Cambridge Waste Water Treatment Plant Relocation Project
Anglian Water Services Limited

Appendix 3.4: Fine Screening Report

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MOTT MACDONALD

Cambridge Waste Water Treatment Plant Relocation

Stage 3 - Fine Screening Report

1 July 2020

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Stage 3 - Fine Screening Report

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S.3. The Initial Options Appraisal concluded that the preferred solution for the relocation of the Cambridge WWTP would comprise a single new WWTP, within a Study Area covering the existing Cambridge and Waterbeach drainage catchment areas.

S.4. The next steps in the process were Stage 1 – Initial Site Selection and Stage 2 – Coarse screening.

S.5. Stage 1 – Initial Site Selection comprised mapping constraints within the Study Area to identify a longlist of potential site areas to be taken forward for further site selection. The initial site selection identified 14 potential areas that could be utilised for the relocation of Cambridge WWTP based on the baseline constraints.

S.6. Stage 2 – Coarse Screening comprised the identification of a shortlist of site areas, using a comparison of the longlisted site areas based on their overall performance against a range of criteria. Each site area was assessed against the identified criteria using a red, amber and green (RAG) evaluation. Where site areas performed poorly compared to the other site areas these were removed from further assessment. A total of seven site areas were removed, resulting in a shortlist of seven remaining site areas, as shown in the Figure S.1.

S.7. As shown above, the seven shortlisted site areas are located in the northern section of the Study Area, north of the A14. Therefore, the southern section was removed from the site area selection process after Stage 2 – Coarse Screening.

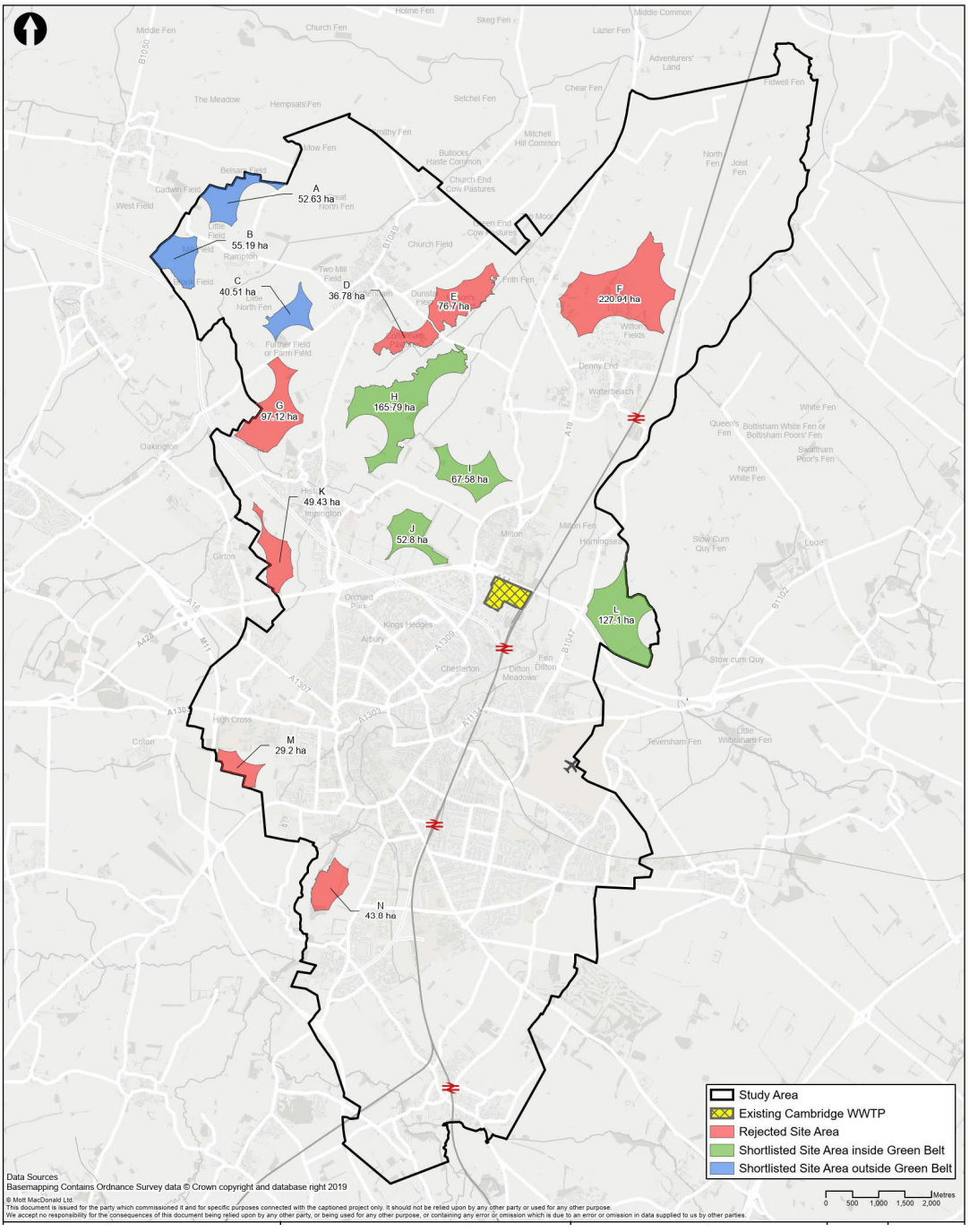
S.8. The Stage 3 – Fine Screening assessment of these shortlisted site areas is the next stage and the subject of this report.

S.9. The Fine Screening assessment has comprised.

- Development of infrastructure requirements for each of the shortlisted site areas, including:
  - Indicative WWTP position within each shortlisted site area
  - New private access roads between the adopted highway network and the new WWTP
  - Waste water transfer tunnel from the existing Cambridge WWTP to the new WWTP
  - Treated effluent and stormwater discharge pipeline taking treated flows from the new WWTP to the River Cam
  - Pipeline to transfer waste water flows from the Waterbeach drainage catchment to the new WWTP, and
  - Estimation of vehicle movements during both the construction and operation stages.
- Development of cost estimates for the waste water transfer infrastructure.
- A further assessment of operational, environmental, planning and community criteria using a RAG evaluation system, intended to provide a more detailed assessment of the site areas

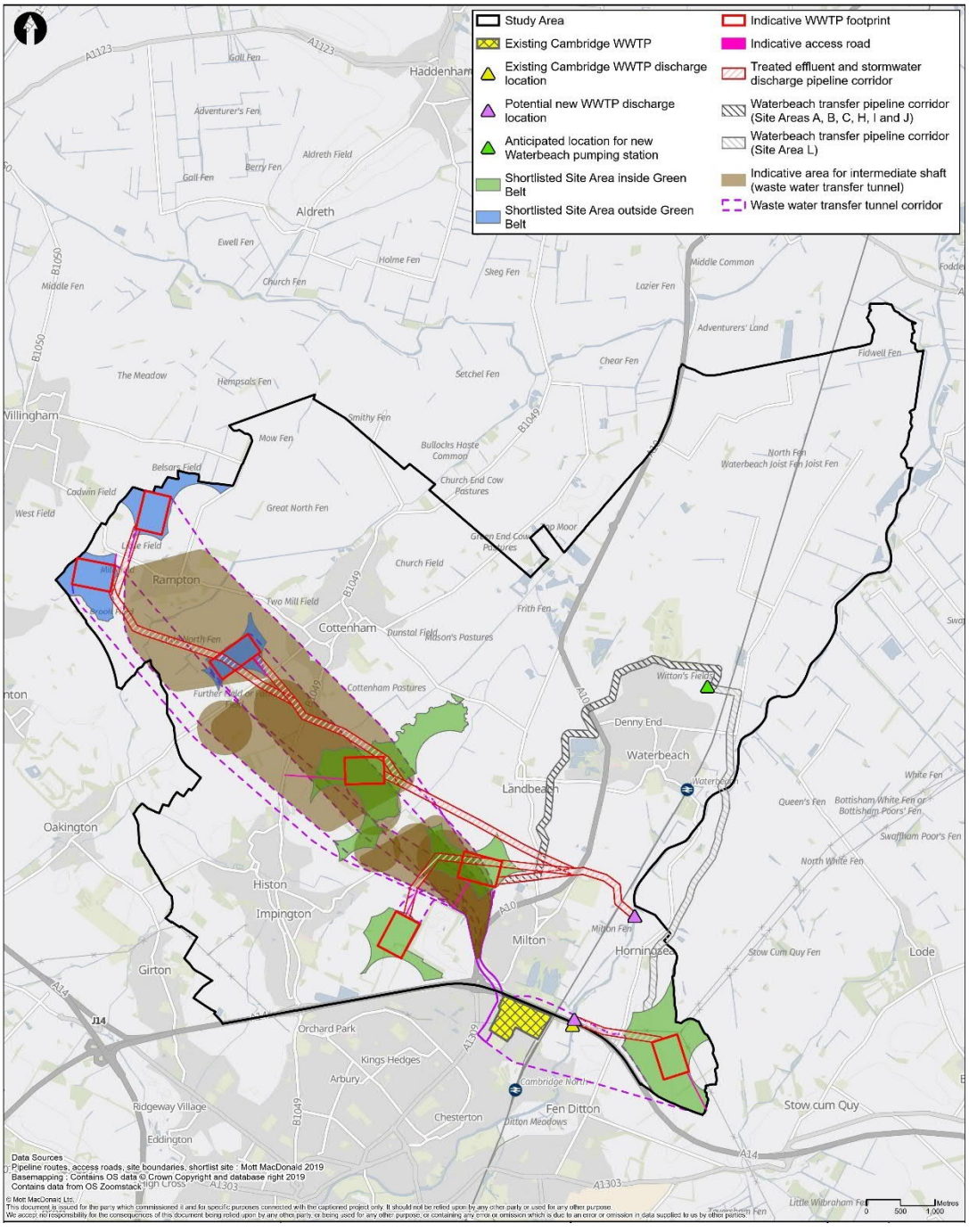
than previously undertaken during Stage 2 – Coarse Screening. Specific desk-top appraisals were recommended by stakeholders for landscape, nature conservation and biodiversity, archaeology and historic environment, and contaminated land to build on the assessments undertaken at Stage 2. These criteria are not considered to be of greater importance than other criteria assessed at Stage 3 but the desk-top appraisals were undertaken to provide sufficient information to inform the RAG assessment.

