 Borrow Pit C) are predicted to have the capacity to produce less cohesive material than potential borrow pits CBP 4 and CBP 5. The estimated volumes that may be extracted from each potential borrow pit is based on a conservative assumption on the depth of excavation of acceptable materials (minimum of 2m) achievable.

5.3.25 Using a conservative assumption on the depth of excavation gives sufficient headroom to be able to refine the design of the selected cohesive borrow pits to ensure they can provide the required quantities of materials. It is considered possible that the excavation depth could be extended to substantially increase the volume of material extracted, although this can only be confirmed by GI at the final selected sites.

5.3.26 Potential borrow pit locations CBP 1 (MA02 Borrow Pit A), CBP 2 (MA02 Borrow Pit B), and CBP 3 (MA02 Borrow Pit C) would be restored using material sourced from construction of the Crewe tunnel and transported along the route of the Proposed Scheme via conveyor. Potential borrow pit locations CBP 4 and CBP 5 would be restored with material sourced from construction of the Manchester tunnel and these materials would have to be transported on the existing public and strategic road network to the point of deposition.

5.3.27 Table 6 compares each of the shortlisted cohesive borrow pit locations and provides information on potential material quantities, construction logistics and environmental constraints.

Table 6: Comparison of shortlisted potential cohesive borrow pit locations

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
Resource details and capacity					
Total area available (m^2)	136,000	105,000	112,000	206,000	235,000
Assumed maximum volume (at 2m minimum assumed thickness of extractable material) (m^3)	272,000	210,000	224,000	412,000	470,000
Ability to meet anticipated demand	Could supply a large proportion of fill requirements	Could supply a large proportion of fill requirements	Could supply a large proportion of fill requirements	Provides the full amount of the fill	Could supply all of the fill requirements
Source of materials for restoration of borrow pits	Crewe tunnel, transported via conveyor along the route of the Proposed Scheme	Crewe tunnel, transported via conveyor along the route of the Proposed Scheme	Crewe tunnel, transported via conveyor along the route of the Proposed Scheme	Manchester tunnel, transported via road	Manchester tunnel, transported via road
Certainty of presence and thickness of cohesive deposit	Yes – geological mapping indicates cohesive deposits are present in this area	Yes – geological mapping indicates cohesive deposits are present in this area	Yes – geological mapping indicates cohesive deposits are present in this area	Yes – geological mapping indicates cohesive deposits are present in this area	Yes – geological mapping indicates cohesive deposits are present in this area
Traffic					
Direct access on to suitable road	Yes, the A530 Nantwich Road	Yes, the A530 Nantwich Road	No, access would need to connect to Coalpit Lane via Yew-Tree Farm existing access track	Yes, Whatcroft Hall Lane	No, access would be needed to connect to the A556 Chester Road
Is on planned construction traffic route?	Yes, the A530 Nantwich Road	Yes, the A530 Nantwich Road	No, construction traffic route does not extend this far on Coalpit Lane. From site, vehicles would travel south to roundabout with Clive Green Lane to join planned route.	Yes, Whatcroft Hall Lane	Yes, the A556 Chester Road

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
Traffic route impacts	Removes up to 64,000 HGV movements (movement of excavated material from the Hulseheath to Manchester Airport area (MA06) to the MA02 area. Cuts highways haulage distance by approximately 4.3 million km. (Based on 67km haul average from external sources).	Removes up to 49,400 HGV movements (movement of excavated material from the Hulseheath to Manchester Airport area (MA06) to the MA02 area. Cuts highways haulage distance by approximately 3.3 million km. (Based on 67km haul average from external sources).	Removes up to 52,800 HGV movements (movement of excavated material from external sources). Cuts highways haulage distance by approximately 3.5 million km. (Based on 67km haul average from external sources).	No reduction in total HGV movements as fill materials would need to be brought by road from Manchester tunnel south portal.	No reduction in HGV movements as fill materials would need to be brought by road from Manchester tunnel south portal.
Environment					
Agriculture	Entails further land loss to Wimboldsley Hall Farm and Grange Farm which is already losing land to Proposed Scheme. The agricultural land is lower quality Agricultural Land Classification (ALC) Grade 4.	Entails further land loss to Wimboldsley Hall Farm and Grange Farm and Lea Hall Farm which are already losing land to Proposed Scheme. The agricultural land is lower quality ALC Grade 4.	Entails further land loss to Yew-Tree Farm which is already losing land to Proposed Scheme. The agricultural land is good quality ALC 3a.	Loss of agricultural land expected during operation.	Loss of agricultural land expected during operation.
Community	There are approximately 15 residential properties in the area, which may be affected by dust, noise and visual effects. Wimboldsley Primary School is located approximately 500m to the north of the site. Site visit and open space surveys have been	There are approximately 20 residential properties in Wimboldsley, which may be affected by dust, noise and visual effects. Wimboldsley Primary School is located immediately south-east of the site. Staff and students	Properties in Stanthorne and users of the Shropshire Union Canal may be affected by dust, noise and visual effects. Site visit and open space surveys have been undertaken at this location.	Approximately 4 properties on Whatcroft Hall Lane, 5 properties on King Street, Higgins Lane Farm, and approximately 10 properties on Davenham Road may be affected by dust, noise and visual effects.	Small number of properties on the A556 Chester Road and to the south of the borrow pit location may be affected by dust, noise and visual effects. Site visit and open space surveys have been

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
	undertaken at this location.	may be affects by dust, noise and visual effects. Site visit and open space surveys have been undertaken at this location.		Site visit and open space surveys have been undertaken at this location.	undertaken at this location.
Ecology and biodiversity	Site does not include statutory designated sites, but would result in loss of mature trees, hedgerows and three ponds. Surveys for amphibians, breeding birds, badger, bats, reptiles and Phase 1 habitat surveys have been undertaken at this site.	Site does not include statutory designated sites, but would result in loss of hedgerows, a small area of woodland, and ponds. Surveys for amphibians, breeding birds, badger, bats, reptiles and Phase 1 habitat surveys have been undertaken at this site.	Site does not include statutory designated sites, but would result in loss of marshy grassland, hedgerows and ponds. Surveys for amphibians, breeding birds, badger, bats, reptiles and Phase 1 habitat surveys have been undertaken at this site.	Site does not include statutory designated sites, although Whatcroft Lane Wetland Local Wildlife Site (LWS) is 30m west of the site; but will result in loss of grassland and ponds. No surveys have been undertaken at this site.	Site does not include any statutory designated sites, although there is Tabley Mere Site of Special Scientific Interest (SSSI) (750m to the east), Round and Rinks Wood Ancient Woodland (400m west), Leonards and Smoker Wood Ancient Woodland and LWS (240m south of the site) in the vicinity. There are no priority habitats within or adjacent to the site, but there would be loss of grassland and ponds. No surveys have been undertaken at this site.
Historic environment	No designated heritage assets within 500m of the site. Approximately half the length of the non-designated Trackway to Wimboldsley Grange	No designated heritage assets within 500m of the site. There are locally listed buildings (School cottages, Wimboldsley and Leahead Cottages to the north) the setting of which	There is one designated heritage asset within 500m of the site. Stanthorne Lodge Grade II Listed building is 250m north. Its setting could be temporarily affected by	There is one designated heritage asset within 500m of the site. The Trent and Mersey Canal is approximately 50m to the west and may experience	There is one designated heritage asset within 500m of the site. Tabley House Registered Park and Garden (RPG) which also contains several listed buildings and a scheduled

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
	would be lost as it passes through the site.	may be temporarily affected by the presence of the borrow pit.	the presence of a borrow pit but the vegetation and screening around the building may help reduce this effect.	temporary change to its setting.	monument, lies 380m to the east. The presumed location of Tabley Inferior possible deserted settlement is in the land required for this borrow pit although the extent of the settlement is unknown. Potential archaeological remains of the settlement may be within and extend into the borrow pit area.
Land quality	Agricultural land use, very low risk of land contamination (to be confirmed by site specific GI).	Agricultural land use, very low risk of land contamination (to be confirmed by site specific GI).	Agricultural land use, very low risk of land contamination (to be confirmed by site specific GI).	Agricultural land use, very low risk of land contamination (to be confirmed by site specific GI). Anecdotal evidence of deposition of dredged silts in proximity to the proposed borrow pit.	Agricultural land use, very low risk of land contamination (to be confirmed by site specific GI).
Landscape and visual	Potentially affected views from Bellsmithy and other properties along the A530 Nantwich Road, notably at Manor Cottage, Hopley House and Yew-Tree House and users of Bridleway Wimboldsley BR2/1. The site would be in the foreground of these properties which would also have construction of	Potentially affected views from residential properties alongside the A530 Nantwich Road notably at Lea House Farm, Wimboldsley and from Wimboldsley Community Primary School. The site would be in the foreground of these properties which would also have construction of	Potentially affected views from residents and users of Shropshire Union Canal, Coalpit Lane, Birch Lane and the A54 Middlewich Road. The site would be in the foreground of these properties which would also have construction of the route of the Proposed Scheme in the view.	Potentially affected views from residential properties along the A530 King Street and on Whatcroft Hall Lane, also for recreational users of the Trent and Mersey Canal and Restricted Bridleway Lach Dennis 8/1. The site would be in the foreground of these properties which would also have	Potentially affected views from residential properties alongside the A556 Chester Road, Smokers Hill Cottage and for users of Footpaths Tabley Inferior 1/1, 2/1 and 2/2. Surveys have not been undertaken at this site.

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
	Crewe North RSD and the route of the Proposed Scheme in the view. Surveys have been undertaken at this site.	Crewe North RSD and the route of the Proposed Scheme in the view. Surveys have been undertaken at this site.	Surveys have been carried out at this site.	construction of the route of the Proposed Scheme in the view. Surveys have not been undertaken at this site.	
Sound, noise and vibration	Dwellings around the A530 Nantwich Road are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit although a significant effect on a community basis is not identified at these dwellings. Baseline noise surveys have been undertaken at this site.	Dwellings around Wimboldsley and Wimboldsley Primary School are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit although a significant effect on a community basis is not identified at these dwellings nor at the school. Baseline noise surveys have been undertaken at this site.	Dwellings around Stanthorne and users the Shropshire Union Canal are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit although a significant effect on a community basis is not identified at these dwellings. Baseline noise surveys have been undertaken at this site.	Dwellings on Whatcroft Lane and King Street Farm are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit. Baseline noise surveys have not been carried out at this site. Appraisal based on a high level review of the potential location. Not included within the Environmental Statement.	Residents of Smokers Hill Cottage and dwellings along the A556 Chester Road are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit. Baseline noise surveys have not been carried out at this site.
Socio-economic	Site is in proximity to business at Hopley House (B&B, farm shop, café, retail units).	No impacts or effects to report.	No impacts or effects to report.	Site is close to a Boarding Kennels on Whatcroft Hall Lane.	Part of the site belongs to the Royal Cheshire Showground for access to the showground and therefore the borrow pit could increase the direct effects on this business.
Water resources and flood risk	The borrow pit would be excavated in glacial till in	The borrow pit would be excavated in glacial till in	The borrow pit would be excavated in glacial till in	The borrow pit would be excavated in glacial till in	The borrow pit would be excavated in glacial till in

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
	proximity to The Dingle, Tributary of River Weaver 2 and Tributary of River Wheelock 1. Excavation of the borrow pit may result in localised impacts on groundwater flows and levels within the Secondary (Undifferentiated) aquifer. However, the risk to the Secondary (Undifferentiated) aquifer is considered to be low due to the cohesive nature of the glacial till deposits and limited resource potential. No adverse impacts are expected on the surface watercourses.	proximity to The Dingle and tributaries of River Wheelock 1, 2, 3 and 4. Excavation of the borrow pit may result in localised impacts on groundwater flows and levels within the Secondary (Undifferentiated) aquifer. However, the risk to the Secondary (Undifferentiated) aquifer is considered to be low due to the cohesive nature of the glacial till deposits and limited resource potential. No adverse impacts are expected on the surface watercourses.	proximity to tributaries of River Wheelock 1, 2, 3, 4, 5 and 6. Excavation of the borrow pit may result in localised impacts on groundwater flows and levels within the Secondary (Undifferentiated) aquifer. However, the risk to the Secondary (Undifferentiated) aquifer is considered to be low due to the cohesive nature of the glacial till deposits and limited resource potential. The excavation of this borrow pit will remove a potential spring and a short section of the headwaters of Tributary of River Wheelock 5. Dewatering flow will be discharged to the watercourse in order to maintain flow. However, the potential spring features will be permanently lost (leading to a major adverse effect, which is significant).	proximity to the Trent and Mersey Canal, Gad Brook and Tributary of Gad Brook 3. Excavation of the borrow pit may result in localised impacts on groundwater flows and levels within the Secondary (Undifferentiated) aquifer. However, the risk to the Secondary (Undifferentiated) aquifer is considered to be low due to the cohesive nature of the glacial till deposits and limited resource potential. It is identified that baseflow to Gad Brook may be adversely affected during operation and restoration of the borrow pit. Impacts will be considered further during detail design of the cohesive borrow pit, to include suitable mitigation for potential reduction in flow (such as discharge to the watercourse during any dewatering operation, and restoration of the	proximity to Smoker Brook and directly over Tributary of Smoker Brook 2. Excavation of the borrow pit may result in localised impacts on groundwater flows and levels within the Secondary (Undifferentiated) aquifer. However, the risk to the Secondary (Undifferentiated) aquifer is considered to be low due to the cohesive nature of the glacial till deposits and limited resource potential. The excavation of the borrow pit would lead to the direct loss of 1.1km of open channel (forming the headwaters of Tributary of Smoker Brook 2), and a reduction in baseflows to Smoker Brook. Impacts will be considered further during detail design of the cohesive borrow pit, to include suitable mitigation for potential reduction in flow (such as discharge to the watercourse during any dewatering operation,

	CBP 1 (MA02 Borrow Pit A)	CBP 2 (MA02 Borrow Pit B)	CBP 3 (MA02 Borrow Pit C)	CBP 4	CBP 5
				borrow pit such that groundwater flow paths are maintained).	and restoration of the watercourse following completion of the works).
Planning	From a review of the available online planning records, there are no committed developments within, or immediately adjacent to (within 250m), the site. Relevant policy allocations are; Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1) – Salt MSA; Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the Local Plan Part 2 (LPP2); and Policy M6 (Salt and brine working) of the LPP2 Policy DM44 (protecting and enhancing the natural environment) of the LPP2.	From a review of the available online planning records, there are no committed developments within, or immediately adjacent to (within 250m), the site. Relevant policy allocations are; Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1) – Salt MSA; Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the Local Plan Part 2 (LPP2); and Policy M6 (Salt and brine working) of the LPP2 Policy DM44 (protecting and enhancing the natural environment) of the LPP2.	From a review of the available online planning records, there are no committed developments within, or immediately adjacent to (within 250m), the site. Relevant policy allocations are; Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1) – Salt MSA; Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the Local Plan Part 2 (LPP2); and Policy M6 (Salt and brine working) of the LPP2 Policy DM44 (protecting and enhancing the natural environment) of the LPP2.	From a review of the available online planning records, the only permission of relevance is considered to be ref. 13/01134/FUL, for which permission was granted for construction of a pipeline for the salt factory at Middlewich. It is not known if the pipeline has been constructed or permission has expired. Relevant policy allocations are; Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1) – Salt MSA; Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the Local Plan Part 2 (LPP2); and Policy DM44 (protecting and enhancing the natural environment) of the LPP2.	From a review of the available online planning records, there are no committed developments within, or immediately adjacent to (within 250m), the site. Relevant policy allocations are; Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1); Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the Local Plan Part 2 (LPP2); and Policy M6 (Salt and brine working) of the LPP2.

5.4 Final selection of cohesive borrow pit locations

5.4.1 The three final cohesive borrow pit locations for the Proposed Scheme are identified in Section 2 of Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02), as the following:

- MA02 Borrow Pit A (CBP 1), located immediately to the east of the route of the Proposed Scheme, south of Wimboldsley (see Volume 2, MA02 Map Book: map CT-05-308b, G9 to J8);
- MA02 Borrow Pit B (CBP 2), located immediately to the east of the route of the Proposed Scheme, north of Wimboldsley (see Volume 2, MA02 Map Book: map CT-05-309, D6 to H7); and
- MA02 Borrow Pit C (CBP 3), located immediately to the east of the route of the Proposed Scheme, north of Yew-Tree Farm (see Volume 2, MA02 Map Book: map CT-05-310, F7 to I9).

5.4.2 The final three selected cohesive borrow pit locations will be referred to as MA02 Borrow Pit A, MA02 Borrow Pit B and MA02 Borrow Pit C from this point on in the report.

5.4.3 Key features of the selected cohesive borrow pits, including the assumed working area and assumed extraction depth, are summarised in Table 7.

Table 7: Key features of selected cohesive borrow pit locations

Borrow pit name	Location and map reference	Extracted material	Assumed working area	Assumed thickness of recoverable material*	Assumed maximum excavation depth (b.e.g.l.**)	Duration	Accessed from
MA02 Borrow Pit A	Open land south of Wimboldsley; CT-05-308b, G9 to J8	Cohesive material	13.6ha	2m	5m	Two years and three months	A530 Nantwich Road during site set up then site haul routes
MA02 Borrow Pit B	Open land north-west of Wimboldsley; CT-05-309, D6 to H7	Cohesive material	10.5ha	2m	3m	Two years and nine months	A530 Nantwich Road during site set up then site haul routes
MA02 Borrow Pit C	Yew-Tree Farm, Stanthorne; CT-05-310, F7 to I9	Cohesive material	11.2ha	2m	3m	Two years and nine months	Coalpit Lane during site set up then site haul routes

**An estimate based on desk based study of the thickness of recoverable material; the assumed maximum excavation depth*

*** below existing ground level*

5.4.4 The key determining factor for the selection of MA02 Borrow Pit A, MA02 Borrow Pit B and MA02 Borrow Pit C from the shortlist of five is related to the location of the cohesive borrow pits within the land required for construction of the Proposed Scheme. In addition, their collective capability to provide the required quantities of acceptable engineering cohesive materials (approximately 706,000m^3) for use in the construction of embankments in the MA02 area, without the need for transportation of materials on the public highway network was a key determining factor.

5.4.5 Excavated materials can be extracted and transported from the three selected cohesive borrow pit locations with no additional construction traffic on the public highway network. Refer to Figures B1, B2 and B3 (Annex B – Additional figures) which show the proposed destinations for cohesive materials extracted from MA02 Borrow Pit A, MA02 Borrow Pit B and MA02 Borrow Pit C to be used in construction of the Proposed Scheme.