Figure S.1: Shortlisted site areas



S.10. The infrastructure requirements for all seven shortlisted site areas are shown in Figure S.2.

Figure S.2: Shortlisted site area infrastructure requirements



S.11. The infrastructure requirements for each of the seven shortlisted site areas were assessed against 14 RAG assessment criteria. A list of all the criteria assessed in Stage 3 – Fine Screening is shown in Table S.1.

Table S.1: Stage 3 – Fine Screening criteria

Category	Criteria Name	Objectives of Assessment
Operational	Ease of access	Assessment of suitability of road/interconnecting road access: particularly for Heavy Goods Vehicles/abnormal indivisible loads and sensitivity of access route
Economic	Affordability	Assessment of whether the development of a new WWTP would be achievable within the limits of the HIF funding allocation.
Environmental	Carbon emissions	Assessment of the whole-life carbon emissions for the transfer infrastructure for each of the shortlisted options, including tunnels, shafts, pipelines and pumps.
	Landscape and visual amenity	Assess whether there would be any impact on landscape context and visual amenity from the development of the options.
	Nature conservation and biodiversity	Assess the potential impact on designated sites, habitats and protected species.
	Historic environment	Identify the potential heritage risks and constraints.
	Contaminated land	Assess the potential sources of contamination within and in proximity to each shortlisted site area and assess potential risk of locating the WWTP development on contaminated land.
	Groundwater impacts	Assess the potential impact of the WWTP development and conveyance infrastructure (tunnel and shafts) on groundwater below the study area.
	Surface water impacts	Consider the extent to which impacts on Water Framework Directive (WFD) surface waterbodies identified at Stage 2 can be mitigated.
Planning	Green Belt	Assessment against Green Belt policy and guidance
	Risk to aviation	Assessment of the potential impacts of the WWTP development on aviation, in relation to proximity to Cambridge Airport.
Community	Non-traffic impact of construction on local communities	Assessment of potential impacts on communities in terms of noise, dust and disruption.
	Traffic impact of construction on local communities	Assessment of potential traffic impacts on communities in relation to congestion, air quality, noise and road safety
	Impact on Public Rights of Way	Assessment of potential impacts on public rights of way.

S.12. The screening assessment resulted in a RAG score for each site area against each of the assessment criteria. A relative comparison of the RAG evaluation for each site area was then used to identify the best performing site areas for further, more detailed, assessment and consultation and those that should be removed from any further consideration.

S.13. For the fine screening assessment of potential WWTP sites there are several criteria that are considered to be of greater importance than others. These criteria, in order of importance, are:

- Affordability
- Impact on local community
- Green Belt, and

- Carbon.

S.14. The main results of the comparison of the RAG assessments were.

- Overall site areas I, J and L performed better than all of the other site areas. This is mainly due to their proximity to the strategic road network and the existing WWTP (which reduces the length of wastewater transfer tunnels), when compared with all of the other site areas.
- The relatively short lengths of both the tunnel to each of the site areas and the return pipeline or tunnel to the River Cam are also significant factors in why site areas I, J and L perform better than the other site areas, particularly in the assessments for the affordability and carbon criteria.
- Development of a new WWTP at site areas I, J and L would be achievable, and include a saving, within the limits of the HIF funding, whereas, developing a new WWTP at site areas A, B and C would not be affordable within the limits of the HIF funding. Development at site area H would also be affordable within the HIF fund but would cost more than site areas I, J and L.
- The road transport routes for site areas I, J and L have a relatively low potential impact on local communities compared with those for site areas A, B, C and H.
- The closest site areas to the existing WWTP and the River Cam, i.e. I, J and L, had the lowest carbon emissions for waste water transfer infrastructure (tunnels, pipelines and pumping stations). In contrast, site areas A, B and C had the highest estimated carbon emissions, which were all more than 200% of the lowest estimated carbon emissions (site areas I, J and L).
- Site areas I, J, H and L are within the Green Belt, and as such 'very special circumstances' would need to be demonstrated to promote one of these site areas for development. Whereas, site areas A, B and C are outside of the Green Belt and therefore potentially more suitable for development of a WWTP in planning policy terms.
- Development at site areas A, B and C is considered to be unaffordable, would have a high risk of impacts on the local community and would result in higher carbon emissions. These factors are considered to outweigh the potential suitability in planning policy terms. As a result, it is considered that these site areas are not feasible options for development of a new WWTP.
- Although site areas H, I, J and L are all within the Green Belt, development of site area H presents a higher risk of impact on the local community, higher carbon emissions and greater risk of impact on a Principal Aquifer in comparison to site areas I, J and L.

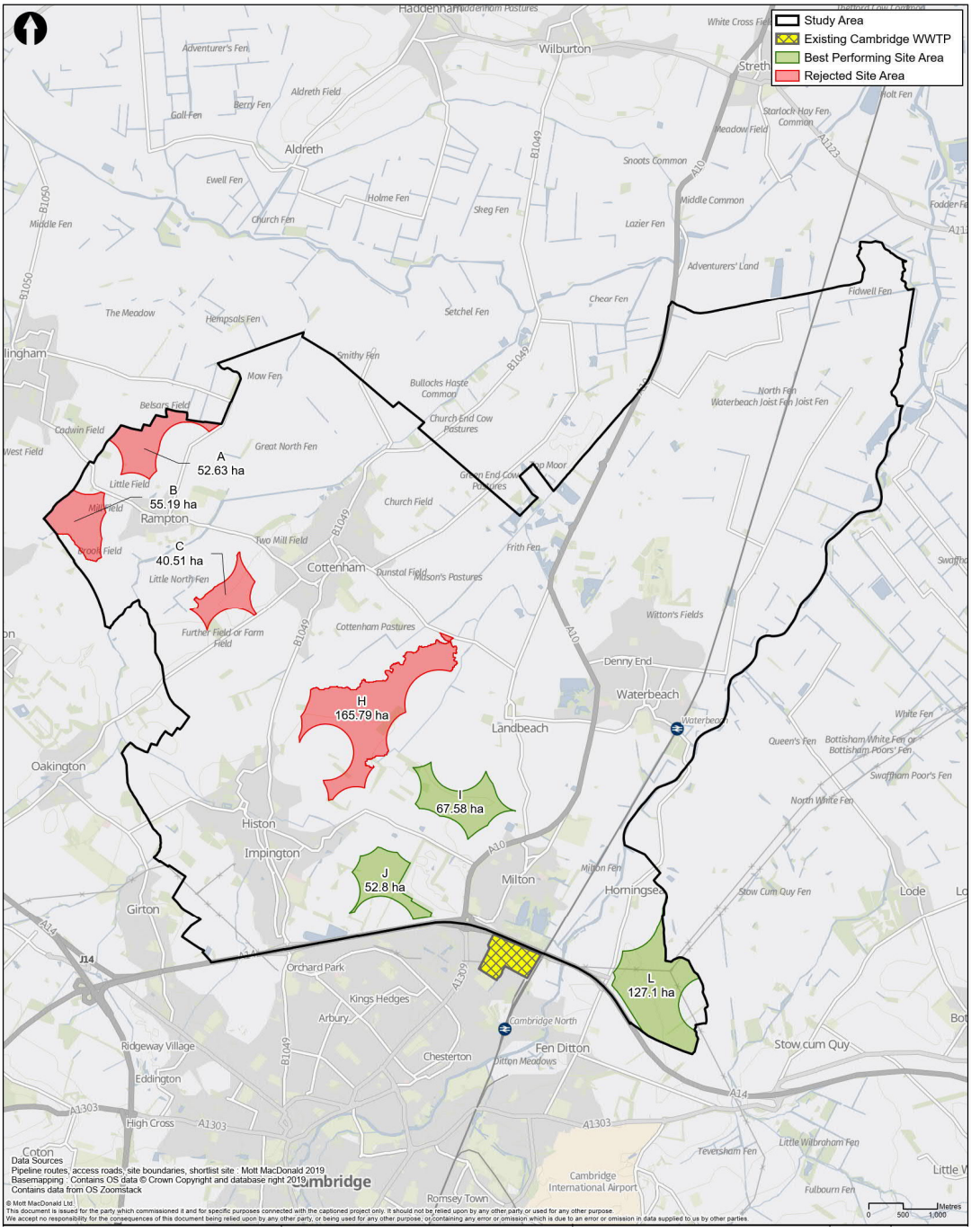
S.15. Based on these findings it is considered that site areas A, B, C and H are not suitable for further assessment.