5.4.6 The restoration of MA02 Borrow Pit A, MA02 Borrow Pit B and MA02 Borrow Pit C can be achieved using materials sourced from construction of the Crewe tunnel which can be transported to the cohesive borrow pit locations via conveyors operating within the land required for construction of the Proposed Scheme with no impacts on the public highway network.

6 Selection of potential granular borrow pit locations

6.1 Introduction

6.1.1 This section describes the process by which potential granular borrow pit locations were identified, how the initial list of 23 potential locations were appraised and reduced to a shortlist of two. Both of these potential granular borrow pit locations were considered viable to provide the quantity and quality of acceptable engineering granular materials required for construction of the Proposed Scheme within the Wimboldsley to Lostock Gralam (MA02) area.

6.2 Initial selection of potential granular borrow pit locations

6.2.1 A total of 23 initial granular borrow pit locations were considered. They were all located within the 6km search area and identified as having the potential to provide useful quantities of acceptable engineering granular material. Twenty one of these locations were scoped out of consideration due to unsuitable geographical, geological and traffic and transport constraints. The geology of the potential borrow pit locations is shown in Volume 5 CT-32 Map Series: maps CT-32-301 to CT-32-303.

Shortlist of potential granular borrow pit locations

6.2.2 Figure 10 and Table 8 provide information on the locations identified as having potential to provide the quantities of granular material needed as engineering fill within the MA02 area. This section describes each potential granular borrow pit location and then provides a comparative assessment of them before explaining why the final granular borrow pit location was chosen.

6.2.3 Volume 5, Map Book CT-32: map CT-32-302 shows the location of the shortlisted granular borrow pit locations together with identified relevant superficial and bedrock geological resources, flood zones and the route of the Proposed Scheme.

Figure 10: Potential locations of shortlisted granular borrow pits

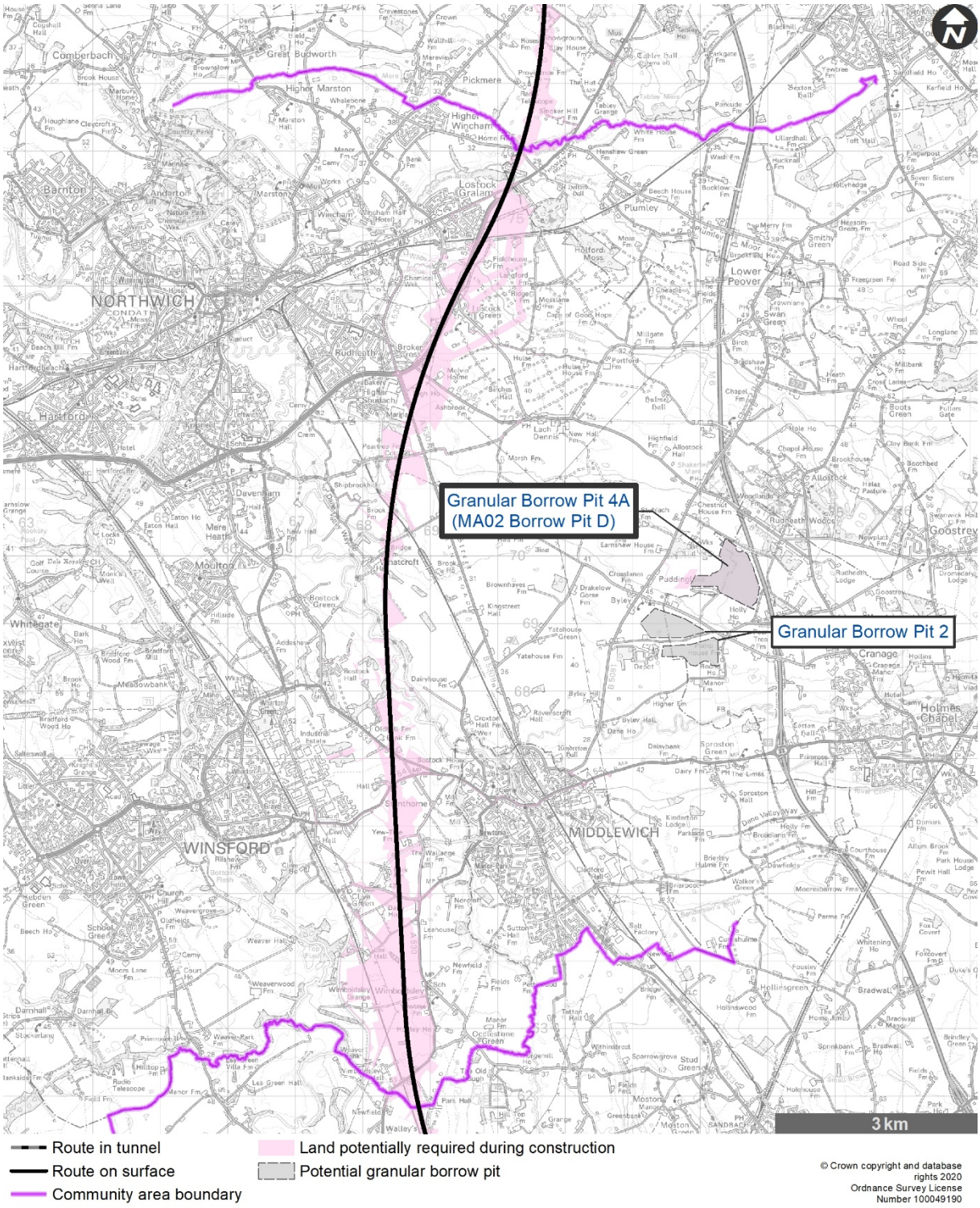


Table 8: Shortlist of potential granular borrow pit locations

Borrow pit name	Location
Granular Borrow Pit 2 (GBP 2)	Located 3.7km east of the route of the Proposed Scheme immediately south of Byley
Granular Borrow Pit 4A (GBP 4A)	Located 4.5km to the east of the route of the Proposed Scheme, north of Moss Lane and immediately west of the M6

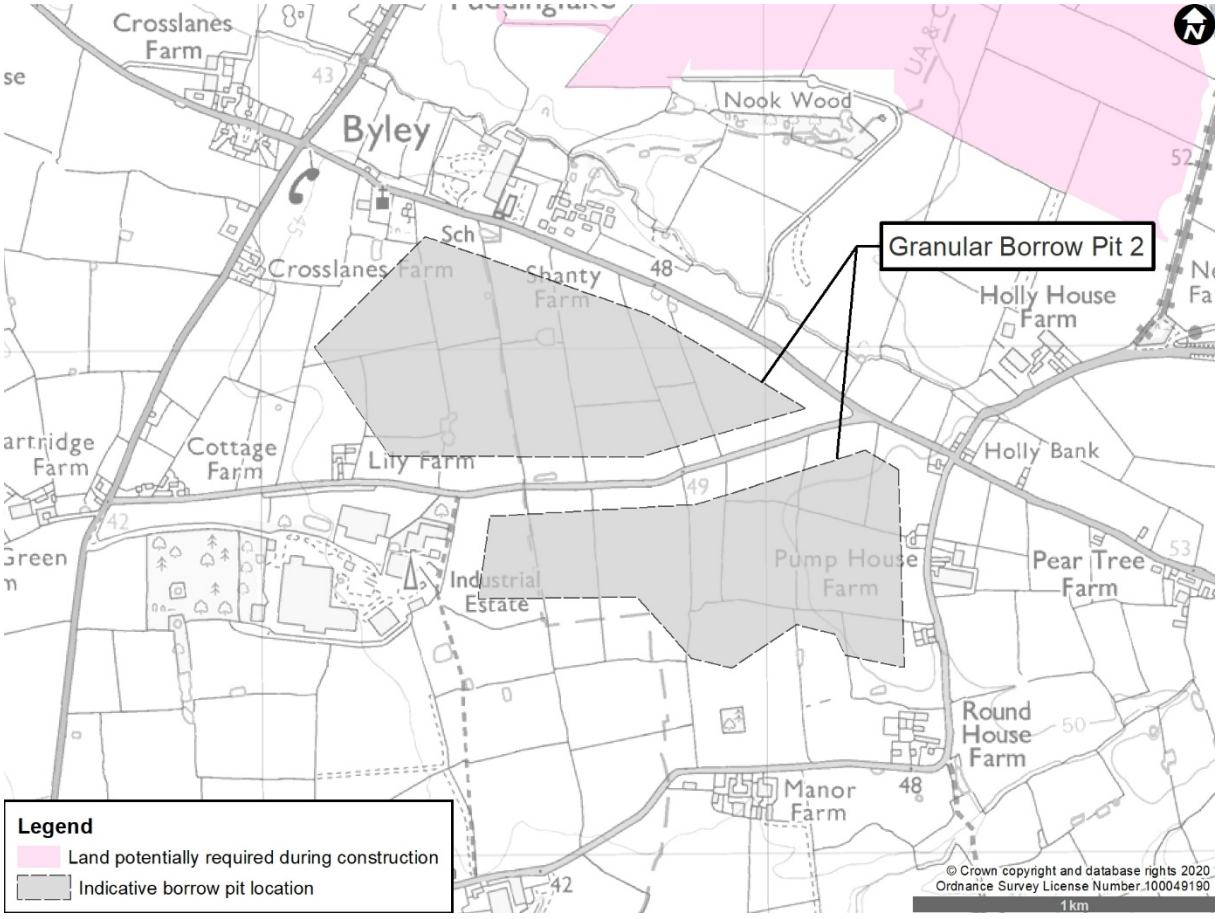
Borrow pit name	Location
(MA02 Borrow Pit D)*	

**name of borrow pit as presented within Section 2 of Environmental Statement Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02).*

Potential GBP 2

6.2.4 Potential GBP 2 is shown in Figure 11 and is located 3.7km east of the route of the Proposed Scheme within the MA02 area. It is located east of the B5081 Byley Road, south of Moss Lane and either side of Lily Lane to the north-east of Middlewich. Byley village, including Byley Primary School, is close to the north and Middlewich Road Industrial Estate is adjacent to the east. Extracted granular material would be transported along Lily Lane, the B5081 Byley Road and the B5309 Centurion Way to reach the area of the land required for construction of the Proposed Scheme.

Figure 11: Location of potential GBP 2



6.2.5 Applying a conservative 2m minimum thickness of recoverable deposit, this potential granular borrow pit site could provide up to a maximum of 960,000m³ of acceptable engineering granular material towards meeting the deficit of granular fill requirement, which is assessed as being 881,000m³, for construction of the Proposed Scheme within the MA02 area. However, following a detailed review of available British Geological Survey (BGS) borehole information from a recent highway widening scheme on the nearby M6, it was

identified that the granular deposits within the area of the potential GBP 2 site could be thinning in an east to west direction and therefore the ability of this borrow pit to provide the required volumes of granular material is less certain.

6.2.6 Restoration of the potential GBP 2 would be achieved by the use of excavated materials from the Crewe tunnel, if suitable, and use of suitable excavated materials from other areas of the Proposed Scheme that would be hauled partly along the land required for construction of the Proposed Scheme to the nearest transfer node to the borrow pit and then transported as return loads for restoration. Construction traffic for potential GBP 2 could join the existing construction traffic routes onto Lily Lane which then connects with the B5081 Byley Road and onto to the Proposed Scheme main construction traffic route. Although the borrow pit is less than 4km from the route of the Proposed Scheme, the distance by using the public highway network is approximately 6km.

Potential GBP 4A (MA02 Borrow Pit D)

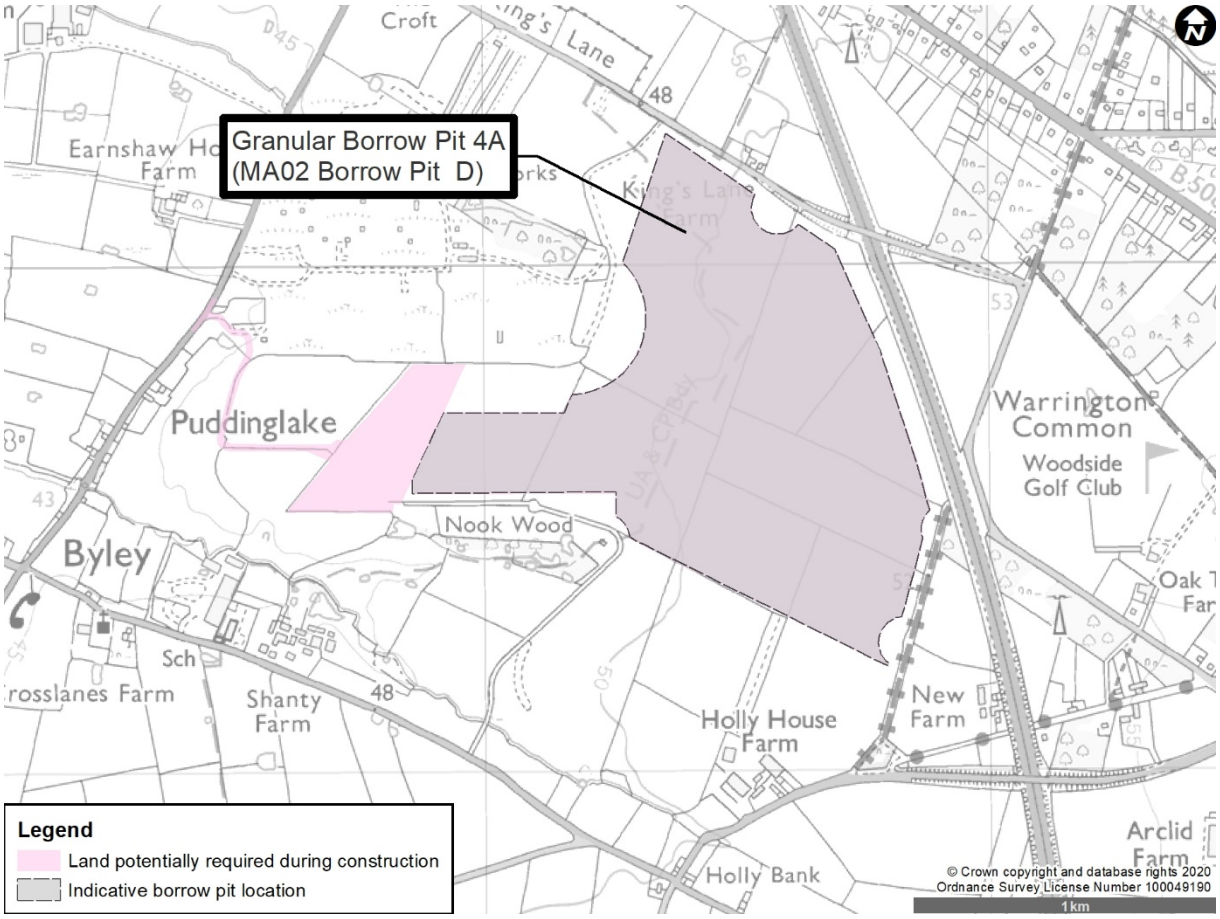
6.2.7 Potential GBP 4A (MA02 Borrow Pit D) is located within a 4.5km radius from east of the route of the Proposed Scheme within the MA02 area. It is located to the west of the M6, south of Kings Lane, east of the B5081 Byley Road and north of Lily Lane. The village of Byley, including Byley Primary School, lies to the south-west. Extracted granular material would be transported along the B5081 Byley Road and the B5309 Centurion Way to reach the land required for construction of the Proposed Scheme. The distance by road, largely following the same route as for potential GBP 2, is approximately 6.5km.

6.2.8 Following a detailed review of available BGS borehole information from a recent highway widening scheme on the nearby M6, it was identified that the geology within the area of the potential GBP 4A (MA02 Borrow Pit D) could provide granular deposits to a depth of up to 5m (potentially deeper towards the M6) and could provide up to a maximum recoverable volume of material of 1.43 million m^3 of acceptable granular material, if required, for the construction of the Proposed Scheme. For the purposes of this initial appraisal, a conservative thickness of recoverable granular deposits of 3m has been assumed to give sufficient headroom when appraising potential yield from the borrow pit following detailed design and site specific GI.

6.2.9 This potential borrow pit location could provide up to a maximum recoverable volume of 1.43 million m^3 of acceptable granular material and this would provide a large degree of assurance and flexibility that it will be capable of providing the full deficit of high quality granular materials required, which is currently assessed as being 881,000m^3.

6.2.10 Figure 12 shows the location of potential GBP 4A (MA02 Borrow Pit D).

Figure 12: Location of potential GBP 4A (MA02 Borrow Pit D)



Comparison of shortlisted potential granular borrow pit locations

6.2.11 Table 9 compares the shortlisted potential granular borrow pit locations and provides information about the material quantities, construction logistics and environmental constraints. The site of potential GBP 2 is estimated to have significantly less available high quality granular material (up to a maximum recoverable volume of 960,000m^3) in comparison to potential GBP 4A (MA02 Borrow Pit D) (up to maximum recoverable volume of 1.43 million m^3), due to a smaller available working area and less certain geological conditions in terms of available yield/depth of granular materials that could be extracted. Using a conservative assumption on the depth of granular materials suitable for extraction gives sufficient headroom to be able to refine the design of the selected granular borrow pit to ensure it can provide the required quantities of high quality granular materials (currently assessed as being 881,000m^3) for construction of the Proposed Scheme in MA02.