S.16. Site areas I, J and L are the best performing site areas. It is considered that it is not possible to differentiate between the assessments for site areas I, J and L at the Fine Screening stage of the site selection. Site areas I and J perform marginally better than Site L, due to the proximity of site L to Cambridge Airport and sensitive watercourses. However, the proximity to Cambridge Airport relates to a consultation zone for structures above a certain height and may not result in any constraints being imposed on a WWTP at site area L. In addition, it is considered that the potential impacts on watercourses could be mitigated by readily available technical solutions, and it would therefore not be appropriate to discount site area L based on these criteria at this stage.

S.17. Therefore, it is considered that site areas I, J and L should be taken forward for the final stage of site selection and phase one consultation. A map illustrating the results of Stage 3 – Fine Screening is presented in Figure S.3.

S.18. Based on the conclusions of the Stage 3 – Fine Screening assessment it was deemed appropriate to carry out a back-checking exercise to confirm that there are no other potential site areas within the study area. This involved modifying the constraints and buffers used in the Stage 1 – Initial Site Selection constraints mapping exercise and assessing the additional and expanded site areas identified. The assessment demonstrated that relaxing the Stage 1 criteria would not produce any site areas that would perform equally to, or better than, site areas I, J and L.

Figure S.3: Stage 3 – Fine Screening results



1 Introduction

This section provides an introduction to the Stage 3 - Fine Screening Assessment (this report).

1.1 Background

1.1.1 A site selection process, comprising a number of detailed appraisal steps was developed to identify sites that may be suitable for the relocation of the waste water treatment plant to replace the existing Cambridge WWTP.

1.1.2 The first step was an Initial Options Appraisal, which examined the strategic issues to be considered in investigating relocation options, and also identified the most appropriate area in which to search for new WWTP sites (the Study Area).

1.1.1 The Initial Options Appraisal concluded that the preferred solution for the relocation of the Cambridge WWTP would comprise a single new WWTP, within a Study Area covering the existing Cambridge and Waterbeach drainage catchment areas (Mott MacDonald Ltd, Cambridge Waste Water Treatment Plant Relocation - Initial Options Appraisal, 2020a).

1.1.2 The next steps in the process were Stage 1 – Initial Site Selection and Stage 2 – Coarse screening.

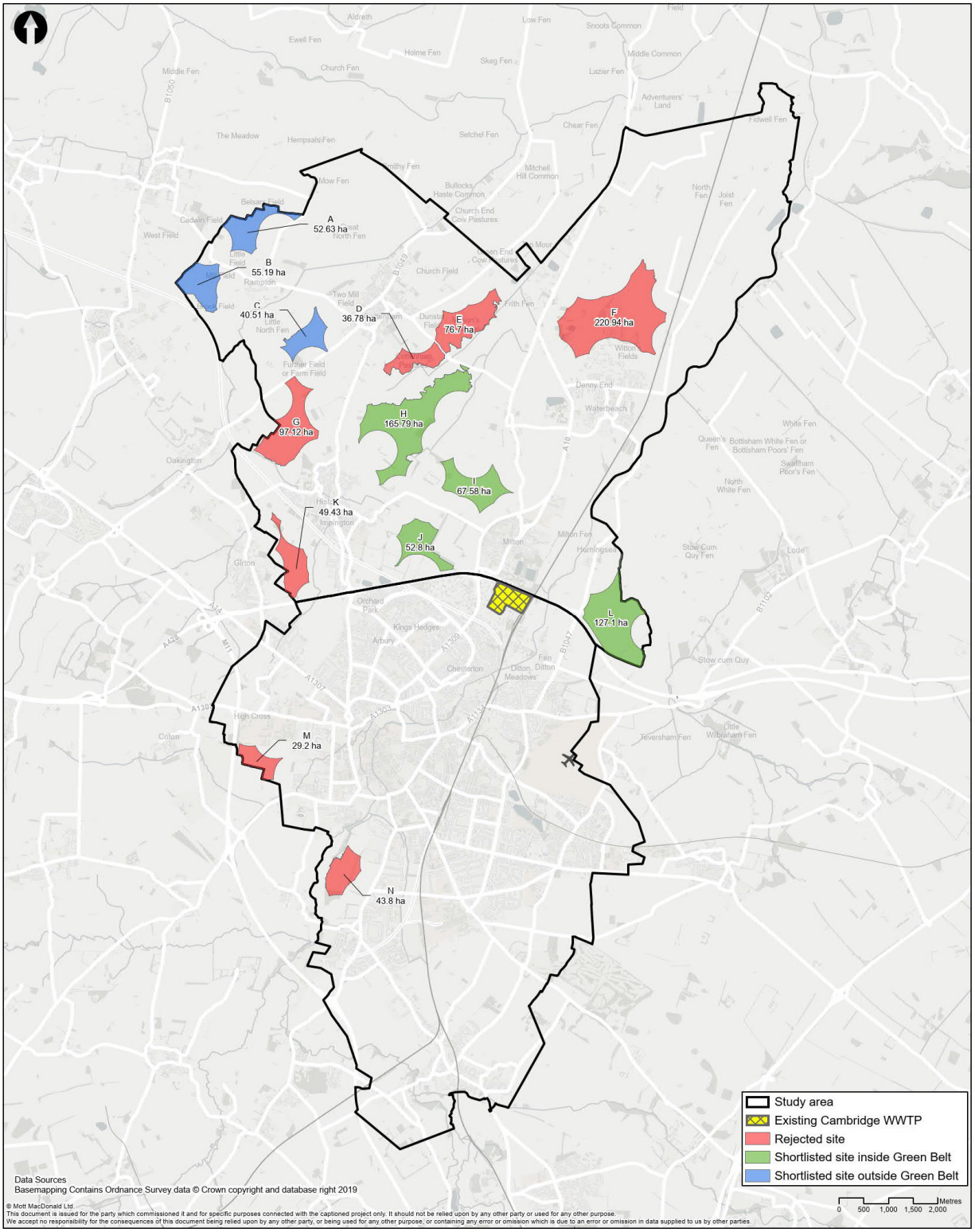
1.1.3 Stage 1 – Initial Site Selection comprised mapping constraints within the Study Area to identify a longlist of potential site areas to be taken forward for further site selection. The initial site selection identified 14 potential areas that could be utilised for the relocation of Cambridge WWTP based on the baseline constraints (Mott MacDonald Ltd, 2020b).

1.1.4 Stage 2 – Coarse Screening comprised the identification of a shortlist of site areas, using a comparison of the longlisted site areas based on their overall performance against a range of criteria (Mott MacDonald Ltd, 2020c). Each site area was assessed against the identified criteria using a red, amber and green (RAG) evaluation. Where site areas performed poorly compared to the other site areas these were removed from further assessment. A total of seven site areas were removed, resulting in a shortlist of seven remaining site areas.

1.1.5 A map of the shortlisted and removed site areas is shown in Figure 1.1, which shows that the seven shortlisted site areas are located in the northern section of the Study Area, north of the A14. Therefore, the southern section was removed from the site area selection process after Stage 2 – Coarse Screening.

1.1.6 Following completion of the Stage 2 – Coarse Screening and the identification of the shortlisted of site areas, Stage 3 – Fine Screening of the shortlisted site areas is required, which is the subject of this report. The Fine Screening assessment includes developing the infrastructure requirements for each of the shortlisted site areas (focussing largely on transfer infrastructure) and then assesses the site areas against specific criteria in order to identify the best performing site areas for the new WWTP within the study area.

Figure 1.1: Shortlisted site areas



2 Stage 3 – Fine Screening

2.1 Introduction

2.1.1 Following the completion of Stage 2 and the identification of a shortlist of site areas, a fine screening assessment of these site areas was required in order to identify the best performing site areas for developing a new WWTP.

2.1.2 The Stage 3 – Fine Screening assessment included the development of the infrastructure requirements for each of the shortlisted site areas, affordability estimates for a new WWTP at each site area, carbon emissions estimates for the waste water transfer infrastructure for each site area and a further assessment against planning, environmental and community criteria using a red, amber, green (RAG) scoring system.

2.2 Site infrastructure requirements

2.2.1 An indicative boundary for the WWTP was positioned within each of the shortlisted site areas that emerged from the Stage 2 – Coarse Screening assessment. In addition, the associated infrastructure that differed for each site area and hence could influence site selection was defined.

2.2.2 The following elements comprised the site infrastructure requirements for the Stage 3 – Fine Screening assessment and are described in this section.

- Indicative WWTP position within the shortlisted site areas
- New private access roads between the adopted highway network and the new WWTP
- Waste water transfer tunnel from the existing Cambridge WWTP to the new WWTP
- Treated effluent and stormwater discharge pipelines taking treated flows back to the River Cam
- Pipeline to transfer waste water flows from the Waterbeach drainage catchment to the new WWTP
- Estimation of construction and operation vehicle movements as well as transport routes to each site area from the strategic road network

2.2.3 For the purpose of Fine Screening, it was assumed that treated effluent and stormwater would be taken to the River Cam via two parallel buried pipelines as this represents the worst case in terms of surface disruption along the route. It is also possible that the treated effluent could be taken to the River Cam using a tunnel and this would be expected to have a smaller impact along the route. However, the choice between a pipeline or tunnel option was not considered to have a material effect on the differentiation between the site areas. The options for waste water transfer infrastructure will be developed further during subsequent design of the project.