Table 9: Comparison of shortlisted potential granular borrow pit locations

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
Resource details and capacity		
Total area available (m^2)	480,000	477,000
Assumed maximum recoverable volume, m^3 (at 2m minimum assumed thickness of granular material for GBP 2 and 3m for GBP 4A – based on geological information reviewed)	960,000	1,431,000
Ability to meet anticipated demand	Yes	Yes
Source of materials for restoration of borrow pits	Suitable excavated materials from within the Proposed Scheme, transported along the route of the Proposed Scheme (via conveyor in the case of materials from Crewe tunnel) before being transported along the existing public highway network, from the closest transfer node. Other material would be transported from cut areas i.e. north of the M6 junction 19 and Manchester south tunnel portal by use of the public highway network.	Suitable excavated materials from within the Proposed Scheme, transported along the route of the Proposed Scheme (via conveyor in the case of materials from Crewe tunnel) before being transported along the existing public highway network, from the closest transfer node. Other material would be transported from cut areas i.e. north of the M6 junction 19 and Manchester south tunnel portal by use of the public highway network.
Certainty of presence and thickness of granular deposits	Assumed 2m layer thickness or less. Requires considerable work to develop for returns in volumes. Medium certainty geotechnical review and presence of boreholes along the M6 (widening project) and until site specific GI is undertaken at the site.	Assumed 3m minimum (potentially up to a maximum of 5m) layer thickness for the purposes of recovery. High certainty from geotechnical review and presence of boreholes along the M6 (widening project) and until site specific GI is undertaken at the site.
Traffic		
Direct access on to suitable road	No. Access via Lily Lane to the B5081 Byley Road that has a listed property and other properties. Lily Lane would need upgrading.	Yes. Short access track to the B5081 Byley Road.
Is on planned construction traffic route?	No, traffic would need to join the B5081 Byley Road from Lily Lane before joining construction traffic route at B5309 Centurion Way.	No, traffic would need to join the B5081 Byley Road to construction traffic route at B5309 Centurion Way.
Traffic route impacts	Effectively no change in HGV flows except on B5081 Byley Road, but would reduce material transport distance of approximately 225,000 HGV movements. Highway haulage distance would be	Effectively no change in HGV flows except on the B5081 Byley Road, but would reduce material transport distance of approximately 438,000 HGV movements. Highway

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
	reduced by approximately 14.1 million km (based on approximately 62.5 km haul average from external sources). Lily Lane and potential traffic control on the B5081 Byley Road/B5039 Centurion Way junction.	haulage distance would be reduced by approximately 27.1 million km. (Based on approximately 62.5km haul average from external sources). Potential traffic control required on the B5081 Byley Road/B5039 Centurion Way junction.
Environment		
Agriculture	Loss of agricultural land expected.	Requires land from 6 holdings, 5 of which are otherwise not affected by the scheme. The holdings affected are: Lea Hall Farm; Shanks Farm, Byley; Allumbrook Farm; Pear Tree Farm, Cranage; and, Wash Lane Farm. The agricultural land is good quality subgrade 3a. Aerial mapping indicates arable land with a strip of woodland within the northern part of the site. Surrounding land uses include commercial/industrial premises to the north-west, understood to be the Holford Brinefield Complex and the M6 to the east.
Community	There are limited residential receptors in the surrounding areas, but these could be impacted by noise, visual, dust and traffic impacts. Approximately 20 residential properties lie in proximity. Byley Primary school and St John the Evangelist's Church are located on Moss Lane, immediately to the north of the potential borrow pit site. There are no Public Rights of Way (PRoW) within the site. Operation of the potential borrow pit would introduce construction traffic along Lily Lane, B5081 Byley Road, through industrial estate and near Cross Lanes Farm. No site visits or open space surveys have been undertaken at this site.	There are limited residential receptors in the surrounding areas, but these could be impacted by noise, visual, dust and traffic impacts. These mainly comprise individual properties located off the road surrounding the site. There are no PRoW within the site although one PRoW (Cranage Byway 7) runs adjacent and parallel to the south-east boundary of the site. Operation of borrow pit would introduce construction traffic along B5081 Byley Road. No site visits or open space surveys have been undertaken at this site.
Ecology and biodiversity	No statutory designated sites identified in proximity to the site. Nearest local wildlife site located approximately 900m south (Sproston Wood LWS). No priority habitat located within 400m. No surveys have been carried out at this site.	No statutory sites identified in proximity to the site. Nearest Local Wildlife Site approximately 500m north (Shakerley Mere). Areas of deciduous woodland (priority habitat) located adjacent to the site.

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
		No surveys have been carried out at this site.
Historic environment	No designated heritage assets are located within the site. • The nearest designated heritage assets include: • Church of St John The Evangelist, Grade II listed building, 90m north; • Round House, Grade II listed building, 120m south; and • World War II defences of the former airfield of RAF Cranage, scheduled monument, 350m north. The use of the borrow pit would not have a physical impact on the scheduled monument or alter its setting. During the temporary construction phase there would be impact on the heritage value of the listed buildings as a result of change within their settings. This would be a moderate or low impact and could amount to a moderate adverse significant effect.	No designated heritage assets are located within the site. The nearest designated heritage assets include: • Church of St John The Evangelist, Grade II listed building, 600m southwest; • Rosebank Cottage, Grade II listed building, 500m W; and • World War II defences of the former airfield of RAF Cranage, scheduled monument, 50m in all directions. The use of the borrow pit would not have an impact on the listed buildings or alter their setting. The use of the borrow pit during temporary construction phase would have a medium adverse impact on the heritage value of the scheduled monument, resulting in a potential major adverse significant effect, as a result of change within its setting.
Land quality	No potential land contamination has been identified within the site. There may be potential land contamination associated with industrial estates to the south and west and former World War II airfield to north.	There is the potential for land contamination at the site associated with the former use as a World War II airfield. Site specific GI required to confirm land contamination status of targeted materials and potential land contamination constraints associated with restoration.
Landscape and visual	The loss of the existing field pattern and established trees would have an adverse impact on the landscape character. Residents in properties on B5081 Byley Road would have direct views north towards the proposed borrow pit area which would be visible on the skyline in the middle distance. Views west from The Round House, Hunters Gate and adjacent properties would be from more elevated positions over the proposed borrow pit area in the near and middle distance. Views east from scattered properties along the B5081 Byley Road and north from Lily Lane are characterised by the presence of hedgerows and established trees, the loss of the trees and the presence of the borrow pit	The borrow pit would be located in proximity to the M6, gas station and factory works and construction activity would be largely screened by roadside and field vegetation although taller plant equipment would be visible from further afield. The magnitude of change would therefore be low and a minor adverse effect. The borrow pit activities would be visible from residential properties along Kings Lane where the presence of construction activity, vehicles and machinery would represent a substantial change in proximity to the receptor, out of character within the open agricultural setting; Moss Lane and Middlewich Road where the presence of

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
	would represent an adverse impact on the quality of the views in the near and middle distance.	construction activity, vehicles and machinery would represent a noticeable change in in the middle distance but partially filtered by existing vegetation. Views for residents in Byley would be largely screened by existing vegetation.
Sound, noise and vibration	Dwellings around Moss Lane, Lily Lane and B5081 Byley Road, together with Byley Primary School and Fox Hound Recording Studio on Moss Lane, are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit.	Dwellings around King's Lane and the B5081 Byley Road are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit although a significant effect on a community basis was not identified at these dwellings. Byley Primary School and Fox Hound Recording Studio on Moss Lane are likely to experience an increase in noise levels during construction from the establishment, excavation and restoration of the borrow pit.
Socio-economic	No direct effects but in proximity to Middlewich Road Industrial Estate and potential sensitive receptors in Byley including Byley Primary School.	No direct effects, but in proximity to a shooting range at Nook Wood and a kennels at Kings Lane Farm.
Water resources and flood risk	Potential adverse impacts to groundwater regime associated with the removal of granular deposits, including potential impacts to baseflows to local surface watercourses during operation and restoration of the borrow pit. Site specific GI is required to confirm local groundwater conditions within the granular deposits. Extraction of materials may be from below/within the groundwater table and control of groundwater may be required during operation and restoration. The site is not located within a flood risk zone or in an area at risk of flooding from surface water or groundwater. The closest watercourses are Puddinglake Brook and tributary of the River Dane, which are located to the immediate north and south of the sites respectively. Springs which feed the tributary of the River Dane are also located directly to the south of the borrow pit. It is identified that baseflow to these watercourses and springs may be adversely effected during operation of the borrow pit as	Potential adverse impacts on the local groundwater regime, including potential impacts to baseflows to local surface watercourses during operation and restoration of the borrow pit. Site specific GI is required to confirm local groundwater conditions within the granular deposits. Extraction of materials may be from below/within the groundwater table and control of groundwater may be required during operation and restoration. The site is not located within a flood risk zone or in an area at risk of flooding from surface water or groundwater. The closest watercourse is Puddinglake Brook, which is located to the immediate south of the site. It is identified that baseflow to this watercourse may be adversely effected during operation of the borrow pit, as dewatering could lead to a reduction in baseflow to the Puddinglake Brook. The borrow pit would likely be backfilled with material of a lower permeability and this could impact on the

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
	dewatering could lead to a reduction in baseflow to the watercourses and springs. The borrow pit would likely be backfilled with material of a lower permeability and this could impact on the groundwater flow regime and flood risk. This could lead to permanent changes in groundwater flow to watercourses and springs. Impacts would be considered further during detail design of the granular borrow pit, to include suitable mitigation for potential reduction in flow (such as discharge to the springs and watercourses during any dewatering operation, and restoration of the borrow such that groundwater flow paths are maintained).	groundwater flow regime and flood risk. This could lead to permanent changes in groundwater flow to Puddinglake Brook. Impacts would be considered further during detail design of the granular borrow pit, to include suitable mitigation for potential reduction in flow (such as discharge to the watercourse during any dewatering operation, and restoration of the borrow pit such that groundwater flow paths are maintained).
Planning	From a review of the available online planning records, there are considered to be no committed developments within, or immediately adjacent to (within 250m). Relevant Cheshire East Policies: Policy PG6 (Open Countryside) of the Local Plan Strategy; Policy SE10 (Sustainable Provision of Minerals) of the Local Plan Strategy; Policy SE14 (Jodrell Bank – consultation zone) of the Local Plan Strategy; Saved Policy PS8 (Open Countryside) of the Congleton Borough Council Local Plan First Review; Saved Policy PS10 (Jodrell Bank Radio Telescope Consultation Zone) of the Congleton Borough Council Local Plan First Review; Saved Policy 47 (Sand and Gravel Area of Search) of the Cheshire Replacement Minerals Local Plan; and Saved Policy 52 (Future Controlled Brine Extraction).	From a review of the available online planning records, there are considered to be no committed developments within, or immediately adjacent to (within 250m). Relevant Cheshire East Policies: Policy PG6 (Open Countryside) of the Local Plan Strategy; Policy SE10 (Sustainable Provision of Minerals) of the Local Plan Strategy; Policy SE14 (Jodrell Bank – consultation zone) of the Local Plan Strategy; Saved Policy PS8 (Open Countryside) of the Congleton Borough Council Local Plan First Review; Saved Policy PS10 (Jodrell Bank Radio Telescope Consultation Zone) of the Congleton Borough Council Local Plan First Review; Saved Policy 47 (Sand and Gravel Area of Search) of the Cheshire Replacement Minerals Local Plan; and Saved Policy 52 (Future Controlled Brine Extraction).

Item	GBP 2	GBP 4A (MA02 Granular Borrow Pit D)
	Relevant Cheshire West and Chester Policies: Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1 - Salt MSA and Sand and Gravel MSA;); Policy M1 (Future sand and gravel working (area of search) of the Local Plan Part 2 (LPP2); Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the LPP2; Policy M6 (Salt and brine working) of the LPP2; Policy DM12 (Jodrell Bank Radio Telescope Consultation Zone) of the LPP2; and Policy DM44 (Protecting and enhancing the natural environment) of the LPP2.	Relevant Cheshire West and Chester Policies: Policy ENV9 (Minerals Supply and Safeguarding) of the Local Plan Part 1 (LPP1) – Salt MSA and Sand and Gravel MSA; Policy M1 (Future sand and gravel working (area of search) of the Local Plan Part 2 (LPP2); Policy M4 (Proposals for exploration, appraisal or production of hydrocarbons) of the LPP2; Policy M6 (Salt and brine working) of the LPP2; Policy DM12 (Jodrell Bank Radio Telescope Consultation Zone) of the LPP2; and Policy DM44 (Protecting and enhancing the natural environment) of the LPP2.

6.2.12 The two shortlisted potential granular borrow pit locations are remote from the land required for construction of the Proposed Scheme. Excavated materials would need to be transported via the existing public highway network to the construction areas. Traffic from potential GBP 2 could join the existing construction traffic routes either immediately or onto Lily Lane which then connects with the B5081 Byley Road before joining the Proposed Scheme main construction traffic route at B5309 Centurion Way. This is a total distance of approximately 2.5km to reach the construction route and up to 6.5km from the borrow pit to the route of the Proposed Scheme by use of the public highway network.

6.2.13 Traffic from potential GBP 4A (MA02 Borrow Pit D) would need to travel approximately 3.5km along B5081 Byley Road and B5309 Centurion Way before joining the existing construction traffic routes to the east of Middlewich, from where it is a further 3km to the route of the Proposed Scheme.

6.2.14 A detailed review of BGS borehole information available in the area around potential GBP 4A (MA02 Borrow Pit D) indicated a greater depth of available granular material. This suggests it could have capacity to provide greater quantities of material than initially assumed. If confirmed by site specific GI and detailed design, the surface area required for potential GBP 4A (MA02 Borrow Pit D) could be reduced in extent and a greater volume extracted, with more certainty, to fulfil the demand for acceptable granular materials for construction of the Proposed Scheme, which is currently assessed as being 881,000m^3.

6.2.15 Restoration of the granular borrow pit sites would be achieved using excavated materials from the Proposed Scheme, if suitable, and from other areas where materials are deemed suitable for the purposes of backfilling. Restoration materials would need to be transported along the public highway and strategic road network or from the closest transfer node to the location of the borrow pit.

6.2.16 The environmental appraisal of the two shortlisted potential granular borrow pit locations did not reveal significant environmental differences between the two locations to be a deciding factor in the selection of the final granular borrow pit. The potential differences at these sites are those associated with the potential impacts on the local hydrogeological regime, land quality and heritage assets.

6.3 Final selection of granular borrow pit

6.3.1 The final selected granular borrow pit for the Proposed Scheme is GBP 4A (MA02 Borrow Pit D), which is located 4.5km to the east of the route of the Proposed Scheme, north of Moss Lane and immediately west of the M6. The distance by public highway network to the Proposed Scheme is approximately 6.5km.

6.3.2 This borrow pit is identified as MA02 Borrow Pit D in Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02) and shown in the Volume 2, MA02 Map book: map CT-05-312-R5, E10 to G2 to J6. This borrow pit will be referred to as MA02 Borrow Pit D from this point on in the report.

6.3.3 MA02 Borrow Pit D was taken forward into the Proposed Scheme (refer to Volume 2, MA02 Map Book: map CT-05-312-R5, E10 to J6) as the available geotechnical information at the time of the appraisal indicated that the depth of acceptable engineering material would likely be greater at this location and is assumed to provide sufficient material to construct the Proposed Scheme in this area. Further, MA02 Borrow Pit D will require less agricultural land, will have less potential air quality, noise and visual impacts whilst material is being extracted from the borrow pit. However, this option will require land from, and have greater setting impacts on, the scheduled moments at RAF Cranage former World War II airfield, and greater construction traffic impacts due to a slightly longer construction traffic route.

6.3.4 The selection of MA02 Borrow Pit D followed a detailed review of the available geological information. This information indicated that the potential depth of granular material available for extraction could be significantly greater at this location in comparison with GBP 2 and that MA02 Borrow Pit D will provide greater assurance and flexibility to provide the quantities of granular material needed to satisfy the demand for materials required to construct the embankments within the MA02 area, currently assessed as being 881,000m^3. Annex B, Figure B4 shows likely destinations for the granular materials extracted from MA02 Borrow Pit D for use in construction of the Proposed Scheme.

6.3.5 The construction traffic routes that would be used for MA02 Borrow Pit D are slightly longer than for GBP 2. However, it is considered that the construction traffic route to be used for MA02 Borrow Pit D would, overall, be less of an impact to the public highway network and receptors in comparison with GBP 2. In addition, GBP 2 is located adjacent Lily Lane which would need substantial upgrading to accommodate the construction traffic associated with operation and restoration of a borrow pit.

6.3.6 It may be possible to reduce the surface area required for MA02 Borrow Pit D if site specific GI confirms that the depth of workable granular deposits is greater than the conservative estimate used in the initial appraisal of potentially available materials from this location.

6.3.7 Key features of the borrow pit selected as a source for granular material, including the assumed working area and assumed extraction depth, are summarised in Table 10.

Table 10: Selected granular borrow pit key features

Borrow pit	Location and map reference	Extracted material	Assumed working area	Assumed depth of recoverable material*	Assumed maximum excavation depth (b.e.g.l.**)	Duration	Accessed from
MA02 Borrow Pit D	Open land between Byley and M6; CT-05-312, R5, E10 to G2 to J6	Sand and gravel	48ha	3m	5m	Four years and nine months	B5081 Byley Road

**An estimate based on desk based study of the thickness of recoverable material; the assumed maximum excavation depth*
*** below existing ground level*

7 Traffic and transport assessment

7.1 Introduction

7.1.1 This section provides a high-level assessment of the traffic and transport implications of the inclusion and removal of the selected cohesive (MA02 Borrow Pits A, B and C) and granular (MA02 Borrow Pit D) borrow pits in the Proposed Scheme.

7.2 HGV movements of excavated material

7.2.1 MA02 Borrow Pits A, B and C are located adjacent to the route of the Proposed Scheme and excavated material leaving and incoming material (for restoration) can be transported via ADT on dedicated site haul routes without the need to carry materials to or from the borrow pits along the public highway network.

7.2.2 MA02 Borrow Pit D is located a distance of 6.5km from the route of the Proposed Scheme by public highway network. All movements of excavated material from MA02 Borrow Pit D and incoming material for its restoration would be by HGV on the public highway network, mainly using the A54 Holmes Chapel Road, the B5309 Centurion Way, and the B5081 Byley Road.