2.2.4 A number of drawings have been prepared to illustrate the infrastructure requirements and these are provided in Appendix A. Drawing 409071-MMD-OO-XX-GIS-Y-0101 illustrates the site infrastructure requirements for all of the shortlisted site areas. Drawings of the requirements for each individual site area are provided in Drawings 409071-MMD-OO-XX-GIS-Y-0102 to 108.

WWTP site position

2.2.5 Anglian Water has confirmed that the size of the new WWTP is expected to be 22ha and would include the following treatment stages and facilities (Anglian Water, Cambridge Waste Water Treatment Plant Relocation Project, Statement of Requirement, 2019a).

- Inlet works
- Storm tanks
- Primary settlement tanks
- Aeration lanes
- Final settlement tanks
- Tertiary treatment
- Sludge treatment centre
- Power/HV substation

2.2.6 The selected processes accord with the outcome of the Initial Options Appraisal (Mott MacDonald Ltd, Cambridge Waste Water Treatment Plant Relocation - Initial Options Appraisal, 2020a) which concluded the optimal approach in technology selection was that of balancing energy use and footprint.

2.2.7 For the purposes of the RAG assessment we have selected a location for the WWTP within each site area, which is indicated by a rectangular footprint of 22ha. A similar shaped WWTP footprint has been used for all shortlisted site areas.

2.2.8 Various factors affecting the position and orientation of the WWTP site were taken into consideration when placing the indicative WWTP footprint within the shortlisted site areas. These included the following:

- Where possible, the orientation of the WWTP site was such that it would minimise the length of WWTP perimeter visible from neighbouring residential properties.
- Heights of treatment process units were considered with regard to potential visual impacts. For the Stage 3 – Fine Screening assessment, a conservative anaerobic digester tank height of 26m has been assumed (anaerobic digesters would be the highest structures on the WWTP[1]).
- Where possible the WWTP was positioned to maximise the distance from residential and conservation areas as well as protected and designated nature conservation and heritage sites.
- New developments that have planning approval or are under construction as well as allocated sites within local plans were also considered in order to ensure the WWTPs would be more than 400m from residential properties.
- WWTP site positioning and orientation also aimed to minimise impacts on any Public Rights of Way (PRoWs).
- Accessibility was also considered with respect to locating the WWTP in order to minimise the length of any new access road required between the WWTP and the existing road network.

2.2.9 The indicative WWTP positions are provided in Drawings 409071-MMD-OO-XX-GIS-Y-0109 to 409071-MMD-OO-XX-GIS-Y-0115 in Appendix A.

[1] The height of the sludge digester tanks has been derived based on AW's normal asset standards, specifically, the height to diameter ratio, the dry solids feed concentration (which dictates the total tank volume) and the number of tanks (which dictates the volume for each tank). It has also been assumed that the digester walls would be constructed entirely above ground to facilitate future maintenance.

Access roads

2.2.10 A high-level assessment was carried out to identify the likely location for new private access roads from the adopted highway network to the proposed location of the new WWTP within each of the shortlisted site areas.

2.2.11 The parameters considered were:

- Required length of new access road
- Route of new access road (e.g. land uses it would traverse)
- Preferred point of entry to the WWTP
- Suitability of connection to the existing road network
- Impacts on residents from road construction, and
- Travel duration for operational vehicles to access the WWTP

2.2.12 The indicative alignments for the new access roads are represented by 20m wide corridors. These corridors are used in the assessment of each of the shortlisted site areas. These are shown on the indicative WWTP position drawings 409071-MMD-OO-XX-GIS-Y-0109 to 409071-MMD-OO-XX-GIS-Y-0115.

Waste water transfer tunnel

2.2.13 An indicative tunnel corridor for each of the shortlisted site areas was also prepared as part of the fine screening assessment. This included the development of possible tunnel alignments within a route corridor.

Tunnel and shaft concept

Tunnel

2.2.14 A potential tunnel corridor has been developed for each of the shortlisted site areas which adopts the most direct route to each site area whilst taking into account technical limitations in tunnelling technology as well as avoiding various above and below ground constraints. The final tunnel route could therefore pass through any area inside the corridor. The width of the corridor reduces where obvious above or below ground obstacles occur.

2.2.15 A minimum finished tunnel diameter of 2.5m has been assumed, which is greater than the diameter of the existing tunnel that brings waste water from the centre of Cambridge to the existing WWTP and will provide capacity for growth. It has been assumed that both a primary and secondary lining would be required for tunnel sections passing through the Lower Greensand or Grey Chalk aquifers to protect the aquifer from the risk of waste water exfiltration. To accommodate the secondary lining, a minimum tunnel diameter of 3.0m (internal diameter of precast concrete segment tunnel lining – the primary lining) would be required. The secondary lining thickness would be confirmed during scheme design.

Shafts

2.2.16 Assumptions have also been made around the diameters and depths of the various shafts (drive, reception and intermediate shafts). The drive shaft for the tunnel (where the tunnel boring machine is inserted) would be located at the proposed WWTP for each shortlisted site area as tunnels are usually bored upgradient to reduce the risk of inundation of the tunnelling machine by groundwater. A minimum internal diameter of 12.5m has been assumed for the drive shaft and a minimum internal diameter of 7.5m has been assumed for the reception and intermediate shafts. Both these diameters are the internal diameter of the primary lining (which may be

precast concrete segments of secant piled walls). Where shafts pass through the Lower Greensand or Grey Chalk aquifers it is assumed that a secondary lining may be required.

2.2.17 For the purposes of comparison, shafts have been split into three types depending on the ground conditions expected. The factors used to differentiate between shafts are the amount of lining pressure, challenges of water management and methods during construction.

2.2.18 The three types of shaft are:

- Type 1: Shaft founded and within either the Gault Clay or Ampthill Clay only
- Type 2: Founded in Ampthill Clay, passing through the Lower Greensand Group or Grey Chalk Subgroup, and
- Type 3: Founded in the Lower Greensand Group or Grey Chalk Subgroup.

2.2.19 Table 2.1 provides the shaft lining types and thicknesses which are indicative only, with the aim to capture the additional construction challenges in the Lower Greensand Group or Grey Chalk Subgroup and to inform the cost and carbon emissions modelling.

Table 2.1: Shaft lining types

Minimum shaft diameter [m]	Lining Type	Segmental lining thickness	Secondary lining thickness	Notes
12.5	Type 1	0.35	N/A	No secondary lining assumed in clay only
	Type 2	0.35	0.50	
	Type 3	0.35	0.50	
7.5	Type 1	0.225	N/A	No secondary lining assumed in clay only
	Type 2	0.225	0.50	
	Type 3	0.225	0.50	

Source: Mott MacDonald

Assumptions and exclusions

2.2.20 Table 2.2 presents the assumptions that have been used for the development of the tunnel conceptual design and Table 2.3 presents items that have been excluded at this stage of the assessment.

Table 2.2: Tunnel concept assumptions

Topic	Assumption
Tunnel diameter	3m diameter assumed for the transfer tunnel. Excludes lining for sections passing through the aquifer.
Drive shaft diameter	Minimum 12.5m internal diameter
Reception shaft diameter	Minimum 7.5m internal diameter
Intermediate shaft diameter	Minimum 7.5m internal diameter
Reception shaft depth	17.3m
Distance between shafts	The maximum allowable distance between shafts has been assumed to be 3,000m and it has also been assumed that there will be no intermediate shaft within 1km of the drive or reception shafts.
Tunnel gradient	1:800 for all tunnel profiles
Intermediate shaft constraints	Areas for the intermediate shafts do not account for urban areas or other constraints which would be removed at later site selection stages.
Alignment corridor	400m buffer around alignments to provide corridor
Ground surface levels	Ground surface levels are based on Environment Agency (EA) open source Lidar data which contains public sector information licensed under the Open Government Licence v3.0.
Geological strata levels	Geological strata levels are indicative only and are based on extrapolation of historic boreholes and should not be relied upon for any purpose. Included to indicate possible interfaces and to enable comparison of options only.
Thickness of Lower Greensand	Thickness of Lower Greensand assumed to be 20m.
Depth below ground level to top of Lower Greensand Group	A 10m buffer has been applied in relation to the depth below ground level on the top of the Lower Greensand Group.
Depth below ground level to base of Grey Chalk Subgroup	A 10m buffer has been applied in relation to the depth below ground level on the base of the Grey Chalk Subgroup.
Location of drive and reception shafts	Corridors drawn assuming drive shaft within the indicative WWTP footprint for each shortlisted site area and reception shaft located at the existing tunnel upstream of the existing WWTP site. This is suitable for comparison only and does not constitute a designed location.
Shaft linings	At this stage, segmental shaft linings are assumed. These are assumed to be wet caisson through water bearing ground and either wet caisson or underpinned in the clays. Grouting may be required to control water inflows. Secondary linings may be required in types 2 and 3 shafts (see below) to manage leakage risks – this is to be confirmed depending on internal pressures and EA requirements.

Source: Mott MacDonald

Table 2.3: Tunnel concept exclusions

Topic	Exclusion
Surface area constraints	No information on listed buildings, sensitive or protected buildings/assets has been reviewed in the assessment of alignment corridors or potential shaft locations. Consideration of obvious surface obstacles has been given, but a detailed alignment study has not been completed at this stage.
Underground infrastructure	No information on underground infrastructure has been reviewed.
Reception shaft location	No consideration for angle of entry to shaft or actual shaft location within the current Cambridge City Council land.

Source: Mott MacDonald

Requirements for minimum tunnel diameters and intermediate shafts

2.2.21 Intermediate shafts are required for health and safety as well as operational purposes. It is current practice in the industry to account for health and safety issues in tunnel design. The Health and Safety Executive (HSE) in particular, holds the view that tunnel design should take into account the health and safety of works during both construction and operation. This is often

reflected in recommendations and decisions made around aspects of tunnelling projects such as minimum tunnel diameters and shafts (including intermediate shafts).

2.2.22 Larger tunnel diameters (3m or larger) have been recommended in recent years to allow sufficient space for a refuge within the tunnel boring machine (TBM) in case of smoke or fire between workers at the front of the TBM and the emergency access shaft. Although smaller tunnels have been built in the past: 100" (2.54 m, Thames Water Ring Main), or later 2.87 m, which allow space to stand to one side for a spoil train, emergency evacuation can be difficult in a small tunnel, particularly past muck cars and equipment.

2.2.23 There are also practical considerations determining tunnel diameter such as the ease of material supply, ventilation and spoil removal and also for operation. Difficulties also increase with the length of the tunnel drive.

2.2.24 There are therefore numerous inter-dependant considerations in selecting a tunnel diameter and although there is no official guidance set out clearly in terms of legal requirements, designers are required to size the tunnel in a way that accounts for safe construction and operation. This also falls under a designers' duty to comply with CDM regulations. Therefore, sufficient space in the tunnel as well as access to and from the tunnel are required.

2.2.25 There are various examples of past projects where the HSE has made recommendations on tunnel sizes. During construction of the London Power Tunnels, the HSE is reported to have carried out a visit on site and were highly critical of the 3m diameter tunnel. The HSE would have insisted on a larger diameter if the works had not already progressed as much as they had at the time of the visit.

2.2.26 It is expected that the British Standard for Health and Safety in Tunnelling (BS6164) which is currently under revision will clarify requirements for refuges and escape requirements. Although, there has not been any publication of an update of this standard to date, it is considered that examples from current practice suggest an increased importance placed on health and safety aspects for tunnelling projects. Design parameters such as tunnel diameter and the allowance for intermediate shafts have therefore been informed by these requirements.

2.2.27 Intermediate shafts will require acquisition of land for both a construction site and access during operation. The following information outlines the likely requirements for the shaft sites during construction and operation.

Tunnel alignments and shaft locations

2.2.28 Indicative tunnel corridors have been created for each of the shortlisted sites and are provided in Drawings 409071-MMD-OO-XX-GIS-Y-0146 to 0152. Indicative alignments have been drawn with a buffer applied to provide a corridor, the corridors narrow where there are obvious constraints. The corridors shown should not be used as the design corridor as further investigation is required. Table 4.4 provides the details of the indicative tunnel alignments to each of the shortlisted site areas.

Table 2.4: Indicative tunnel corridor details

Site area	Length of tunnel (km)	Number of intermediate shafts	Intermediate shaft type	Length of tunnel in a Principal Aquifer (km)	Number of geological transitions	Comments
A	9.1-9.7	3	1: Type 1 2: Type 3 3: Type 2	3-4	2	Several alignment options are available for site area A. For this reason, the corridor is broader than the alignments to the other site areas.
B	9.0	2	1: Type 3 2: Type 2	3-4	2	Two intermediate shafts have been assumed, which is acceptable for the length of tunnel. However, this restricts the areas where the shafts can be located. If these areas are not suitable, then three intermediates shafts would be required.
C	6.9	2	1: Type 1 2: Type 3	3-4	2	If the first intermediate shaft can be located in the region of site area I or before this will increase the likelihood of a type 1 shaft.
H	4.4	1	1: Type 1	2-3	1	The indicative tunnel corridor passes to the east of the landfill in order to minimise total length. Therefore, the intermediate shaft would be located in the area of site area I.
I	2.3	0	N/A	<0.5	1	The indicative tunnel corridor passes to the east of the landfill. Space restricted by the landfill and target to reduce crossing below urban areas. Likely end of tunnel and drive shaft base within Greensand
J	3.0	0	N/A	0.5-1	1	The indicative tunnel corridor passes to the east of the landfill. Corridor restricted by the landfill and target to minimise tunnelling below urban areas where possible. Likely end of tunnel and base of drive shaft within Greensand.
L	2.4	0	N/A	<0.5	1	Crosses railway at 90 degrees, avoid new station. Possible interface with substation/pylon. Crosses new development site. Expected within Gault clay only. However, potential that end of tunnel could be within Grey Chalk Subgroup.

Treated effluent and stormwater discharge pipelines or tunnel

2.2.29 As described in Section 2.2.3, for the purpose of Fine Screening it was assumed that the new WWTP will require two parallel buried pipelines to transfer both treated effluent and stormwater from the site area to a discharge location on the River Cam. It is also possible that the treated effluent could be taken to the River Cam using a tunnel[2] and this remains an option to be considered during the detailed design of the project. However, a tunnel would be expected to have a smaller impact along the route and hence a more conservative option in terms of potential impacts, use of buried pipelines, has been assumed for Fine Screening.

2.2.30 It is considered that the River Cam is the only watercourse within the Study Area that would be able to accept the expected volume of the discharge from the new WWTP without adverse impacts. Therefore, only potential discharge locations on the River Cam have been considered. The reasons why smaller watercourses would not be suitable for the discharge from the new WWTP is discussed in the Initial Options Appraisal report (Mott MacDonald Ltd, 2020a).

2.2.31 The consented discharge location for the existing WWTP is directly south of the A14 to the east of the WWTP. As a new discharge permit would be required for the new WWTP, it is considered reasonable for the purpose of site selection to identify a preferred discharge location on the River Cam for each of the shortlisted site areas, based on the shortest route to the river.

2.2.32 The discharge points considered in the generation of pipeline routes are as follows:

- North of A14 – Discharge location related to shortest potential route from site area L, and
- North east Milton – Discharge location related to shortest potential route from site areas A, B, C, H, I and J.

2.2.33 No hydrological assessment has been undertaken for the proposed discharge locations used in this Fine Screening assessment. A detailed hydrological assessment will take place during subsequent stages of the project. However, this assessment is considered to be appropriate for the differentiation of potential site areas at this stage.

2.2.34 The assumptions used in routing the pipelines for all the shortlisted site areas were as follows:

- All residential areas, gardens and land for recreational purposes have been avoided, where possible, and routing through open agricultural land maximised.
- Avoided route from site area J south of Milton landfill along the A14 as this would require significant pipejacking sections under a major road junction and potentially impact access to buildings on the Cambridge Science Park during construction.
- Pipeline must cross under roads and railways at right angles to avoid issues with uneven settlement damaging major transport infrastructure. Any crossings would be pipe jacked; which is a method of installing pipes below ground, that avoids surface disruption, by thrusting pipes through the ground as controlled excavation.
- For consideration of potential environmental impacts of the pipeline a 100m corridor has been assumed along the alignment of each pipeline.
- Each treated effluent pipeline would have a diameter of 1500mm.

2.2.35 The main details for each of the pipeline routes are provided in Table 2.5. The pipeline routes are shown on Drawings 409071-MMD-OO-XX-GIS-Y-0102 to 409071-MMD-OO-XX-GIS-Y-0108.

[2] A tunnel to transfer treated effluent and stormwater to the River Cam would require a terminal pumping station located in proximity to the River Cam and a short section of buried pipeline in order to lift the flows from the tunnel and transfer them to the river.

Table 2.5: Pipeline details

Discharge location	Site area	Length (m)	Crossings			
			Major road (A or B class)	Minor road (C class or unclassified)	Waterway (excluding field drains)	Railway
North east Milton	A	10300	2	6	1	1
	B	9400	2	5	1	1
	C	7000	2	4		1
	H	4300	1	3		1
	I	2400	1	2		1
	J	4300	1	3		1
North of A14	L	1300		1		

Source: Mott MacDonald

Conclusions

2.2.36 The pipeline route from site area L to the River Cam directly north of the A14 is the shortest route and has relatively fewer constraints than the routes from the other site areas.

2.2.37 The pipelines from site areas A, B, C and H, follow broadly similar routes to the potential discharge location to the north east of Milton, although the further site areas have longer pipelines and subsequently encounter more constraints.

2.2.38 The route from site areas I and J are shorter than the routes from A, B, C and H and encounter fewer constraints, although the routes all converge at the A10 north of Milton and so have the same constraints from there to the discharge location north east of Milton.

Waterbeach waste water transfer pipeline

2.2.39 Indicative pipeline corridors have been developed for the transfer of waste water flows from the Waterbeach drainage catchment to each of the shortlisted site areas. The corridors are illustrated on Drawing 409071-MMD-OO-XX-GIS-Y-0101. The following assumptions have been made in defining the corridors.

- The pipelines would start at a pumping station located at or close to the location of the existing Waterbeach WWTP. The WWTP itself will be decommissioned and redeveloped as part of the Waterbeach New Town development (subject to planning).
- The pipeline routes to site areas A, B, C, H, I and J would be the same for the section between Waterbeach and the vicinity of site area I. From there the corridors would differ as follows:
  - The pipelines for site areas A, B, C and H would culminate at an intermediate shaft on the waste water transfer tunnel in the vicinity of site area I, which would be required for all of these sites. The waste water flows from Waterbeach would enter the immediate shaft and flow to the new WWTP via the transfer tunnel.
  - The routes to site areas I and J would continue as buried pipelines to the location of the new WWTP. The routes would follow the corridors defined for the treated effluent transfer pipelines. This would allow the pipelines to be laid in parallel. The Waterbeach transfer pipelines would culminate at the location of the inlet works on the new WWTP.
- Due to the location of site area L, the corridor route would be different to other site areas. The pipeline would culminate at the inlet works of the new WWTP.