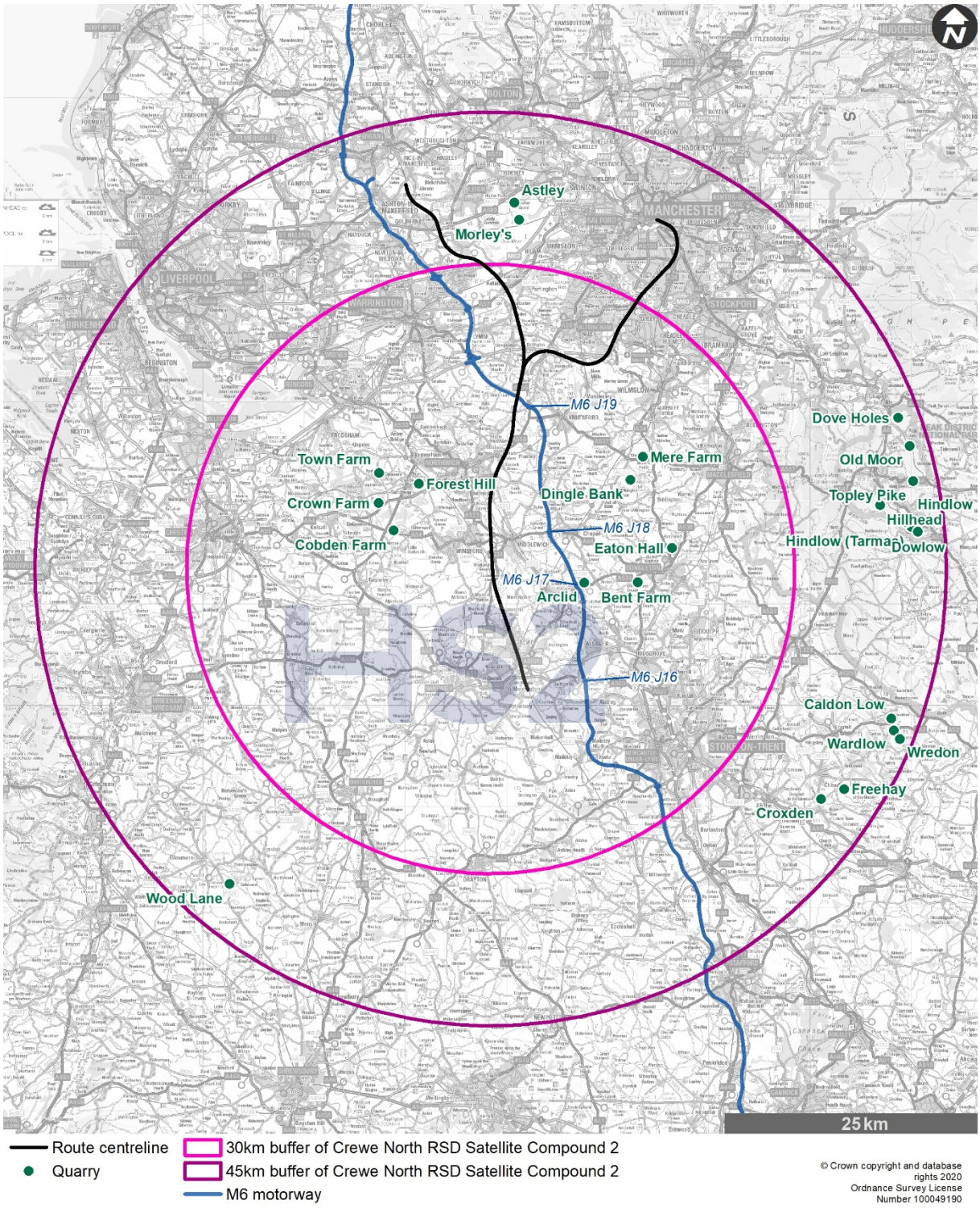
7.2.3 The programme for the Proposed Scheme assumes that between 150-250 loaded HGV per day, a daily total of up to a maximum of 500 HGV movements, would be generated from MA02 Borrow Pit D. This equates to a total of up to 50 HGV per hour over a period of more than 30 months. This flow of HGV is constrained by the logistical capacity to load HGV at the borrow pit during each hour of a maximum 10-hour working day.

7.2.4 As set out in Section 3 of this report, if borrow pits were not used, the main potential quarries providing the necessary material would be located to the east of the route of the Proposed Scheme (e.g. north west Derbyshire and north Staffordshire) and in the Ellesmere area of Shropshire, to the south-west of the (MA02 area, between Wrexham and Shrewsbury.

7.2.5 As well as being located further away from the Proposed Scheme, the most appropriate routing from these quarries to the transfer nodes could mean that there may be limited opportunity for HGV to use the strategic road network (e.g. the M6). This constraint may result in more quarry traffic using the public highway network between the quarries and the Proposed Scheme.

7.2.6 The locations of quarries in relation to the M6 Motorway and the Proposed Scheme is shown in Figure 13.

Figure 13: Location of potential quarries in relation to the M6 and the Proposed Scheme



7.3 Implications of removal of borrow pits

7.3.1 The selected cohesive (MA02 Borrow Pits A, B and C) and granular (MA02 Borrow Pit D) borrow pits have been considered separately in order to provide a high level traffic assessment of the potential implications that the removal or reduction in materials generated by the borrow pits would have on construction traffic in different parts of the Proposed Scheme. The removal of the cohesive borrow pits (MA02 Borrow Pits A, B and C) would result in transport of construction material moving from site haul roads to the public highway network which would have a detrimental impact on the public highway network in the vicinity of the scheme, while the removal of the granular borrow pit (MA02 Borrow Pit D) would have a minor impact on the routing of HGV already using the public highway network.

7.3.2 The assessment has been based on the Proposed Scheme programme for the movement of excavated material for the following material types:

- import – material required to construct the Proposed Scheme arriving from external sources (e.g. quarries); and
- export – excavated material removed from site (e.g. from cuttings) for disposal at external locations (e.g. landfill or use by other schemes).

7.3.3 For the purpose of these assessments:

- material previously proposed to be extracted from borrow pit(s) has been replaced by imported material from quarries and sustainable sources;
- material previously assigned to backfill the borrow pit(s) has been re-designated as exported material; and
- no material is proposed to be required for restoration of the borrow pit(s).

7.3.4 This high-level assessment has been undertaken based on the assumed use of the construction transfer nodes being able to cater for the additional movements from the removal of the borrow pits or a change in the borrow pit strategy. The transfer nodes have been selected and assigned based on borrow pit locations and their proximity to the identified areas of fill (see Annex C – Transfer node assignments).

Removal of cohesive borrow pits (MA02 Borrow Pits A, B and C)

7.3.5 If MA02 Borrow Pits A, B and C were to be removed from the Proposed Scheme, the following implications would arise:

- an increase in the import of engineering materials from external sources via the public highway network, requiring 166,100 additional HGV journeys on the public highway network;

- excavated materials arising from the construction of the Proposed Scheme, that would have been reused for the borrow pit restoration, would require space for stockpiling and either of the following in order to transport the material from the site:
  - 166,100 additional HGV movements; or
  - 1,200 train movements (assuming a loading capacity of 600m^3 per train), requiring 2,400 train paths on the West Coast Main Line (WCML);
- an increase in both volumes and overall duration of HGV traffic flows on the public highway network in the vicinity of all transfer nodes between Crewe North RSD Transfer Node (TN02) and Rudheath Embankment Transfer Node (TN05). The A54 Holmes Chapel Road, the A54 Kinderton Street and the A54 St. Michael's Way in particular, would experience periods of increased HGV movements over an extended duration;
- with removal of MA02 Borrow Pits A, B and C, the intensity of the volume of HGV would increase closer to the Proposed Scheme, resulting in greater impacts on communities through which these additional HGV movements would pass;
- an increase in HGV flows on the public highway network between quarries and the strategic road network (these additional movements have not been included in this assessment as these movements are assumed to form part of original consents to operate these quarries); and
- an adverse impact on the resilience of the programme for construction of the Proposed Scheme, since use of borrow pits provides greater control over the supply of materials where and when required.

7.3.6 Table 11 shows the extra HGV movements associated with the removal of each of MA02 Borrow Pits A, B and C. These movements are expressed as one-way and therefore include both loaded and unloaded HGV from and to quarries supplying material if MA02 Borrow Pits A, B and C are removed and as such reflect the importation of materials only.

Table 11: Extra HGV movements associated with the removal of the cohesive borrow pits

Borrow pit	Extra HGV movements
MA02 Borrow Pit A	64,000
MA02 Borrow Pit B	49,400
MA02 Borrow Pit C	52,700
Total	**166,100**

7.3.7 The removal of MA02 Borrow Pit A would require replacement materials to be sourced and transported which would result in 64,000 additional HGV movements that would be routed through Crewe RSD North Transfer Node (TN02), with additional traffic coming from M6 junction 16 via the A500 Newcastle Road, the A51 Nantwich Bypass and the A530 Nantwich Road.

7.3.8 The removal of MA02 Borrow Pit B would require replacement materials to be sourced and transported which would result in 49,400 additional HGV movements that would be routed through Crewe RSD North Transfer Node (TN02). These additional HGV movements would

come from M6 junction 16 via the A500 Newcastle Road, the A51 Nantwich Bypass and the A530 Nantwich Road.

7.3.9 The removal of MA02 Borrow Pit C would require replacement materials to be sourced and transported which would result in 52,700 additional HGV movements to be routed through the following transfer nodes:

- 7,700 additional HGV movements via A533 Bostock Road Transfer Node (TN03), with the additional traffic coming from M6 junction 18 via the A54 Holmes Chapel Road, the A54 Kinderton Street, the A54 St. Michael's Way, the A530 Nantwich Road, the A530 Newton Bank, the A54 Chester Road and the A54 Middlewich Road through central Middlewich;
- 19,000 additional HGV movements via Gad Brook Viaduct South Transfer Node (TN04), with the additional traffic coming from M6 junction 18 via the A54 Holmes Chapel Road, the B5309 Centurion Way, the B5309 King Street and the A530 King Street; and
- 26,000 additional HGV movements via Rudheath Embankment Transfer Node (TN05), with the additional traffic coming from M6 junction 19 via the A556 Chester Road and A556 Shurlach Road.

Removal of granular borrow pit (MA02 Borrow Pit D)

7.3.10 The removal from the Proposed Scheme of MA02 Borrow Pit D would have the following implications:

- the journey distance by road for HGV supplying granular material to the Proposed Scheme would increase from 6.5km, when sourced from the borrow pit, to an assumed average of 67km when sourced from quarries, representing a ten-fold increase in HGV miles on the public highway network, and an increase in the number of vehicles on the road at any one time given the greater distance they would have to travel;
- excavated materials arising from the construction of the Proposed Scheme that would have been used to backfill MA02 Borrow Pit D would need to be disposed of and would require additional space for stockpiling and 207,400 additional HGV journeys in order to remove the material from the site;
- available landfill space in the north-west of England for disposal of materials is limited and adding to the demand for landfill space may result in taking available existing capacity used by others and potential considerable increases in journey distances;
- imported materials would mainly come through the M6 junction 18 and generally use the same roads to access the transfer nodes as those from MA02 Borrow Pit D. This would increase the construction traffic on the section of the A54 Holmes Chapel Road between the M6 junction 18 and B5309 Centurion Way, but would remove the construction HGV from B5081 Byley Road between B5309 Centurion Way and MA02 Borrow Pit D;
- material going to the Lostock Gralam area using Penny's Lane Transfer Node (TN06) and Lostock Gralam Viaduct Transfer Node (TN07) would come from the M6 junction 19 as this is the closest point of access onto the strategic road network;

- an increase in HGV flows on local roads used to access quarries from the strategic road network. However, these movements have not been included in this assessment as this has been assumed to form part of the consent granted to the quarry operator; and
- an adverse impact on the resilience of the programme for construction of the Proposed Scheme, since the use of MA02 Borrow Pit D would provide greater control over the supply of materials where and when required.

7.3.11 Although there would be an increase in the length of journey along the public highway network for HGV bringing imported material from quarries instead of MA02 Borrow Pit D, this would be partially offset by the existing journeys made between MA02 Borrow Pit D and the individual transfer nodes. The calculation of the average net distance between quarries and transfer nodes is shown in Table 12.

Table 12: Estimated change in HGV journey distance resulting from removal of MA02 Borrow Pit D

Borrow Pit Scenario	Transfer node journeys	Approximate distance by road between MA02 Borrow Pit D and transfer nodes (km)
With MA02 Borrow Pit D	TN02 Crewe RSD North Transfer Node	50
	TN03 A533 Bostock Road Transfer Node	6.5
	TN04 Gadbrook Viaduct South Transfer Node	9
	TN05 Rudheath Embankment Transfer Node and TN06 Penny's Lane Transfer Node	10.5
	TN07 Birches Lane transfer node	12
	TN08 Lostock Gralam Viaduct transfer node	13.7
	Average distance between MA02 Borrow Pit D and transfer nodes	17
Without MA02 Borrow Pit D	Average distance between quarries and transfer nodes	67
Average net additional distance between quarries and transfer nodes		**50**

7.3.12 The 50km approximate distance of the route between MA02 Borrow Pit D and TN02 Crewe RSD North Transfer Node is as a result of the direct route along Clive Green Lane not being available due to other HS2 related construction works. The construction traffic routes from MA02 Borrow Pit D to the transfer nodes are shown in Figure 14.

7.3.13 The average net additional distance that would be travelled between quarries and transfer nodes is estimated at 50km and this has been used to estimate the carbon emissions impact of using quarries to source the required granular materials instead of MA02 Borrow Pit D.

Carbon emissions impact associated with importing materials from quarries

7.3.14 The overall carbon emissions impact of removing MA02 Borrow Pits A, B, C and D and replacement with materials imported from quarries is presented in Table 13. This excludes the removal of excavated material from the Crewe tunnel that would have been used to restore the cohesive borrow pits (MA02 Borrow pits A, B and C), as this is assumed to go by

rail (assuming available train paths) and if removed by road would further increase carbon emissions.

7.3.15 The carbon emissions assessment also assumes that there is zero change in vehicle km for restoration of the granular borrow pit (MA02 Borrow Pit D) as the material that would have been used for restoration would instead be transported for disposal off-site.

Table 13: Estimated net carbon emissions impact of importing material from quarries*

Borrow pit name	Material volume (m^3)	Average journey distance km	Vehicle journeys (laden)	kg CO_2e per km (laden)	Vehicle journeys (unladen)	kg CO_2e per km (unladen)	Total kg CO_2e
MA02 Borrow Pit A	272,000	67	32,000	1.07	32,000	0.65	3,706,100
MA02 Borrow Pit B	210,000		24,700		24,700		2,861,300
MA02 Borrow Pit C	224,000		26,400		26,400		3,052,100
MA02 Borrow Pit D	881,000	50	103,700		103,700		12,003,900
	1,587,000		**186,800**		**186,800**		**21,623,400**

** Materials journey from transfer node to site location similar to material journey from borrow pit to site location on site haul routes so neutral for calculation purposes.*

Export of Crewe tunnel arisings by rail

7.3.16 The removal of MA02 Borrow Pits A, B and C would mean that material excavated during construction of the Crewe tunnel would no longer be used as backfill for the borrow pits. If the excavated material is not used for backfilling borrow pits, there would be an adverse impact on the programme for construction of the Proposed Scheme, which is reliant on the excavated materials being transported to the borrow pits for their restoration.

7.3.17 The extension to the construction programme would be caused by the logistical impact of having to store large quantities of excavated materials at Crewe RSD north until it could be exported offsite. In addition, the need to stockpile excavated materials from Crewe tunnel at Crewe RSD would cause adverse impacts on the depot's construction programme.

7.3.18 Rail export of the excavated materials would be undertaken from the railhead at MA02/1a TN 01. With an estimated capacity for each train of 600m^3 of excavated materials, it has been calculated that a total of 2,400 train movements will be required to transport Crewe tunnel arisings by rail (1,200 laden journeys and 1,200 unladen return journeys).

7.3.19 It is estimated that these rail journeys would have a maximum distance of 150km, as this is the maximum practicable distance for a return trip to be possible by a train in one day. Other suitable sites closer to the Proposed Scheme may be identified as part of detailed analysis of rail export options.

7.3.20 Although excavated materials would be exported using the Proposed Scheme's link with the electrified WCML, it is unlikely that the entire journey would be possible via electrified railway and so it has been assumed that all trains would be diesel powered throughout their journey and would use the most common type of diesel freight locomotive on the network.

7.3.21 Table 14 shows the estimated carbon emissions impact of exporting the Crewe tunnel arisings by rail.

Table 14: Estimated carbon emissions impact of exporting Crewe tunnel arisings by rail

Train journey direction	Volume of spoil (m^3)	Train journeys	Distance (km)	Total train kms	Kg CO_2 per train km*	Total kg CO_2e
Outbound laden train	720,000	1,200	150	180,000	55	9,990,000
Inbound unladen train	0	1,200	150	180,000	22	3,960,000
Total estimated carbon emissions impact of Crewe tunnel arisings export by rail						**13,860,000**

**assumes a diesel powered Class 66 locomotive and uses value of 27.5g CO_2e /tonne km to calculate emissions for a 2000 tonne laden train and 800 tonne unladen train (ORR Rail Emissions 2019-20).*

7.3.22 As a result of removal of MA02 Borrow Pit A, B and C, an additional 13.9 million tonnes of carbon emissions is predicted to be generated as a result of rail export of tunnel arisings that would otherwise have been used to backfill the cohesive borrow pits.

7.3.23 A calculation of the carbon emissions impact of transporting excavated material used to backfill MA02 Borrow Pit D from the Proposed Scheme has not been undertaken, as it has been assumed that this would be exported a similar distance to external landfill sites and no benefit is attributed to this.

Effect of removal of all borrow pits

7.3.24 The effect of removal of all the borrow pits from the Proposed Scheme, in terms of increased traffic generation, would be dominated by the removal of the cohesive borrow pits, MA02 Borrow Pit A, B and C, which would require all imported and exported material to be transported on the public highway network.

7.3.25 The removal of MA02 Borrow Pit A, B and C, would effectively add 166,100 HGV movements onto the public highway network to import acceptable engineering material and would also add approximately 2,400 train paths for the removal of the Crewe tunnel spoil to landfill.

7.3.26 Only a minimal traffic effect would occur if the granular borrow pit (MA02 Borrow Pit D) was removed, since the main impact would be the removal of HGV from the 4km of B5081 Byley Road between MA02 Borrow Pit D and B5309 Centurion Way.

7.3.27 The removal of all borrow pits would substantially increase overall HGV vehicle distances travelled, with material needing to be imported from quarries located remote from the route, typically over more than 60km, and this would also result in substantial increases in overall carbon emissions, estimated as being 21.6 million tonnes of carbon emissions.

7.3.28 In addition, there would also be an estimated 13.9 million tonnes of carbon emissions as a result of having to export the Crewe tunnel arisings by rail rather than being transported by conveyor to be used for the restoration of MA02 Borrow Pits A, B and C.

7.4 Traffic assessment

7.4.1 The removal of MA02 Borrow Pits A, B and C would add a significant number of HGV trips to the public highway network, since the transport of cohesive material required to construct the Proposed Scheme would no longer be limited to site haul roads within the defined construction site boundary for the Proposed Scheme. The daily flows of HGV that would need to use the public highway network to get to the transfer nodes would be limited by each compound's ability to process the HGV bringing this material from remote quarries.

7.4.2 Due to the construction routes taken between quarries and transfer nodes, in some locations the cumulative impact of removing MA02 Borrow Pits A, B and C is greater than the HGV capacity of a single compound or transfer node. This is because some routes would carry HGV travelling between multiple transfer nodes.

7.4.3 The Transport Assessment (TA) has considered:

- routes between compounds and the strategic road network and use of the strategic road network itself. Routes between the strategic road network and specific quarries or clusters of quarries have not been assessed as these are considered to be within individual quarries' planning/use consents;
- flows do not include light vehicle or car movements which may be affected;
- a manual estimate of the projected flows; and
- considers only the period of peak generation of the borrow pits which typically forms only a short period within the overall project when base layer materials provided by the borrow pits are required for construction of earthworks.

7.4.4 The TA in this document only considers the period affected by import and export of material associated with the borrow pits and the potential impact of their removal from the Proposed Scheme.

7.4.5 As the period of peak movements to and from borrow pits generally occur in 2026, which is outside the peak traffic generation for the Proposed Scheme (around 2028) and using the same routes, detailed traffic modelling of borrow pit HGV movements that are lower than the overall peak HGV construction traffic of the Proposed Scheme would not be expected to identify additional impacts and has not been undertaken. This relationship between borrow pit traffic and the overall construction peak for the Proposed Scheme is demonstrated later in this section in Table 15.

7.4.6 The TA considers the following transfer nodes:

- TN02 - Crewe RSD North Transfer Node;
- TN03 - A533 Bostock Road Transfer Node;

- TN04 - Gadbrook Viaduct South Transfer Node; and
- TN05 - Rudheath Embankment Transfer Node and TN06 Penny's Lane are considered together, as these effectively have the same access point from the A530 King Street.

7.4.7 Transfer Node 07 Birches Lane and Transfer Node 08 Lostock Gralam Viaduct only require import of granular material and are not considered in the assessment of cohesive borrow pits.

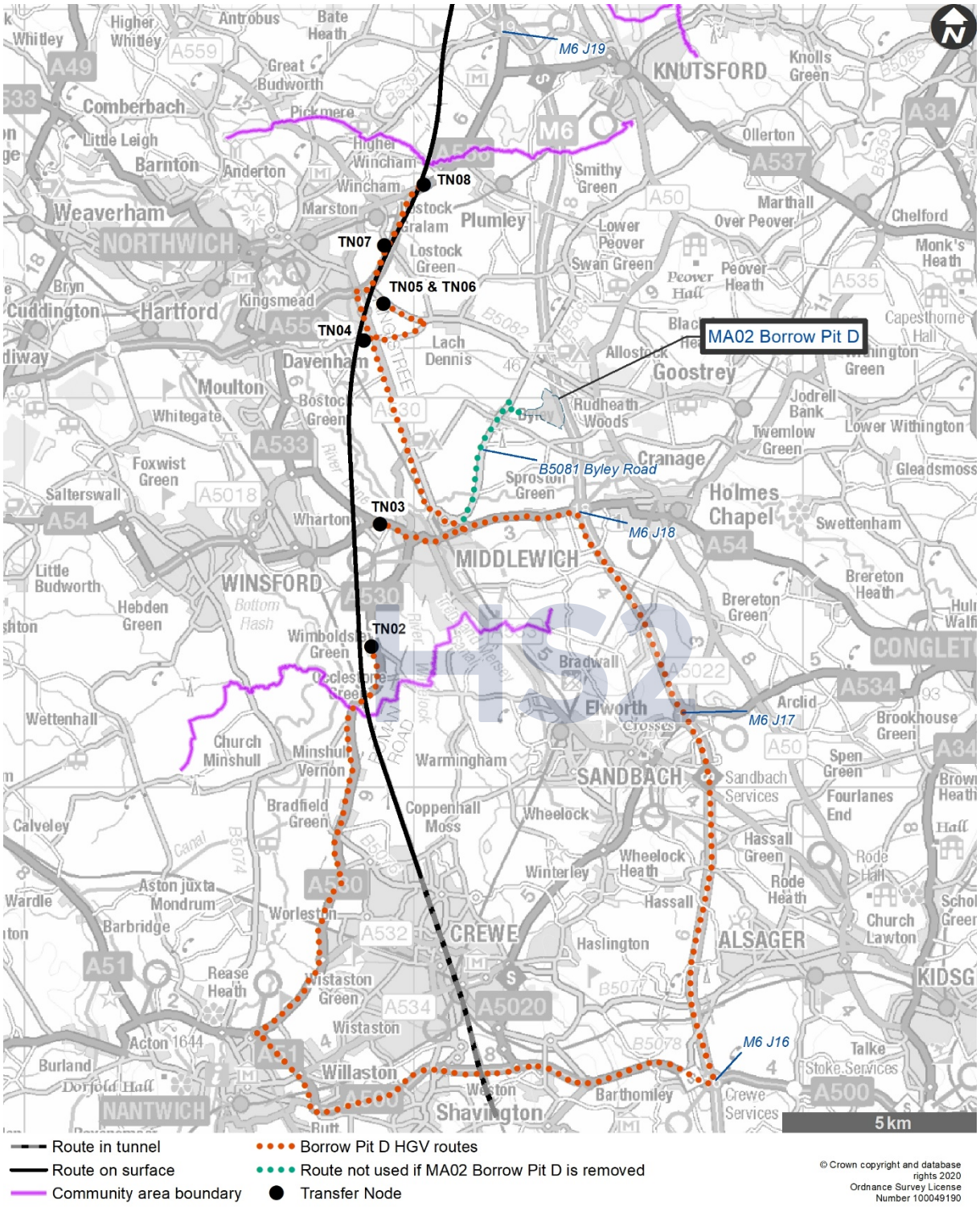
7.4.8 Figure 14 shows the construction traffic routes that would be used to import granular material from MA02 Borrow Pit D to the Proposed Scheme. The detour required between MA02 Borrow Pit D and TN02 is apparent, as is the impact of the removal of this borrow pit on the use of the B5081 Byley Road by HGV. The use of the B5081 Byley Road would only be required to access the borrow pit itself and would carry no construction HGV if MA02 Borrow Pit D is not used for importing granular material.

7.4.9 Transport of cohesive material to the Proposed Scheme if MA02 Borrow Pits A, B and C were not used would follow similar routes between the M6 and transfer nodes.

7.4.10 The routes between the MA02 Borrow Pit D and transfer nodes shown in Figure 14 follow construction routes defined as part of the Proposed Scheme. With MA02 Borrow Pit D in place, all routes commence from B5081 Byley Road to access the Proposed Scheme, with return routes using the same roads in reverse.

7.4.11 If MA02 Borrow Pit D is not used, the route along B5081 Byley Road highlighted in green will not be required. All routes from remote quarries are expected to use the same routes from the M6 to the Proposed Scheme, except for HGV travelling to Transfer Node 02 which would not need to use the A54 Holmes Chapel Road between M6 junction 18 and Middlewich.

Figure 14: HGV traffic routes between MA02 Borrow Pit D and transfer nodes



Traffic assessment for the removal of MA02 Borrow Pits A, B and C

7.4.12 The removal of MA02 Borrow Pits A, B and C would typically affect road traffic flows in the early stages of the project in 2026/2027, when the main demand for acceptable engineering material for construction of the embankments within MA02 occurs.

7.4.13 In this section, peak daily HGV movements are shown as one-way movements that include both loaded and unloaded HGV between quarries and the Proposed Scheme, with hourly HGV movements also provided for each direction.

7.4.14 Table 15 shows that the removal of MA02 Borrow Pits A, B and C would mean that several hundred HGV movements daily would move from site haul roads onto the public highway network between the M6 and the Proposed Scheme.

7.4.15 The additional HGV movements resulting from removal of MA02 Borrow Pits A, B and C would create a peak in HGV construction traffic on the surrounding public highway network earlier in the construction programme in 2026 than would be the case if these borrow pits were retained. This is due to the need to undertake construction activities using the material from the borrow pits, or imported from quarries, during the 2026 earthworks season.

Table 15: Traffic impacts on public highway network of removing MA02 Borrow Pits A, B and C

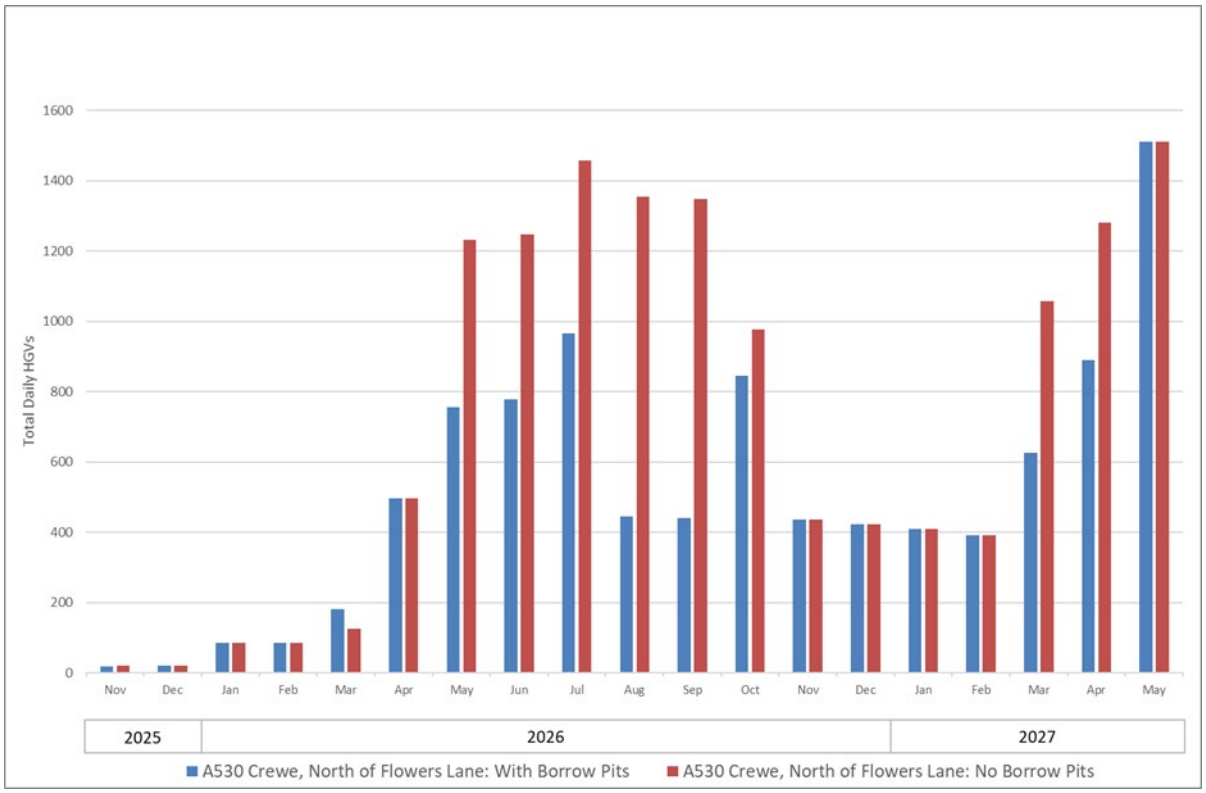
Transfer node (TN) and affected roads	Peak daily HGV importing material		Peak month of borrow pit activity
	With borrow pits	Without borrow pits	
TN02 A530 near Flowers Lane	970	1,460	July 2026
TN03 A533 Bostock Road	480	520	May 2026
TN03 A54 Middlewich near Lewin Street	510	720	May 2026
TN04-08A A530 & B5309 north of Byley Road	390	720	Sept 2026
A556 south of M6 junction 19	330	410	Sept 2026

7.4.16 The peaks shown in the table above relate to construction HGV movements associated with material imported to the Proposed Scheme only. Further peaks in HGV movements occur later in the overall construction period.

A530 Nantwich Road

7.4.17 With the removal of MA02 Borrow Pits A, B and C, a total of up to 1,460 HGV per day, 73 HGV per hour in each direction, would be predicted to use the A530 Nantwich Road to access TN02 during July 2026. This compares to a maximum of 970 HGV per day, 39 HGV per hour in each direction, if the cohesive borrow pits are used. This pattern of construction traffic is shown in Figure 15.

Figure 15: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A530 Nantwich Road



7.4.18 The greatest increase in HGV movements resulting from removal of the MA02 Borrow Pits A, B and C would occur during August and September 2026, although the peak in movements would occur in July 2026. An underlying peak in other construction HGV movements would cause this earlier peak on the A530.

7.4.19 If MA02 Borrow Pits A, B and C were removed, there would be a peak in daily HGV movements occurring on B5076 Flowers Lane that would start significantly earlier and be greater in volume than would be the case if borrow pits were used. As well as increasing the peak in the volume of HGV movements occurring during 2026, removal of MA02 Borrow Pits A, B and C would also result in a prolonged peak which would last for a period of six months.

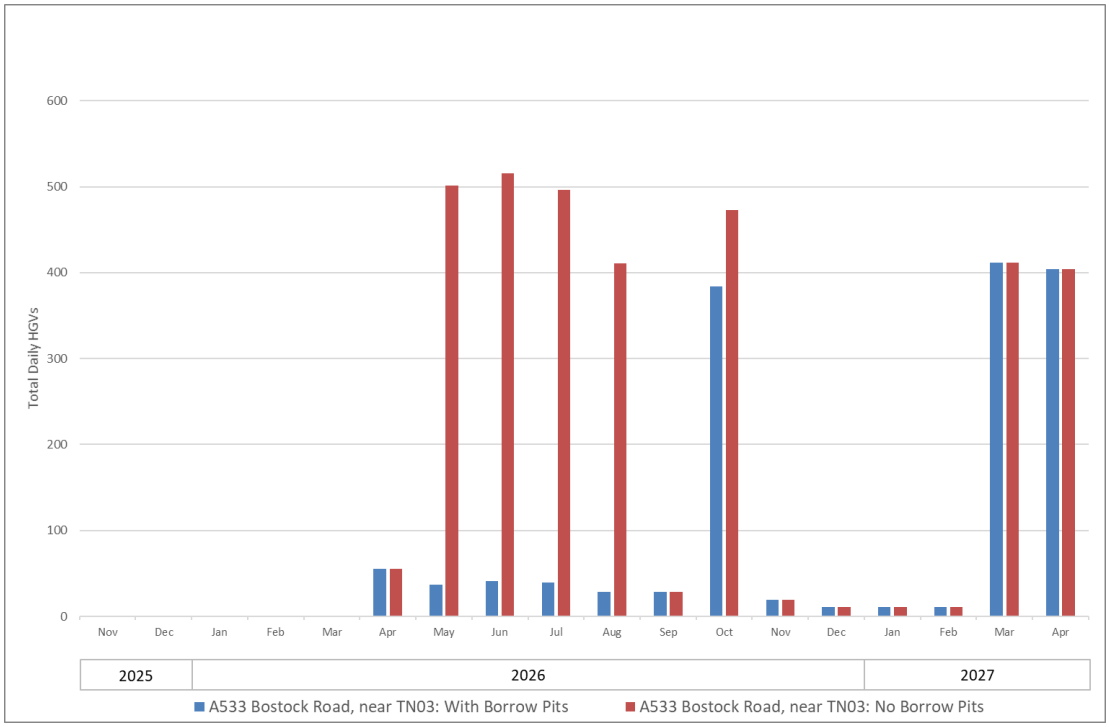
7.4.20 In August and September 2026, construction movements on the public highway network in the vicinity of TN02, including both loaded and unloaded HGV would fall to 1,360, before falling further due to a pause in earthworks activities during the winter months. A brief resumption of impacts from removal of MA02 Borrow Pits A, B and C would then occur in March and April 2027 before ceasing entirely in May 2027.

7.4.21 The period of lower HGV movements that occur between November 2026 and March 2027 relates to other, less weather-dependent, construction activity taking place during these months.

A533 Northwich Road

7.4.22 With the removal of MA02 Borrow Pits A, B and C, a total of approximately 500 HGV per day, 25 HGV per hour in each direction, would be predicted to use the A533 Northwich Road to access TN03, west of Middlewich, between May and July 2026. This compares to fewer than 50 HGV per day, 3 HGV per hour in each direction, if the MA02 Borrow Pits A, B and C are used. This pattern of construction traffic is shown in Figure 16.

Figure 16: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A533 Northwich Road

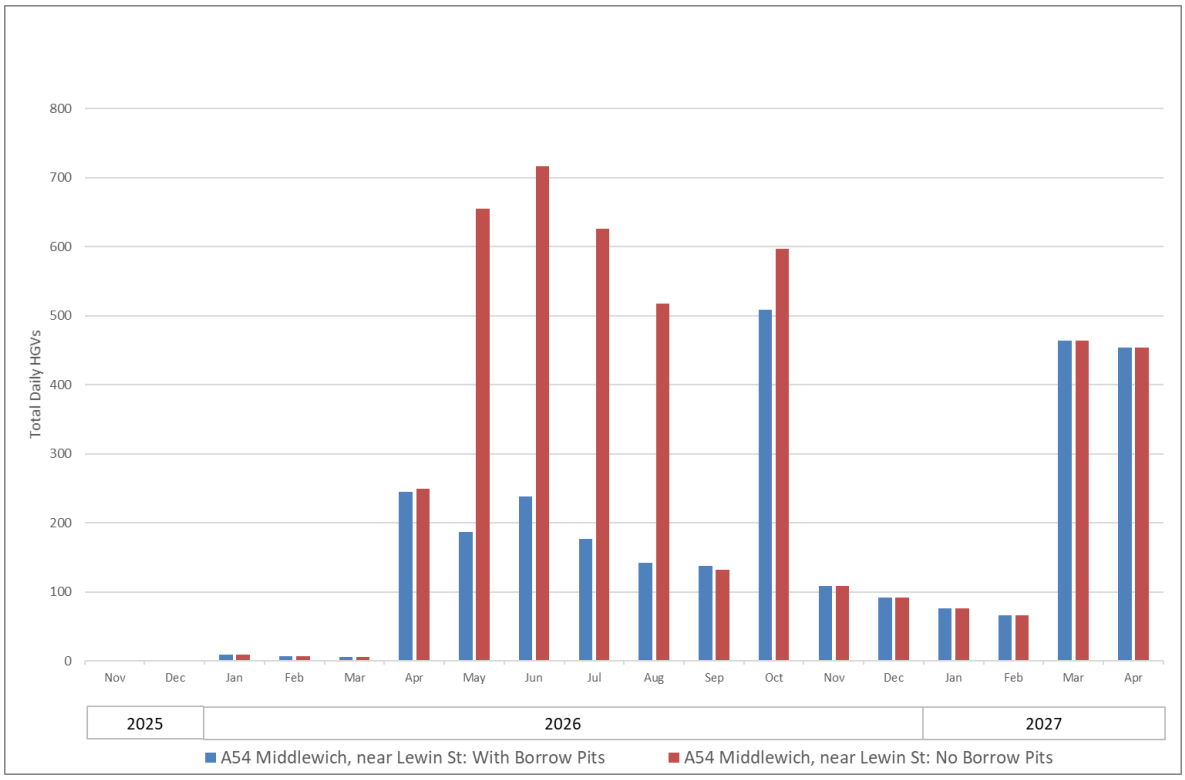


7.4.23 With the use of MA02 Borrow Pits A, B and C, the graph shows that the daily flow of HGV along A533 Northwich Road throughout the first year of construction, and until March 2027, would be less than 50 daily except for a brief peak of 400 HGV movements occurring in October 2026. The removal of MA02 Borrow Pits A, B and C would cause a ten-fold increase in HGV movements between May and July 2026 and would also result in a prolonged peak in HGV movements, which would occur on A533 Northwich Road over a six-month period during 2026.