2.2.40 Although indicative corridors have been defined, it is not deemed necessary to include the waste water transfer from Waterbeach in the RAG assessment of shortlisted site areas in Stage 3 – Fine Screening for the following reasons.

- The length of pipeline required is relatively similar for all sites due to the assumptions described above and therefore would not add to the differentiation of the site areas in terms of carbon emissions.
- The pipeline will comprise small diameter dual rising mains, the potential impacts of which are considered to minor in comparison to the waste water transfer infrastructure required for the relocation of the Cambridge WWTP, i.e. the waste water transfer tunnel to the new WWTP and treated effluent pipeline to the River Cam.
- The potential impacts will be temporary during construction and due to the size of the pipeline it should be possible to adjust the route in order to avoid constraints and minimise the potential impacts of the pipelines.

2.2.41 Therefore the waste water transfer from Waterbeach is not considered further in the Stage 3 – Fine Screening assessment.

2.2.42 In addition to the waste water transfer from Waterbeach, it will be necessary to divert several existing rising mains that currently transfer waste water from other villages to the existing Cambridge WWTP for treatment. However, similarly to the Waterbeach transfer, these diversions are considered to be minor in comparison to the main infrastructure requirements and do not aid the differentiation of site areas. Therefore, they are not defined or assessed as part of the Stage 3 – Fine Screening assessment.

2.2.43 The pipeline corridors will be included in the detailed assessment of the best performing site areas as part of Stage 4 – Final Site Selection to identify the site that will be taken forward to DCO application.

Construction and operation vehicle movements

2.2.44 The number of HGV movements for the construction of the transfer infrastructure (tunnels, shafts and pipelines) have been estimated based on the expected spoil volumes to be removed.

2.2.45 It is likely that some of the spoil removed during construction of transfer infrastructure would be used during the development of the WWTP. However, the amount would differ based on existing ground conditions at the WWTP site and the quality of the spoil removed.

2.2.46 Therefore, for comparison at this stage it is currently assumed that all the spoil would need to be removed. The estimated HGV movement numbers are shown in Table 2.6.

2.2.47 It is noted that all the spoil generated from excavating the tunnel and the drive shaft would be collected at, and removed from, the new WWTP site. However, the spoil from the intermediate shafts would be collected and removed from the shaft locations and the spoil from the pipelines excavation would be removed incrementally along the route as the pipelines are laid. Therefore, whilst the majority of construction vehicle movements will be focussed at the new WWTP, there would also be vehicle movements along the transfer corridors to each site area.

Table 2.6: Construction HGV movements

Site area	A	B	C	H	I	J	L
Tunnel							
Length of tunnel to WWTP (m)	9,100	9,000	6,900	4,400	2,300	3,000	2,400
Total number of HGV movements	11,325	11,000	8,470	5,370	3,190	3,970	3,295
Duration of construction (months)[3]	39	38	30	19	11	14	11
HGV movements/day[4]	22	22	22	22	22	22	22
Pipeline							
Length of pipelines from WWTP (m)	10,300	9,400	7,000	4,300	2,400	4,300	1,300
Total number of HGV movements	4,165	3,801	2,830	1,739	970	1,739	526
Duration of construction (months)[5]	12	11	8	5	3	5	2
HGV movements/day	13	13	13	13	13	13	13

Source: Mott MacDonald

2.2.48 Operational vehicle movements relate to the number of HGVs delivering and removing material to/from the sludge treatment centre that would be located on the new WWTP, septic waste transfers as well as vehicles required for maintenance and other non-routine activities. The number of vehicle movements is assumed to be the same for all the shortlisted site areas.

2.2.49 Table 4.7 indicates that there would be a total of 146 operational HGV movements each day. The spread of these movements throughout the day is not currently known, however, this is not expected to have a material influence on the comparison of the shortlisted site areas.

Table 2.7: Operational HGV movements

Type of HGV movement	Average daily number of HGV loads	Average HGV movements/day
Liquid sludge imports	31	62
Biosolids exports	5	10
Non-routine tanker movements	7	14
Septic waste movements	30	60
Total	**73**	**146**

Source: Anglian Water, 2019

2.2.50 The above information demonstrates that operational vehicle movements would be considerably greater than those during construction of the tunnel, shafts and pipeline. Therefore, the operational vehicle movements are likely to have a much greater impact on the local area than those during construction.

2.3 Red Amber Green (RAG) Assessments

2.3.1 The objective of Stage 3 – Fine Screening was to assess the infrastructure requirements of each shortlisted site area against operational, economic, environmental, planning and

[3] Duration assumes drive shaft would be excavated at 12 metres per month, tunnel would be excavated at a rate of 250 metres per month and all other shafts would be constructed in during tunnel excavation.

[4] Assumes that construction vehicles would only operate for 26 days each month and that 1 movement is one-way to or from site.

[5] Duration assumes pipeline would be laid at a rate of 800 metres per month.

community criteria, and based on their cumulative performance, identify the best performing site areas.

2.3.2 This included specific desk-top appraisals, recommended by stakeholders, for landscape, nature conservation and biodiversity, archaeology and historic environment and contaminated land, which are intended to provide a more detailed assessment of the shortlisted site areas than previously undertaken during Stage 2 – Coarse Screening. However, these criteria are not considered to be of greater importance than other criteria assessed at Stage 3 but the desk-top appraisals were undertaken to provide sufficient information to inform the RAG assessment.

2.3.3 Each shortlisted site area and associated infrastructure requirements was evaluated against the identified criteria by means of a RAG assessment which highlighted the potential significance of the different assessment criteria for each site area. It is important to note that none of the assessments are exclusionary i.e. red does not indicate that a site area should be excluded from further consideration.

2.3.4 The assessment criteria adopted at Stage 3 are listed in Table 2.8 below. The approach to assessing each criterion is reported in the following sections.

2.3.5 The potential odour impacts on local communities were not assessed as part of Stage 3 – Fine Screening. It is considered that the 400m buffer around residential properties employed in Stage 1 – Initial Site Selection is appropriate for the purpose of site selection. Odour control measures, in accordance with industry best practice would be employed at the new WWTP site. An appropriate odour impact assessment will form part of the EIA for the site area identified to take forward in the DCO application.

Table 2.8: Assessment Criteria Adopted at Stage 3

Category	Criteria Name	Objectives of Assessment
Operational	Ease of access	Assessment of suitability of road/interconnecting road access: particularly for Heavy Goods Vehicles/abnormal indivisible loads and sensitivity of access route
Economic	Affordability	Assessment of whether development of a new WWTP would be achievable within the limits of the HIF funding.
Environmental	Carbon emissions	Assessment of the whole-life carbon emissions for the transfer infrastructure for each of the shortlisted options, including tunnels, shafts, pipelines and pumps.
	Landscape and visual amenity	Assess whether there would be any impact on landscape context and visual amenity from development of the options.
	Nature conservation and biodiversity	Assess the potential impact on designated sites, habitats and protected species.
	Historic environment	Identify the potential heritage risks and constraints.
	Contaminated land	Assess the potential sources of contamination within and in proximity to each shortlisted site and assess potential risk of locating the WWTP development on contaminated land.
	Groundwater impacts	Assess the potential impact of the WWTP development and conveyance infrastructure (tunnel and shafts) on groundwater below the study area.
	Surface water impacts	Consider the extent to which impacts on WFD surface waterbodies identified at Stage 2 can be mitigated.
Planning	Green Belt	Assessment of whether development would be within the Cambridge Green Belt.
	Risk to aviation	Assessment of the potential impacts of the WWTP development on aviation, in relation to proximity to Cambridge Airport.
Community	Non-traffic impact of construction on local communities	Assessment of potential impacts on communities in terms of noise, dust and disruption.
	Traffic impact of construction on local communities	Assessment of potential traffic impacts on communities in relation to congestion, air quality, noise and road safety
	Impact on Public Rights of Way	Assessment of potential impacts on public rights of way.

Source: Mott MacDonald

Carbon emissions

2.3.6 An estimate was produced for the embodied (construction stage), operational and whole-life carbon emissions for the transfer infrastructure for each of the shortlisted site areas, including tunnels, shafts, pipelines and pumps.

2.3.7 The carbon emissions estimates used in this RAG assessment can be found in the Carbon Assessment report (Mott MacDonald Ltd, Cambridge Waste Water Treatment Plant Relocation Carbon Assessment - Waste Water Transfer Infrastructure, 2020d)). Carbon models for preparing the embodied carbon estimates were provided by Anglian Water. Operational carbon estimates were based on the predicted energy use for pumping waste water (to the treatment plant) and treated effluent (from the treatment plant to the discharge location) and grid power carbon emissions factor for 2019 published by the UK Government.

2.3.8 In terms of RAG assessment, a relative scoring scale was adopted where the site areas with the lowest whole-life carbon were scored as Green and the remaining options were scored either as

Amber or Red based on the difference in whole life carbon emissions compared to the lowest carbon option.

2.3.9 The RAG definitions adopted in the carbon emissions assessment are provided in Table 2.9.

Table 2.9: Carbon emissions - RAG definitions

Green	Amber	Red
Whole-life carbon emissions of the site option are less than 140% of the site area with the lowest whole life carbon emissions	Whole-life carbon emissions of the site area are equal to or more than 140% but no more than 200% of the site area with the lowest whole life carbon emissions	Whole-life carbon emissions of the site area are more than 200% of the site area with the lowest whole-life carbon emissions

Affordability

2.3.10 As described in Section 1.1.3, the relocation of Cambridge WWTP will be publicly funded through a government grant from the HIF. For the relocation to be viable, the cost of developing the WWTP, including design, enabling works, construction and commissioning, must be within the total HIF grant amount.