The A54 Holmes Chapel Road in Middlewich, near Lewin Street

7.4.24 With the removal of MA02 Borrow Pits A, B and C, the overall peak HGV flows would increase to approximately 720 HGV per day, 35 HGV per hour in each direction, and would also extend peak HGV flow by four months. The pattern of construction traffic is shown in Figure 17.

Figure 17: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A54 Holmes Chapel Road



7.4.25 The peak in additional HGV movements resulting from removal of MA02 Borrow Pits A, B and C would occur between May and October 2026, with a brief pause in September and would affect the A54 Holmes Chapel Road, the A54 Kinderton Street, the A54 St. Michael's Way, the A530 Nantwich Road, the A530 Newton Bank, the A54 Chester Road, the A54 Middlewich Road and A533 Northwich Road.

7.4.26 If MA02 Borrow Pits A, B and C were removed, there would be a new prolonged peak in HGV movements occurring on the A54 Holmes Chapel Road through Middlewich. This larger and longer peak would commence five months earlier than would be the case if MA02 Borrow Pits A, B and C were used. The increase would result in HGV movements generated by the Proposed Scheme being up to three times those expected with MA02 Borrow Pits A, B and C being used during this period.

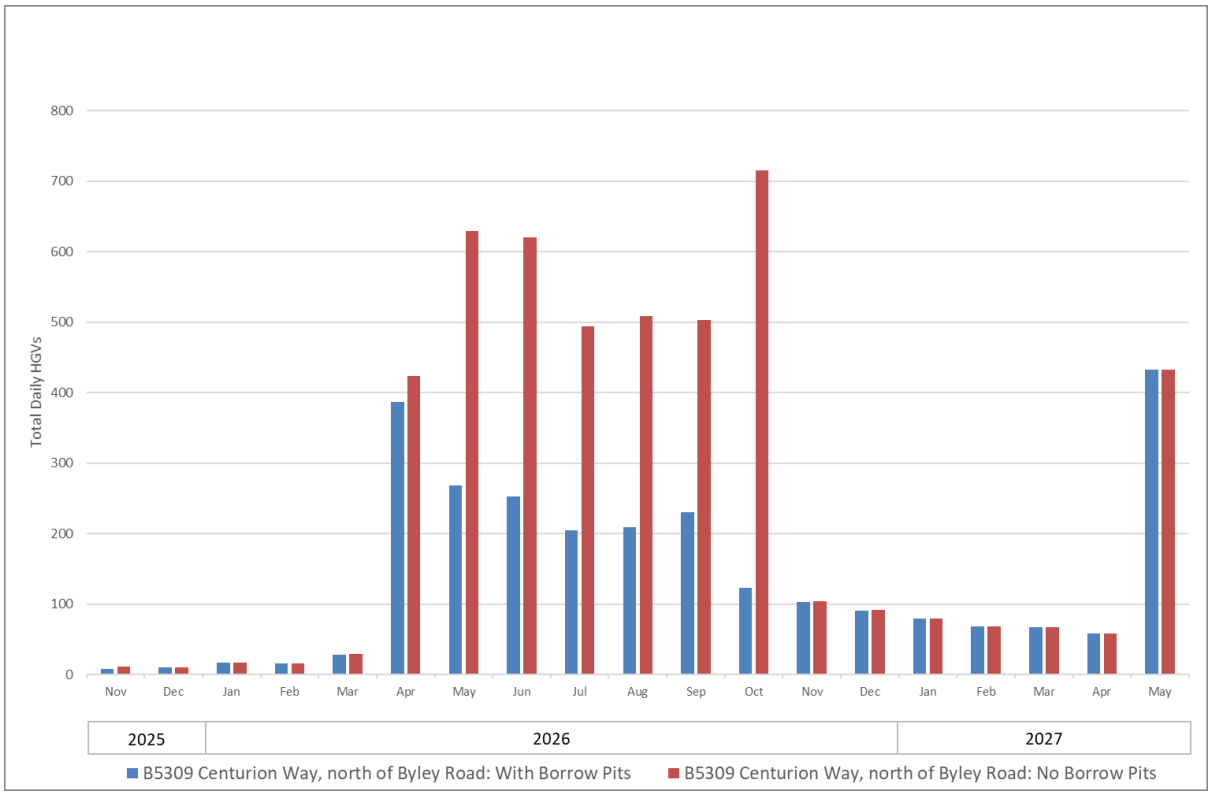
7.4.27 The majority of the import movements would take place between April and July 2026, with all other HGV activity occurring irrespective of the borrow pits as a result of other HS2 construction activity. A brief pause in HGV movements attributed to removal of MA02 Borrow Pits A, B and C, occurring in September 2026, is due to other construction activities.

B5309 Centurion Way, north of B5081 Byley Road

7.4.28 The removal of MA02 Borrow Pits A, B and C, would result in an increase in HGV flows in 2026, from less than 400 HGV daily to approximately 720 HGV per day. This would however have limited effect on roads such as the B5309 King Street and the Morrison's access

junction south of Gadbrook on A530 King Street. This pattern of construction traffic is shown in Figure 18.

Figure 18: Daily HGV flows with and without MA02 Borrow Pits A, B and C for B5309 Centurion Way



7.4.29 The peak in additional movements attributable to removal of MA02 Borrow Pits A, B and C would be greatest between May and October 2026 and would result in the peak in traffic during this period being approximately double that expected if MA02 Borrow Pits A, B and C are used.

7.4.30 If MA02 Borrow Pits A, B and C were removed, there would be a prolonged seven-month peak in HGV movements occurring on the public highway network over a year earlier than would be the case if MA02 Borrow Pits A, B and C were used.

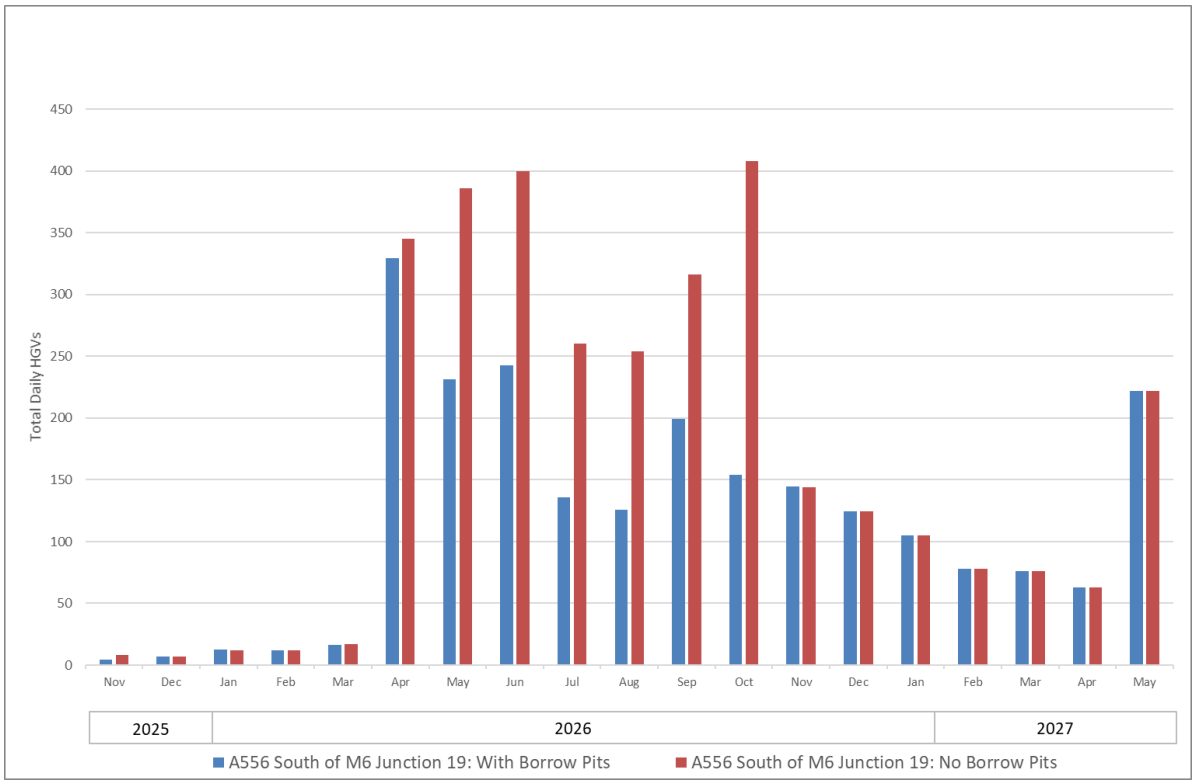
7.4.31 In particular, in October 2026 the highest additional HGV movements attributed to removal of MA02 Borrow Pits A, B and C would be approximately six times those which would occur with MA02 Borrow Pits A, B and C being used, as these roads form the main route for access to the Gadbrook (TN04), Rudheath (TN05) and Penny's Lane (TN06) transfer nodes.

The A556 Chester Road and A556 Shurlach Road, south of M6 junction 19

7.4.32 With the removal of MA02 Borrow Pits A, B and C, there would be an increase in traffic flows in mid-2026 to above 400 HGV per day, as the A556 Chester Road and the A556 Shurlach Road south of M6 junction 19 would form the alternative route for access to Gadbrook

Viaduct South Transfer Node (TN04), Rudheath Embankment Transfer Node (TN05) and Penny's Lane (TN06) transfer node. This pattern of construction traffic is shown in Figure 19.

Figure 19: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A556 Chester Road and A556 Shurlach Road



7.4.33 The additional HGV movements that would occur with removal of MA02 Borrow Pits A, B and C would be most significant between May and October 2026. If MA02 Borrow Pits A, B and C were removed, there would be a new prolonged seven-month peak in HGV movements occurring on the public highway network earlier than would be the case if MA02 Borrow Pits A, B and C were used.

7.4.34 In particular, daily HGV flows on the A556 Chester Road and the A556 Shurlach Road south of M6 junction 19 without MA02 Borrow Pits A, B and C would be almost trebled in October 2026, compared to expected HGV movements if MA02 Borrow Pits A, B and C were used.

Strategic road network

7.4.35 As well as adding HGV trips to the public highway network in the vicinity of the Proposed Scheme, the removal of MA02 Borrow Pits A, B and C would mean that these HGV trips would also use the strategic road network, including the M6.

Traffic assessment for the removal of MA02 Borrow Pit D

B5081 Byley Road

7.4.36 The impact of removing MA02 Borrow Pit D would be to change HGV routes to and from the transfer nodes such that they would no longer need to use the B5081 Byley Road. This would mean that the 460 HGV movements per day associated with the use of MA02 Borrow Pit D would no longer need to use the B5081 Byley Road.

West of the B5081 Byley Road/B5309 Centurion Way

7.4.37 Removal of MA02 Borrow Pit D would not change the Proposed Scheme's construction flow forecasts on the A54 Holmes Chapel Road west of the B5309 Centurion Way. This section would be used as the main route for construction material to access the A533 Bostock Road Transfer Node (TN03) with or without borrow pits.

The A530 King Street and B5309 Centurion Way, north of Middlewich

7.4.38 If MA02 Borrow Pit D is removed, this would not change construction flow forecasts on the A530 King Street to the north of the B5309 Centurion Way as this section would still be used for transporting construction materials for the Proposed Scheme with or without borrow pits.

A54 Holmes Chapel Road between B5081 Byley Road and M6 junction 18

7.4.39 If MA02 Borrow Pit D is removed, granular materials would have to be sourced and transported from quarries remote from the Proposed Scheme. Instead of using the B5081 Byley Road to access the transfer nodes, removal of MA02 Borrow Pit D would result in granular material being transported from quarries using the M6 junction 18 and the A54 Holmes Chapel Road to reach the required transfer nodes.

7.4.40 Without MA02 Borrow Pit D, HGV bringing material from quarries to TN02 would not use the A54 Holmes Chapel Road between B5081 Byley Road and the M6 junction 18 and would instead leave the M6 at junction 16 and then follow the A500 Newcastle Road, the A51 Nantwich Bypass and the A530 Nantwich Road route around the south and west side of Crewe.

Other locations

7.4.41 Removal of MA02 Borrow Pit D would have no overall impact on the number of construction traffic movements around TN02, the Crewe North RSD (north of B5076 Flowers Lane). HGV

bringing granular material to TN02 would route via the M6 junctions 18 and the M6 junction 16, and along the A500 Newcastle Road, the A51 Nantwich Bypass and the A530 Nantwich Road to access the Crewe RSD North Transfer node (TN02). Thus, with removal of MA02 Borrow Pit D, there would effectively be no change in HGV movements on the A530 Nantwich Road south of the Crewe North RSD as material to/from MA02 Borrow Pit D to the transfer nodes would still access from the strategic road network via the M6 junction 16 and then follow the same route.

7.4.42 The long detour to reach TN02 from the M6 junction 16 via the A500 Newcastle Road would be required due to enabling construction works activity on Clive Green Lane. Clive Green Lane will be realigned and upgraded as part of the Proposed Scheme and is not scheduled to be available to HGV construction traffic until the second half of 2028, which is after the period when granular material would be required. Clive Green Road's closure means that there would be no suitable alternative route to TN02 from the M6.

7.4.43 With removal of MA02 Borrow Pit D, there would be no change in construction flows on the A556 Chester Road and the A556 Shurlach Road to the south of M6 junction 19, unless this junction was used in preference to M6 junction 18 for the supply of granular material to Gadbrook Viaduct South Transfer Node (TN04), Rudheath Embankment Transfer Node (TN05) and Penny's Lane (TN06) transfer node. With quarries located mainly to the east of M6 junction 18, increases in flows on the A556 Chester Road and the A556 Shurlach Road south of M6 junction 19 would be limited and would occur prior to the overall peak period in construction movements occurring in 2028.

Strategic Road Network

7.4.44 Some HGV trips associated with the transport of granular material between MA02 Borrow Pit D and the Proposed Scheme would need to use the M6, particularly to access TN02. With the removal of MA02 Borrow Pit D, all material would be expected to access the Proposed Scheme via the routes shown in Figure 13, using the M6.

7.5 Summary

7.5.1 The removal of MA02 Borrow Pits A, B, C and D from the Proposed Scheme would significantly increase the journey length for acceptable engineering materials being brought to the Proposed Scheme as there would be a requirement to import large volumes of acceptable engineering materials from commercial quarries remote from the Proposed Scheme.

7.5.2 The removal of MA02 Borrow Pits A, B and C would require all movements of cohesive material to be transported by new HGV trips on the public highway network. The transfer of HGV trips to the public highway network would principally impact on the A54 Holmes Chapel Road, the A54 Kinderton Street and the A54 St. Michael's Way around Middlewich, as well as on the route from the M6 junction 16 along the A500 Newcastle Road, the A51 Nantwich Bypass and the A530 Nantwich Road to TN02. The majority of these additional HGV

movements attributed to removal of MA02 Borrow Pits A, B and C would take place between May and October 2026. Removal of MA02 Borrow Pits A, B and C would result in substantially prolonged peak HGV flows.

7.5.3 Removal of the MA02 Borrow Pit D would principally result in the removal of HGV from the B5081 Byley Road. This road is the only suitable route from MA02 Borrow Pit D to reach the construction routes via the A54 Holmes Chapel Road, the B5309 Centurion Way and the A530 King Street between the Proposed Scheme and the M6 junction 18. Removal of MA02 Borrow Pit D would result in 460 daily HGV trips being removed from the B5081 Byley Road, while there would be very limited effects on the public highway network around the Proposed Scheme as these routes will still be used for other construction related activities.

7.5.4 The excavated materials from construction works for the Crewe tunnel will be used for the restoration of MA02 Borrow Pits A, B and C. If MA02 Borrow Pits A, B and C are removed from the Proposed Scheme the excavated materials from the Crewe tunnel would need to be removed for possible disposal offsite. It is estimated that over 2,000 additional train paths would be required to remove the materials from the Crewe tunnel construction site. In addition, there would be a need to stockpile excavated materials at Crewe RSD which would cause adverse impacts on the construction programme.

8 Borrow pit operations

8.1 Introduction

8.1.1 The construction and operation of borrow pits will be bound by the commitments of the Environmental Minimum Requirements (EMR) and carried out in pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill and the draft Code of Construction Practice (CoCP) (see Volume 5, Appendix CT-002-00000), which sets out the measures required to mitigate noise, dust, traffic movements and other possible impacts on the surrounding land and communities (including working hours).

8.2 Survey and design

8.2.1 In order to inform both working arrangements and the development of the site specific restoration plans further surveys will be undertaken. They will typically will include:

- detailed topographic surveys;
- ground investigations, using boreholes and trial pits, to establish the quality, variability and depth of the ground conditions and to establish archaeological (geoarchaeological and palaeoenvironmental) potential of deposits;
- evaluation of the presence of soil contamination and, if necessary, ground investigation in order to confirm the full extent of any areas of contamination;
- specific hydrological and hydrogeological investigations using boreholes to establish the appropriate depth of extraction and any necessary mitigation; and
- baseline monitoring of groundwater and surface water levels and quality to establish baseline water quality; and where necessary further:
  - ALC surveys to determine the existing grade of agricultural land;
  - soil surveys to determine soil types and properties;
  - archaeology surveys including monitoring of GI works (boreholes) to establish archaeological potential of materials; and
  - further ecology and landscape surveys, of species, habitats and natural features.

8.3 Excavation

8.3.1 Material from the borrow pits will be excavated to meet the Proposed Scheme construction programme and in some cases, this may mean both excavation and restoration will be phased during construction, if this is reasonably practicable. Extracted material that is not the target material will be retained and stockpiled within the footprint of the source borrow pit to be used for backfill to restore the borrow pit to its former use.

8.3.2 Excavation of materials from the borrow pit is subject to approval of the local planning authority pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill.

8.3.3 Material excavated from elsewhere in the Proposed Scheme may have to arrive at the borrow pit location before it can be backfilled. In these cases, a temporary stockpile may need to be formed so that it can be backfilled as soon as possible and prepared for restoration. In addition, excavation may be phased by zones, where sufficient space has been retained adjacent to each zone for stockpiling backfill material until the zone is depleted.

8.3.4 Excavated materials will be handled in accordance with the DEFRA Construction Code of practice for the Sustainable Use of Soils on Construction Sites (2011).

8.3.5 During excavation, monitoring of water quality, flow and levels will be undertaken in order to determine the effectiveness of mitigation measures needed to limit pollution risk. Watercourses and/or groundwater receiving surface water runoff will be monitored to enable the effectiveness of treatment and other sustainable drainage systems measures to be determined and to ensure that an unacceptable rise in groundwater levels does not occur.

8.3.6 In general, the site set up and operational phase for the borrow pits to comprise the following:

- site set up with security fences, office compound and designated processing area;
- establishment of site haul routes to the land required for the construction of the Proposed Scheme;
- phased removal of topsoil, subsoil (where present), and storage in bunds around the perimeter of the site in order to provide screening from nearby residential properties or roads;
- phased extraction of useable mineral using plant and transfer to processing area[8];
- the hydrogeological regimes at the selected borrow pit sites are uncertain at this stage but the need for groundwater control during borrow pit excavation has been assumed;
- where agreed, dewatering of the borrow pit, or extraction through water and provision of settling ponds for silted water;
- screening and/or processing of extracted material to separate the fraction of material that meets the specification for acceptable engineering materials;
- transfer of acceptable engineering mineral to the area of need on the Proposed Scheme; and
- reuse non-conforming material from screening as backfill to worked-out areas.

[8] The borrow pits may be extracted and backfilled in zones. This will avoid the unnecessary storage of material.

8.3.7 An outline programme for the operation and restoration of the borrow pits can be seen in the Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02) Section 2.

9 Restoration strategy

9.1 Introduction

9.1.0 The purpose of this section is to set out the principles for restoration and aftercare of land following excavation of the borrow pits, in order to provide assurance to the regulatory bodies, landowners and the affected local community that the restoration proposals are practically achievable. The strategy reflects good practice as applied to minerals extraction and restoration and is in line with relevant minerals policy guidance and has been developed with regard to the national and local mineral planning policies outlined in Section 4.

9.1.1 The standards that will be applied to the excavation, restoration and aftercare of the selected borrow pits are comparable to those which the regulatory bodies would expect to apply to a commercial mineral operation. Further details concerning the planning and implementation of restoration and aftercare will be developed during detailed design. The site specific restoration plans will be developed in accordance with the principles outlined in this strategy.

9.1.2 The restoration of borrow pits will be bound by the commitments of the Environmental Minimum Requirements (EMR) and carried out pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill and the draft CoCP (see Volume 5, Appendix CT-002-00000), which sets out the measures required to mitigate noise, dust, traffic movements and other possible impacts on the surrounding land and communities (including working hours).

9.2 Restoration objectives and design principles

9.2.1 The overarching objectives of the strategy for the restoration and aftercare of borrow pits are to:

- post-excavation, restore land to a condition suitable for its original use;
- maximise the reuse of materials arising from the construction of the Proposed Scheme in the restoration process, which will reduce the disposal of materials to landfill; and
- provide essential mitigation for identified local environmental effects that occur as a consequence of the use of the borrow pits.

9.2.2 The following design principles apply to the borrow pits and the strategy:

- the borrow pits will be backfilled using natural, uncontaminated material from Proposed Scheme excavations and restored using subsoil and topsoil stripped and stored from the site of the borrow pit and, if required, from other areas of the Proposed Scheme;
- it is intended that the borrow pits will be restored to the original ground level and to a condition suitable for their previous land use;

- where agricultural uses are to be resumed on land used for borrow pits, the objective will be to avoid reductions in long-term capability which would downgrade the quality of the disturbed land, through the adoption of good practice in handling, storing and reinstating soils to provide a sufficiently deep soil profile;
- there is currently limited GI data from the selected borrow pit sites and therefore the area, volume and suitability of cohesive and granular material extracted will be refined as the design develops and site-specific GI data becomes available; and
- it is anticipated that there will be no requirement to import additional materials from outside the Proposed Scheme for backfilling of the borrow pits.

9.2.3 In order to inform both the working arrangements and the development of site specific restoration plans, further surveys will need to be undertaken at each of the selected borrow pit sites, including:

- detailed topographic surveys;
- site specific GI using boreholes and trial pits to establish the quality (including soil contamination assessment), variability and depth of materials and establish the local hydrological and hydrogeological regime;
- additional ALC surveys to assess the soil types, grade and properties in detail; and
- additional archaeological, ecology and landscape surveys (where required).

9.3 Restoration

9.3.1 It is proposed that the four selected borrow pits will be made available to be returned to their original land use, which is agricultural. Other engineering uses, such as balancing ponds or access tracks, as necessary, may be required for the selected borrow pits, in particular for the granular borrow pit, MA02 Borrow Pit D.

9.3.2 The materials proposed for use as backfill for the four selected borrow pits are anticipated to be predominantly cohesive material. There may also be a need for granular material to be added as part of mitigation works during restoration, for example, to create gravel drains or drainage layers. These will be confirmed during detailed design.

9.3.3 MA02 Borrow Pits A, B and C will be restored using materials sourced wholly from the construction associated with the Crewe tunnel. MA02 Borrow Pit D restoration materials will be sourced from a variety of sources within the Proposed Scheme.

9.3.4 Table 16 provides a summary of material sources that would be used for the restoration of the MA02 Borrow Pits A, B, C and D.

Table 16: Source of materials for the restoration of MA02 Borrow Pits A, B, C and D

Borrow pit	Material source (Community Area)	Total volume (m^3)	Transportation method
A	Crewe tunnel (MA01)	272,000	Materials will be transported using conveyor from the source to the borrow pit locations.
B	Crewe tunnel (MA01)	210,000	
C	Crewe tunnel (MA01)	224,000	
D	**Total demand (MA03 to MA08)**	**881,356**	All materials from these locations will be transported to MA02 Borrow Pit D via the public highway network. The average distance from the source location to MA02 Borrow Pit D for materials used in the restoration of MA02 Borrow Pit D is approximately 12km.
	Hoo Green North cutting (MA03)	186,642	
	High Legh cutting (MA03)	106,684	
	M56 West overbridge (MA03)	8,663	
	Agden Cutting (MA03)	84,659	
	Halebank Cutting (MA06)	81,418	
	Altrincham Road ventilation and intervention shaft (Vent Shaft) (MA07)	13,836	
	Palatine Road vent shaft (MA07)	31,535	
	Wilmslow Road vent shaft (MA07)	31,052	
	Birchfield Road vent shaft (MA07)	22,625	
	Manchester Airport cutting (MA06)	32,361	
	Rostherne cutting (MA06)	62,289	
	Highways cut, Ashley (MA06)	174	
	Highways cuts, Mobberley Road (MA06)	730	
	Highways cuts, Thorns Green (MA06)	232	
	Highways cuts, Manchester Airport High Speed station (MA06)	3,236	
	Manchester tunnel south portal (MA06)	215,220	

9.3.5 Subject to agreement with landowners and the local planning authority, the restoration will, as a minimum, include:

- backfilling with clean inert fill using excavated materials arising from Proposed Scheme earthworks (e.g. cuttings) and compaction in accordance with the required earthworks specification for restoration;
- reinstatement with subsoil and topsoil (stored on site at commencement of works) to the same levels as prior to commencement, unless otherwise agreed;
- provision of site drainage within and surrounding the borrow pits, as needed;
- reinstatement of hedgerows, PRoW removed during excavation; and
- restore the land to its former use as agricultural, unless otherwise agreed.

9.3.6 Table 17 sets out the outline approach to the restoration of the selected borrow pits proposed for the construction of the Proposed Scheme. The backfill specification will be developed at detailed design stage and will require the testing of materials prior to placement to confirm material properties and placement requirements. In addition,

verification testing of the as-placed material may be required to confirm the quality of the end-product.

Table 17: Approach to restoration of MA02 Borrow Pits A, B, C and D

Borrow pit name	Materials used for backfill	Source of backfill materials	End state use
MA02 Borrow Pit A	Mercia Mudstones (unacceptable as engineering fill) combined with mixed formations from the tunnelling processes	Excavated material from Crewe tunnel and shaft excavations	Return to original use (agricultural)
MA02 Borrow Pit B	Mercia Mudstones (unacceptable as engineering fill) combined with mixed formations from the tunnelling processes	Excavated material from Crewe tunnel and shaft excavations	Return to original use (agricultural)
MA02 Borrow Pit C	Mercia Mudstones (unacceptable as engineering fill) combined with mixed formations from the tunnelling processes	Excavated material from Crewe tunnel and shaft excavations	Return to original use (agricultural)
MA02 Borrow Pit D	Predominantly Mercia Mudstone material from cuttings combined with materials generated from the tunnelling processes	Excavated material, principally from Hoo Green cutting, Manchester Airport cutting and Manchester tunnel south portal	Return to original use (agricultural)

9.3.7 Generally, backfill will be placed in an appropriate way and differential settlement is not expected to be a concern for the restored borrow pits. However, during detailed design, further consideration will be given to differential settlement as a result of varying depths of excavation and backfill in different zones and interfaces between the backfill and other engineering features, such as utilities or drainage systems.

9.3.8 On restoration, existing baseflow and catchment runoff characteristics will be maintained for surface water features, where present. Similarly the groundwater regime will maintain baseflow connectivity with the surface water regime. This will be achieved through appropriately designed drainage systems to control groundwater levels to sustain groundwater baseflow to nearby watercourses. Groundwater and surface water levels, flow and quality will be managed in accordance with the measures described in the draft CoCP.

9.3.9 GI and environmental monitoring data will be used to inform the site specific restoration plans, which may require integrated surface water and groundwater drainage systems. These will be prepared in consultation with the Environment Agency. Post restoration monitoring would be used to confirm the groundwater levels and flows and whether additional drainage mitigation may be required.

9.4 Aftercare and monitoring

9.4.1 An aftercare plan will be set out in the site specific restoration plan for each borrow pit. An extended period may apply where ecological mitigation has been provided, or for land restored to agriculture where is agreed with landowners or occupiers.

9.4.2 The preparation of aftercare plans will be undertaken by HS2 Ltd or the nominated undertaker, in consultation with the local planning authority, the Environment Agency and affected landowners. The method of aftercare delivery at the borrow pits will be determined on an individual basis reflecting land use at each location.

9.4.3 It is anticipated that there will be a period of monitoring of the success of restoration and aftercare works. A process for agreeing the satisfactory completion of each year's works prior to commencement of the subsequent year of aftercare will be set out in the site specific restoration plans whilst the exact nature and extent of monitoring will be agreed with the local planning authority, the Environment Agency and affected landowners, it will include monitoring newly created habitats.

9.4.4 In respect of restored agricultural land where the temporarily displaced soils have been reinstated and supplemented with any surplus soils from elsewhere in the Proposed Scheme, soil drainage and moisture retention will be monitored after the five year aftercare period to ensure that the potential and desired soil profile characteristics have been achieved.

10 Conclusions

10.1.1 The natural bedrock geology within the MA02 area is known to contain halite (salt) deposits. It is documented that localised ground subsidence can occur as a result of the dissolution of salt deposits through the movement and flow of groundwater within the bedrock. As a result, the alignment of the Proposed Scheme within the MA02 area has been designed to be located on structural embankments to avoid the need to excavate within the bedrock geology.

10.1.2 A detailed assessment of the quantities and types of (site won) materials that will be available (approximately 6 million m^3) and the quantities of materials required (approximately 10 million m^3) for construction of the Proposed Scheme has been undertaken. This has shown that there will be a substantial deficit (approximately 4 million m^3) of acceptable engineering material needed for the construction of the Proposed Scheme.

10.1.3 There is a requirement to source acceptable engineering materials from commercial quarries and from borrow pits to meet the full demand for acceptable engineering materials (both cohesive and granular) for the construction of the Proposed Scheme. Commercial quarries alone will not be able to provide the required quantities of high quality engineering materials for construction of the Proposed Scheme (assessed as being approximately 2.4 million m^3).

10.1.4 A list of potential cohesive and granular borrow pit locations was initially appraised against a set criteria and methodology to establish a shortlist of potential borrow pits locations that could provide the quantity, quality and blend of acceptable engineering fills required (assessed as being approximately 1.6 million m^3).

10.1.5 The shortlist of potential cohesive and granular locations was further assessed against defined criteria including the potential material quantities (quality and type), construction logistics, traffic impacts and environmental constraints. From this appraisal, a final list of three cohesive and one granular borrow pit locations were selected as follows:

- cohesive - MA02 Borrow Pit A, located immediately to the east of the route of the Proposed Scheme, immediately west of the A530 Nantwich Road and to the south of Wimboldsley (see Volume 2: MA02 Map Book, map CT-05-308b, G9 to J8);
- cohesive - MA02 Borrow Pit B, located immediately to the east of the route of the Proposed Scheme, west of the A530 Nantwich Road and north of Wimboldsley (see Volume 2: MA02 Map Book, map CT-05-309, D6 to H7);
- cohesive - MA02 Borrow Pit C, located immediately to the east of the route of the Proposed Scheme, west of Coalpit Lane and north of Yew-Tree Farm (see Volume 2: MA02 Map Book, map CT-05-310, F7 to I9); and
- granular - MA02 Borrow Pit D, located 4.5km to the east of the route of the Proposed Scheme, north of Moss Lane and immediately west of the M6 (see Volume 2: MA02 Map Book, map CT-05-312-R5, E10 to G2 to J6).

10.1.6 The key factors that informed the final selection of the MA02 Borrow Pits A, B and C were their location within the land required for construction of the Proposed Scheme and their capability to provide the required quantity of acceptable engineering materials for construction of the Proposed Scheme within MA02 (conservatively assessed as being a maximum of up to 706,000 m^3). This will enable the cohesive materials to be extracted and reused with no transport impacts to the public highway network.

10.1.7 MA02 Borrow Pit D was taken forward into the Proposed Scheme (refer to Volume 2, MA02 Map Book, map CT-05-312-R5, E10 to J6) as the available geotechnical information at the time of the appraisal indicated that the depth of acceptable engineering material would likely be greater at this location and is assumed to provide sufficient material to construct the Proposed Scheme in this area. Further, MA02 Borrow Pit D will require less agricultural land, will have less potential air quality, noise and visual impacts whilst material is being extracted from the borrow pit. However, this option will require land from, and have greater setting impacts on, the scheduled moments at RAF Cranage former World War II airfield, and greater construction traffic impacts due to a slightly longer construction traffic route.

10.1.8 The removal of MA02 Borrow Pits A, B, C and D from the Proposed Scheme would significantly increase the journey length for acceptable engineering materials being brought to the Proposed Scheme as there would be a requirement to import large volumes of acceptable engineering materials from commercial quarries remote from the Proposed Scheme.

10.1.9 The removal of MA02 Borrow Pits A, B, C and D would substantially increase overall HGV vehicle distances travelled, with material needing to be imported from quarries located remote from the route, typically over more than 60km, and this would result in substantial increases in carbon emissions, estimated as being 21.6 million tonnes of CO_2. In addition, there would also be an estimated 13.9 million tonnes of CO_2 generated as a result of having to export the Crewe tunnel excavated materials for disposal by rail rather than being transported by conveyor to be used for the restoration of MA02 Borrow Pits A, B and C.

10.1.10 Site specific GI will assess the ground conditions at each of the proposed borrow pit locations. The GI will allow for a more accurate calculation of the volume, quality and suitability of materials to be sourced from the borrow pits and will also assess the engineering properties and hydrogeological regime at each location.

10.1.11 Construction, operation and restoration of the borrow pits will be bound by the commitments of the EMRs and carried out pursuant to the provisions for the discharge of deemed planning conditions in the hybrid Bill and the draft CoCP which sets out the measures required to mitigate noise, dust, traffic movements and other possible impacts on the surrounding land and communities (including working hours).

10.1.12 Material from MA02 Borrow Pits A, B, C and D will be excavated to meet the Proposed Scheme construction programme and in some cases, this may mean both excavation and restoration will be phased during construction, if this is reasonably practicable. Extracted material that is not the target material will be retained and stockpiled within the footprint of the source borrow pit to be used for backfill to restore the borrow pit to its former use.

10.1.13 MA02 Borrow Pits A, B and C will be restored using materials sourced wholly from the construction associated with the Crewe tunnel. MA02 Borrow Pit D restoration materials will be sourced from a variety of sources within the Proposed Scheme.

10.1.14 The overarching objectives of the strategy for the restoration and aftercare of borrow pits are to:

- restore land to a condition suitable for its original use, post-excavation;
- provide essential mitigation for local environmental effects that occur as a consequence of the use of the borrow pits; and
- maximise the reuse of materials arising from the construction of the Proposed Scheme in the restoration process, which will reduce the disposal of materials.

10.1.15 There will be a requirement to undertake a period of monitoring and aftercare to gauge the success of the restoration works. The exact nature and extent of the post restoration monitoring will be agreed with the local planning authority and the Environment Agency. The post restoration monitoring is expected to encompass soil drainage and moisture retention, newly created habitats, and the soil profile and characteristics of restored agricultural land.