2.3.11 A significant proportion of the cost for the new WWTP comprises the construction of waste water transfer infrastructure, the main components of which are the tunnel to transfer waste water flows from the existing WWTP and the pipelines or tunnel to return treated effluent to the River Cam.

2.3.12 The cost to construct these transfer elements increases with distance from the existing WWTP and the discharge location on the River Cam. As a result, there is a maximum distance from these locations at which development of a new WWTP would become unaffordable within the bounds of the HIF grant.

2.3.13 Using the corridors and constraints developed in the tunnelling and pipeline assessments and applying the unit costs used in the HIF funding application, the costs of developing a new WWTP at each of the shortlisted site areas have been calculated.

2.3.14 These costs have then been used to map the affordability of developing new WWTP in the Study Area. This map has then been combined with the shortlisted site area locations to assess the affordability of constructing a new WWTP at these locations, as shown in Drawing 409071-MMD-00-XX-GIS-Y-0116A.

2.3.15 The RAG definitions adopted for this assessment are provide in Table 2.10. Both green and amber relate to affordable site areas within the HIF funding limit. However, to differentiate between affordable site areas, the green score relates to site areas that would cost less than or equal to 85% of the HIF funding.

Table 2.10: Affordability – RAG definitions

Green	Amber	Red
Development of a new WWTP would cost less than or equal to 85% of HIF fund	Development of a new WWTP would cost between 85% to 100% of the HIF fund	Development of a new WWTP would cost more than 100% of the HIF fund

Ease of access

2.3.16 A criterion was developed to assess the accessibility of the site areas for the different options as well as the suitability of access routes for construction and operational traffic, in particular for heavy goods vehicles.

2.3.17 As part of this criterion, a high-level desk-top review was conducted using available aerial imagery, OS mapping and a review of Cambridgeshire County Council's 'My Cambridge' interactive map (Cambridgeshire County Council, My Cambridge, 2019) only. The aspects covered by the review were as follows:

- Proximity of site area to strategic road network:
  - Estimation of average journey time during peak hours from the closest junction on the A14 to the beginning of the site area access road.
- Suitability of route from strategic network:
  - Approximate width of road along route to strategic network, and
  - Potential pinch points on roads, junctions, narrow roads, mini roundabout, etc.
- Suitability of connection to existing road for new access road:
  - Speed limit of existing road network in comparison with likely speed of traffic entering site area, and
  - Visibility at junction with existing road.

2.3.18 It is noted that no site visits or transport modelling has been used in these assessments. A more detailed assessment of transport and access arrangements should be carried out during future stages. However, this assessment is considered to be appropriate for the differentiation of potential site areas at Stage 3 – Fine Screening.

2.3.19 The RAG definitions adopted to account for the above issues are shown in Table 2.11.

Table 2.11: Ease of access - RAG definitions

Green	Amber	Red
Site area is in close proximity to strategic road network (journey time < 5 mins) and; Route to site area from strategic network is suitable including suitable connection for new access road to existing road.	Site area is in moderate proximity to strategic road network (journey time between 5 and 10 mins) and/or; Route to site area from strategic network and/or connection for new access road is largely suitable with some constraints which can be overcome.	Site area is at a longer distance from strategic road network (journey time >10 mins) and/or; Route to site area from strategic network or connection for new access road poses constraints which would be difficult to overcome.

2.3.20 The following maps have been used in this assessment and can be found in Appendix A.1.

Transport and access - Drawings 409071-MMD-00-XX-GIS-Y-0117 to 0123.

Landscape and visual amenity

2.3.21 A desktop landscape appraisal was carried out as part of the Fine Screening in order to consider if there would be any impacts on landscape or visual amenity for each of the options. The appraisal is provided in Appendix C.

2.3.22 This document comprises an investigation of:

- Landscape designations
- Landscape character
- Topography
- Potential visibility from key receptors, including:
  - Occupiers of residential properties orientated towards the development
  - Walkers and visitors to heritage assets, and

- Designated or protected views (a full list of receptors is provided in Section 3 of the Landscape Appraisal in Appendix C).

2.3.23 An overview of the Landscape Context is provided to outline the sensitivities, opportunities and constraints within the landscape, and an overview of the visual amenity to highlight the potential impacts upon local receptors.

2.3.24 The assessment of landscape context and visual amenity have been undertaken using a methodology that follows current best practice and guidance from:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA), 3rd Edition: Landscape Institute and Institute of Environmental Management and Assessment (2013).

2.3.25 The final section of the document provides a series of recommendations to further inform the design of the WWTP to provide a scheme that reflects the local landscape character and minimises the impact upon local visual receptors.

2.3.26 The RAG definitions for the landscape appraisal are provided in Table 2.12.

Table 2.12: Landscape - RAG definitions

Criteria	Green	Amber	Red
Potential to impact landscape designations	No landscape designations within 1km of the site area	Landscape designations within 500m and 1km of the site area	Landscape designations within 0m and 500m of the site area
Landscape character sensitivity	Located within a landscape character area of low sensitivity	Located within a landscape character area of medium sensitivity	Located within a landscape character area of high sensitivity
Opportunity to utilise existing features for screening	Existing vegetation screening greater than 50% of the site area	Existing vegetation screening up to 50% of the site area	No existing vegetation providing screening opportunities
Visual sensitivity	Fewer than 10 receptor locations within 1km of the site area	Between 10 and 50 receptor locations within 1km of the site area	Greater than 50 receptor locations within 1km of the site area

2.3.27 The overall Landscape RAG score was assessed using qualitative assessment of the importance of the above categories. The overall scores are provided in the appraisal in Appendix C.

Nature conservation and biodiversity

2.3.28 For Stage 3 – Fine Screening, an appraisal was carried out to identify the potential impacts of WWTP development on nature conservation and biodiversity within and around each of the shortlisted site areas and the corridors for the treated effluent discharge pipelines. The full nature conservation and biodiversity appraisal is provided in Appendix D.

2.3.29 Using the methodology described in the appraisal document, the following constraints were assessed:

- Protected and notable species recorded within the indicative boundary of the WWTP and within a 5km Ecological Zone of Influence (EZoI).
- Habitat types within the indicative boundary of the WWTP and their potential to support protected and/or notable species.
- Potential for Great Crested Newts (GCN) within the indicative boundary of the WWTP and within the EZoI.

- Potential ecological impact pathways to statutory and non-statutory designated sites during the construction of the treated effluent discharge pipelines and WWTP access roads.

2.3.30 The RAG definitions provided in Table 2.13 were defined to assess the potential ecological constraints at each of the seven shortlisted site areas (A, B, C, H, I, J and L).

2.3.31 Finally, the RAG scores for the individual components of the assessment shown in Table 2.13 were combined with the Stage 2 Course Screening RAG scores[6] to provide an overall assessment of the potential ecological constraints at each of the proposed site areas.

2.3.32 The overall RAG rating is presented in Table 8 of the appraisal (see Appendix D) and corresponds to the highest level of risk across the components of the Stage 3 – Fine Screening (as described above) and the Stage 2 – Coarse Screening.

[6] The Stage 2 Coarse Screening identified potential pathways for impact between the proposed WWTP sites and any designated areas of nature conservation or biodiversity importance (both statutory and non-statutory designations) within a 5.0 km EZoI.

Table 2.13: Nature conservation and biodiversity - RAG definitions

Potential ecological constraint	Green	Amber	Red
Protected and notable species recorded within 5.0 km EZoI	Confirmed records of notable species without specific legal protection (e.g. nationally rare or nationally scarce) recorded within indicative WWTP boundary or within a 0.5km EZoI of the indicative WWTP boundary; and/or Confirmed records of EPS species within 1.0km – 5.0km of the indicative WWTP boundary.	Confirmed records of protected species (e.g. SPI and species listed on the Wildlife and Countryside Act 1981) within a 5.0km EZoI of the indicative WWTP boundary; and/or Confirmed records of EPS species within 0.5km – 1.0 km of the indicative WWTP boundary.	Confirmed records of protected species (e.g. SPI and species listed on the Wildlife and Countryside Act 1981) within the indicative WWTP boundary; and/or Confirmed records of EPS species within the boundary of the proposed WWTP site or within a 0.5km EZoI of the indicative WWTP boundary.
Habitat types within the indicative WWTP boundaries	No Habitats of Principal Importance (HPI) within the indicative WWTP boundary; and Habitats present considered unlikely to support protected species.	HPI within the indicative WWTP boundary; Ancient woodland within 0.5km of the indicative WWTP boundary; and/or Potentially suitable habitat for protected species found within the indicative WWTP boundary.	Ancient woodland within the indicative WWTP boundary.
Potential for proposed site to support GCN	No GCN recorded within the indicative WWTP boundary or within a 0.5km EZoI of the indicative WWTP boundary; and Lack of suitable GCN habitat within the indicative WWTP boundary or within 0.5km of the indicative WWTP boundary.	No GCN recorded within the indicative WWTP boundary or within a 0.5km EZoI of the indicative WWTP boundary and Identification of habitat within the indicative WWTP boundary or within a 0.5km EZoI of the indicative WWTP boundary that has the potential to support GCN (e.g. ponds, ditches, drainage network).	GCN recorded within the indicative WWTP boundary or within a 0.5km EZoI of the indicative WWTP boundary.
Impact pathways between pipeline routes / access roads and statutory / non-statutory designated sites	No national, regional or local designations likely to be adversely affected, or effect likely to be positive i.e. no pathways from indicative WWTP boundary.	Designation of regional or local importance likely to be adversely affected, i.e. a pathway from the indicative WWTP boundary was identified e.g. County Wildlife Sites, Country Parks	Designation of national and/or international importance and/or Ancient Woodland likely to be adversely affected, i.e. pathway from indicative WWTP boundary. e.g. Sites of Special Scientific Interest (SSSIs), Ancient Woodland (AW) an Local Nature Reserves (LNRs)
Potential future work	Further surveys required. Implementation of simple mitigation or precautionary mitigation measures likely but low risk.	Further surveys required. Consultation with County Ecologist may be required. Implementation of mitigation or precautionary mitigation measures likely.	Further surveys required. Consultation with Natural England may be required for proposed works impacting designated sites. Natural England mitigation licensing may be required. Mitigation measure may be intensive; including capture and relocation of potentially impacted species.