10.1.16 Preliminary environmental surveys have been undertaken at the selected borrow pits sites for the purposes of the ES. In order to inform both the working arrangements and the development of site specific restoration plans, further site specific surveys will need to be undertaken at each of the selected borrow pit site locations, including:

- detailed topographic and hydrological (water feature) surveys;
- site specific intrusive GI using boreholes and trial pits to establish the quality (including soil contamination assessment), variability and depth of materials and, establish and monitor the local hydrological and hydrogeological regime;
- establish archaeological (geoarchaeological and palaeoenvironmental) potential of deposits through monitoring of the GI works;
- ALC surveys to assess the soil types, grade and properties in detail; and
- additional detailed archaeological, ecology and landscape surveys (where required).

Annex A – Stakeholder engagement

Table A 1: Dates of engagement meetings undertaken for borrow pits

Stakeholder	Date
Cheshire West and Chester Council Officers / Members	13 January 2020 4 November 2020
Cheshire East Council Officers / Members	4 February 2020 5 November 2020
Environment Agency, Natural England, Canal & River Trust, Forestry Commission, Historic England	26 February 2020
National Farmers Union	7 October 2020
Landowners	28 October 2020
Byley Parish Council	28 January 2021

Annex B – Additional figures

Figure B 1: Destination of materials from MA02 Borrow Pit A

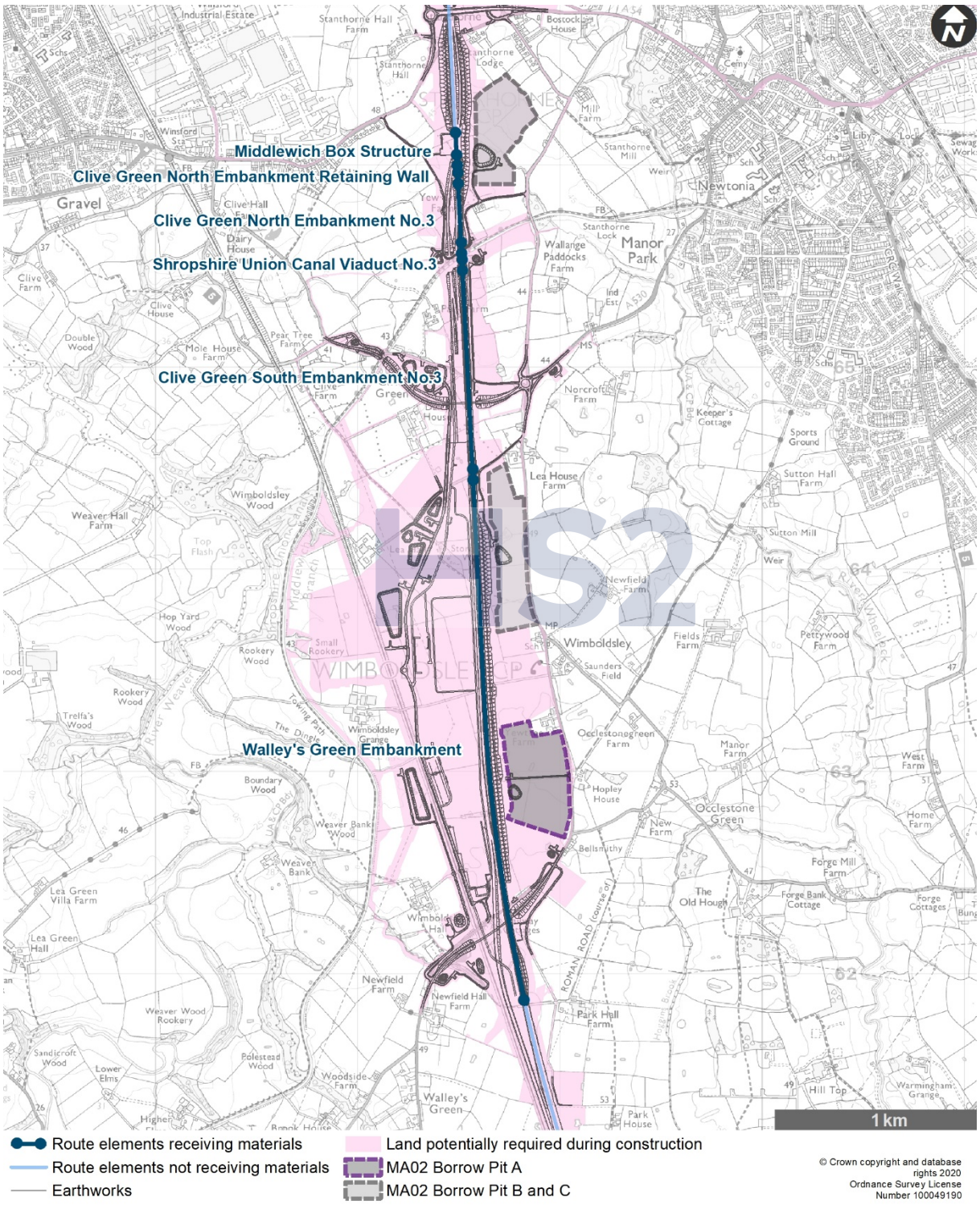


Figure B 2: Destination of materials from MA02 Borrow Pit B

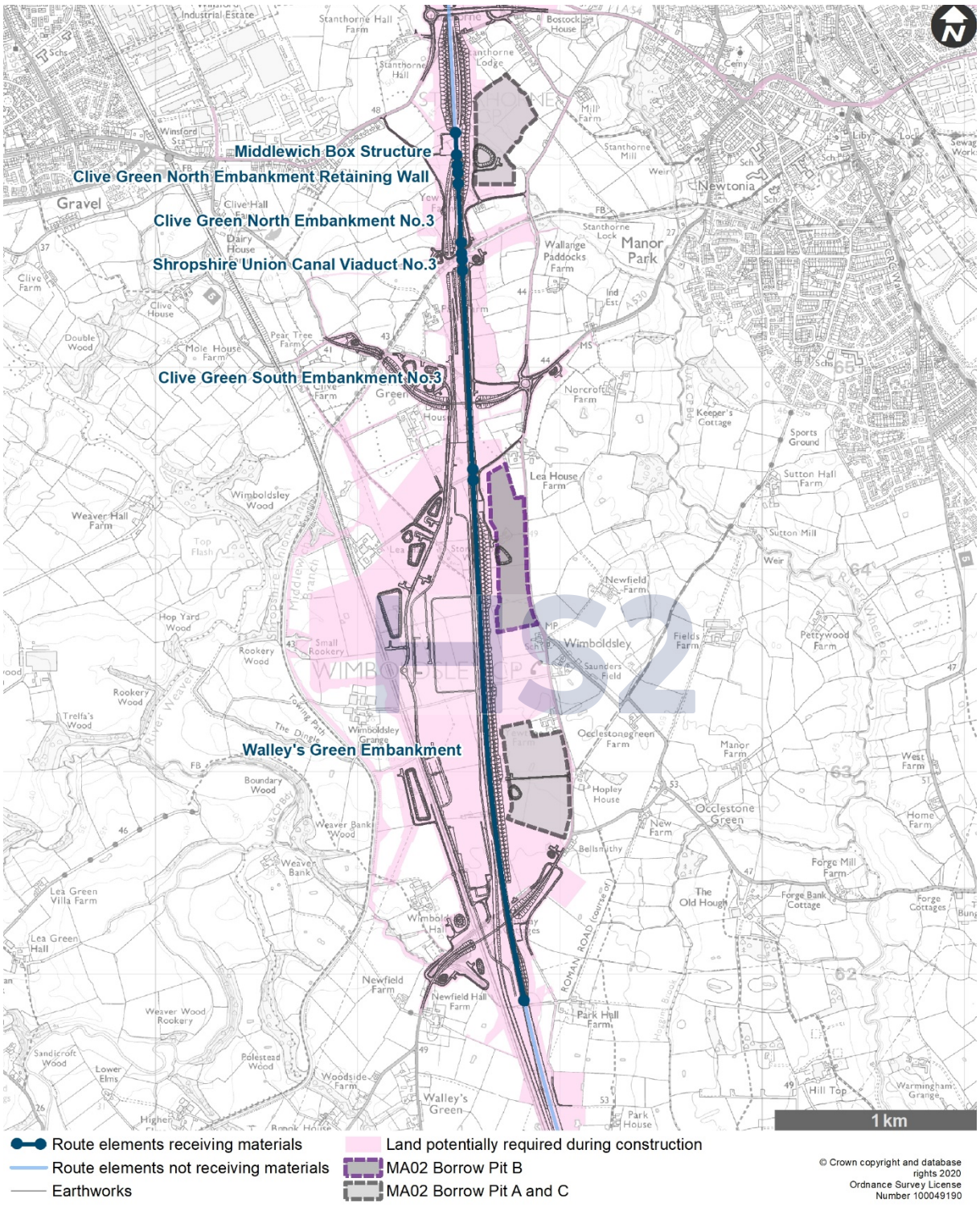


Figure B 3: Destination of materials from MA02 Borrow Pit C

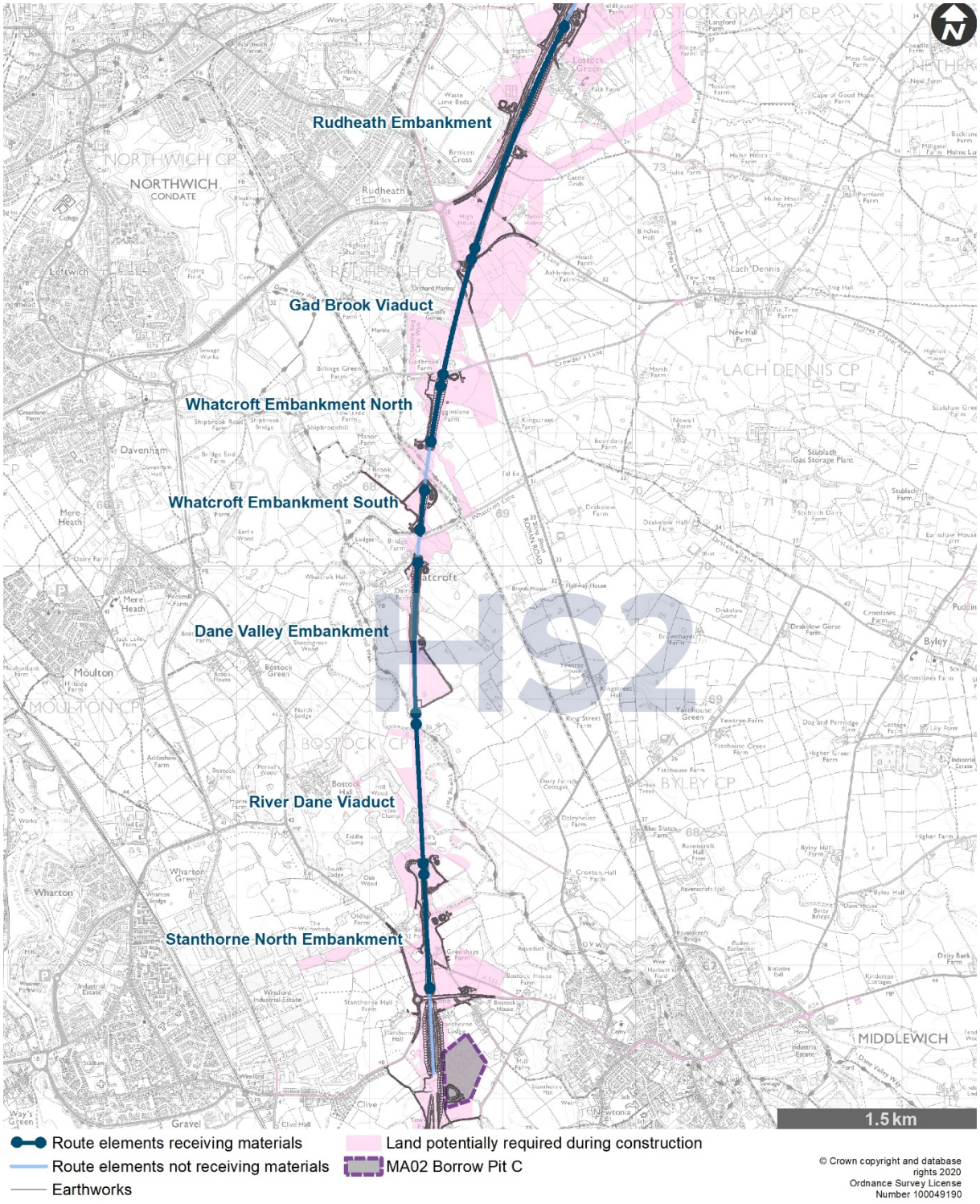
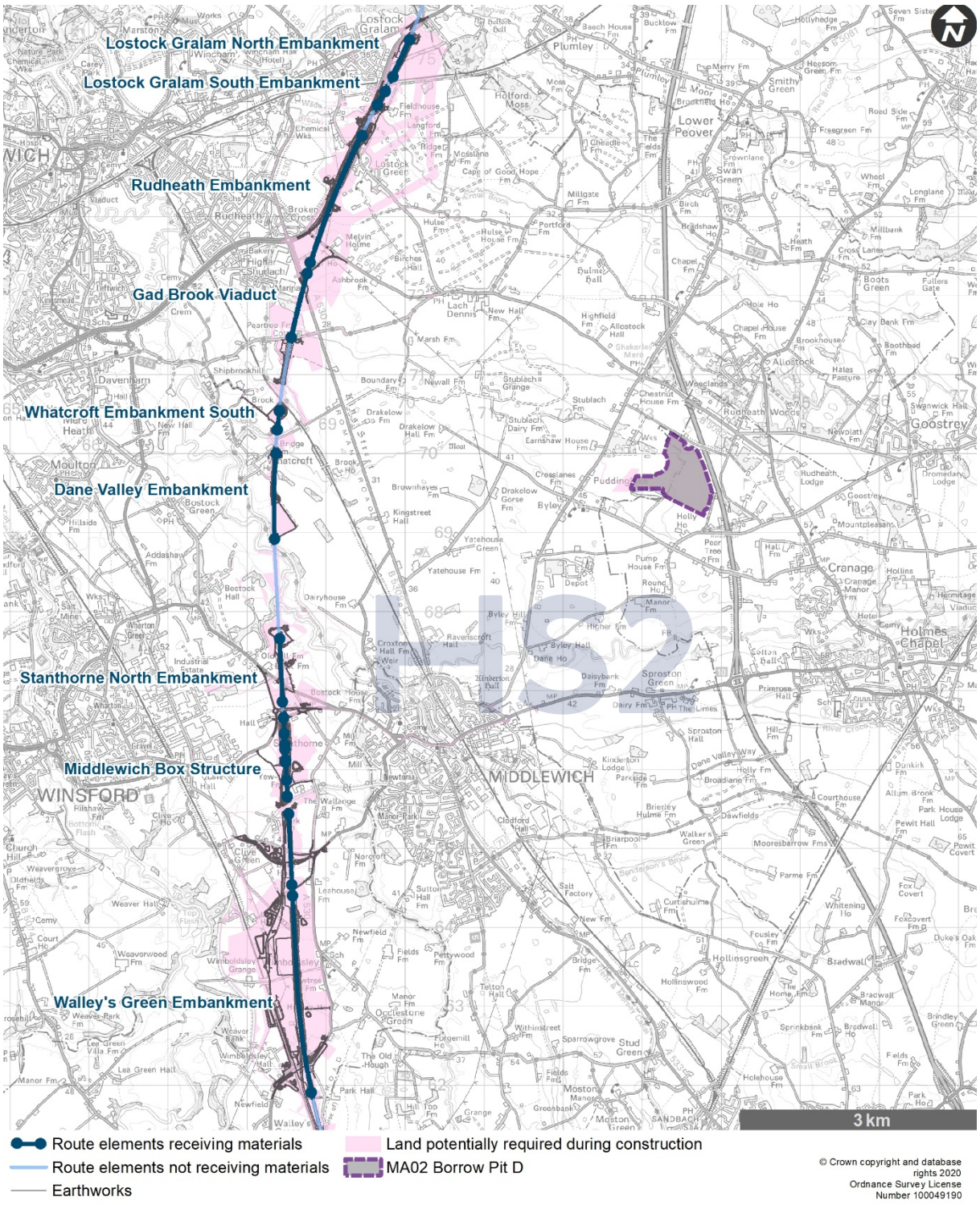


Figure B 4: Destination of materials from MA02 Borrow Pit D



Annex C – Transfer node assignments

Table C 1: Borrow pit transfer node assignments

Borrow pit name	Borrow pit compound name	Transfer node compound name	Environmental statement map reference
MA02 Borrow Pit A	MA02 Borrow Pit A Satellite Compound	Crewe RSD North transfer node for Walley's Green embankment (TN02)	CT-05-308a
MA02 Borrow Pit B	MA02 Borrow Pit B Satellite Compound	Crewe RSD North transfer mode for A54 Middlewich Road highway embankments (TN02)	CT-05-311
MA02 Borrow Pit C	MA02 Borrow Pit C Satellite Compound	A533 Bostock Road transfer node for Stanthorne North embankment (TN03)	CT-05-11-R1
MA02 Borrow Pit C	MA02 Borrow Pit C Satellite Compound	Gad Brook Viaduct South transfer node for Whatcroft embankment south, (TN04)	CT-05-313
MA02 Borrow Pit C	MA02 Borrow Pit C Satellite Compound	Rudheath embankment transfer node for Gad Brook Viaduct area highway embankments (TN05)	CT-05-314
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Crewe RSD North transfer node for Walley's Green embankment (TN02)	CT-05-308a
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	A533 Bostock Road transfer node for Clive Green North embankment (TN03)	CT-05-310
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	A533 Bostock Road transfer node for Middlewich box structure	CT-05-311
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	A533 Bostock Road transfer node for Stanthorne south embankment	CT-05-310
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	A533 Bostock Road transfer node for Stanthorne north embankment	CT-05-310
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Gad Brook Viaduct South transfer node for Gad Brook South Viaduct (TN04)	CT-05-313
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Gad Brook Viaduct South transfer node for Whatcroft embankment south	CT-05-313
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Gad Brook Viaduct South transfer node for Whatcroft embankment north	CT-05-313
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Rudheath embankment transfer node for Rudheath embankment (TN05)	CT-05-314
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Birches Lane transfer node for Lostock Gralam embankment south (TN07)	CT-05-315
MA02 Borrow Pit D	MA02 Borrow Pit D Satellite Compound	Lostock Gralam Viaduct transfer node for Lostock Gralam embankment north (TN08)	CT-05-315

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High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA
Freephone: 08081 434 434
Minicom: 08081 456 472
Email: HS2enquiries@hs2.org.uk