Source: Mott MacDonald

Historic Environment

2.3.33 A historic environment appraisal was carried out to identify the potential risks and constraints for the shortlisted site areas and the treated effluent discharge pipeline options. A historic environment baseline for each was comprised from available information. This was used to inform an assessment of the archaeological potential of each site area. A subsequent desktop assessment of the potential risks and constraints relating to the historic environment, based on the available information for each shortlisted site area, was undertaken. RAG scores were assigned based on the outcome of these impact assessments.

2.3.34 Information on the historic environment has been collected for each shortlisted site area and within a 500m buffer of the site area boundaries. This buffer was chosen to encompass heritage assets which may experience direct impact or significant setting alteration to be examined in greater depth than during previous site selection stages. The potential for impact on the setting of designated heritage assets within a wider study area was considered during Stage 2: Coarse Screening.

2.3.35 Information has also been collected for the routes of the proposed treated effluent pipelines so that the potential on the historic environment of constructing the pipelines could be assessed.

2.3.36 The information collected comprised:

- Designated Heritage Assets – Those offered specific legal protection due to their heritage significance, which includes: World Heritage Sites, Listed Buildings, Scheduled Monuments, Registered Parks and Gardens, Registered Historic Battlefields, Conservation Areas and Ancient Woodlands.
- Non-Designated Heritage Assets – Those whose importance is acknowledged and are identified as having a degree of significance meriting consideration in planning decisions, but which are not formally designated assets, including: Locally Listed Buildings, Historic Buildings, Historic Parks and Gardens, Historic Battlefields, Monuments, Sites, Places, Areas and Landscapes.

2.3.37 Data relating to these assets was obtained from the following sources:

- The National Heritage List for England (NHLE) as held by Historic England[7]
- The Cambridgeshire Historic Environment Record (CHER)
- Geological Mapping information from The British Geological Society (BGS)[8]
- Available online heritage and archaeology reports, including those held by the Archaeological Data Service[9]
- Available online historic maps

2.3.38 From this baseline an assessment of the archaeological potential of these site areas was undertaken. A subsequent desktop assessment of the potential risks and constraints relating to the historic environment, based on the available information for each shortlisted site area, was undertaken. RAG scores were assigned based on the outcome of these impact assessments. Recommendations based on these outcomes can be found in Appendix B.6.

2.3.39 Where the value of heritage assets is discussed, the following criteria have been used:

[7] Historic England (2019) *The National Heritage List for England* [online]. Available at: https://historicengland.org.uk/listing/the-list/ (Accessed July 2019)

[8] British geological Society (2019) Geological map of Britain [online] Available at: www.mapapps.bgs.ac.uk (Accessed July 2019)

[9] The archaeological Data Service (2019) Available at: https://archaeologydataservice.ac.uk/ (Accessed July 2019)

- High Value – a designated heritage asset of potentially national importance, including Scheduled Monuments and Grade I and II* Listed properties
- Moderate Value – a heritage asset of regional importance, including non-designated assets and Grade II Listed properties
- Low value – non-designated assets of local importance or no notable significance

2.3.40 The RAG definitions for the Historic Environment assessment are shown in Table 2.14.

Table 2.14: Historic Environment - RAG definitions

Green	Amber	Red
No anticipated impact on designated heritage assets, and; No/ few, low value heritage assets identified in the site area, and; Low archaeological potential for assets of high value, and; No high value assets represented on historic maps.	No anticipated impact on high value designated heritage assets, and; Moderate value heritage assets identified within the site area; Potential for substantial impact on the setting of heritage assets of moderate value within the study area; High archaeological potential for assets of moderate value, and/or; High value assets represented on historic maps.	Potential for impact on high value designated heritage assets, and/or; Potential for substantial impact on the setting of heritage assets of high value within the study area;

Contaminated Land

2.3.41 The contaminated land appraisal considered the potential risk of locating the WWTP development on contaminated land.

2.3.42 The seven potential site areas were subject to detailed screening by review of Envirocheck data, which include:

- Historical mapping
- Abstraction and discharge consents
- Pollution incidents
- Industrial land uses
- Ground stability
- Proximity to waste management sites and landfills.

2.3.43 The screening reviewed historical potential sources of contamination on and in close proximity to the site areas, migration pathways for contaminants and presence of sensitive receptors. Where a source, pathway and receptor were present there was deemed to be a potential pollution linkage which required further assessment. Where one or more of these was found to be absent, the site area was considered 'green' i.e. low risk.

2.3.44 For site areas where a source-pathway-receptor linkage was present a generic qualitative risk assessment was undertaken following guidance set out in Environment Agency CLR11 'Model procedures for the management of land contamination' and CIRIA C552 'Contaminated land risk assessment, a guide to good practice'. This assessment was then used to identify the risk of contamination at these site areas.

2.3.45 The RAG definitions developed to assess the risk of contamination at the shortlisted site areas are shown in Table 2.15.

Table 2.15: Contaminated Land - RAG definitions

Green	Amber	Red
Low risk of contamination for WWTP development	Moderate risk of contamination for WWTP development	High risk of contamination for WWTP development

2.3.46 The results of the assessments for each of the individual site areas are provided in Appendix F.

Groundwater impacts

2.3.47 Hydrogeology is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks below ground level.

2.3.48 This assessment considers the potential impact of the WWTP and waste water transfer infrastructure (tunnel and shafts) on groundwater below the study area.

2.3.49 Groundwater can be found below ground in both shallow superficial deposits as well as deeper bedrock formations.

2.3.50 The Lower Greensand Group and the Grey Chalk Subgroup are groups of bedrock geological formations that exists below the Study Area and are designated as Principal Aquifers by the Environment Agency. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of groundwater storage. They may support water supply and/or river base flow on a strategic scale.

2.3.51 The Environment Agency also defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. A review of SPZs has confirmed that there are none within the Stage 3- Fine Screening Study Area. Therefore, SPZs are not considered in this assessment.

2.3.52 In addition to Principal Aquifers there are superficial deposits that overlay the bedrock geology in Study Area that are designated as Secondary Aquifers by the Environment Agency. These are permeable layers, typically with lower levels of groundwater storage, capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

2.3.53 Groundwater aquifers and rivers that are important for the environment are also classified under the Water Framework Directive (WFD). This ensures that they are protected from deterioration due to development and construction activities.

2.3.54 The construction and operation of the conveyance tunnel, intermediate and terminal shafts as well as the WWTP development could have a potential impact on water quality and groundwater flow within WFD classified bedrock aquifers. The risk of potential impacts is considered to increase with the length of tunnel constructed within the aquifer and the number of shafts that would penetrate into or through the aquifer as well as where a Principal Aquifer is at outcrop below the location of the WWTP.

2.3.55 The shafts and WWTP could also have an impact on shallow aquifers within superficial deposits, which could be connected to WFD classified surface waterbodies.

2.3.56 The potential impacts identified at each of the shortlisted site areas in Stage 2 – Coarse Screening have been reviewed using the infrastructure requirements and contaminated land assessments. The assessment consists of these aspects:

- Number of shafts that penetrate a Principal Aquifer

- Length of tunnel in a Principal Aquifer
- Extent of Principal Aquifers at outcrop below the proposed WWTP site
- Extent of Secondary aquifers below proposed WWTP site and connection to WFD surface waterbodies
- Risk of contamination below ground at proposed WWTP site

2.3.57 The RAG definitions adopted in the groundwater assessment are shown in Table 2.16.

Table 2.16: Groundwater impacts - RAG definitions

Green	Amber	Red
Works will only penetrate unproductive strata (i.e. not containing WFD groundwater or surface waterbody)	Moderate potential for adverse impact to a WFD groundwater or surface waterbody: Length of tunnel in Principal Aquifer <500m and 1 shaft penetrating Principal Aquifer; or Principal Aquifer is at outcrop below the WWTP site; or Secondary aquifer below WWTP site and likelihood of hydraulic connection to WFD surface waterbody is low; and Risk of contamination below the WWTP site is low to moderate.	High Potential for adverse impact to a WFD groundwater or surface waterbody: As per Amber but with a high risk of contamination below the WWTP site; or Length of tunnel in Principal Aquifer >500m and >1 shaft penetrating Principal Aquifer; or Secondary aquifer below WWTP site and likelihood of hydraulic connection to WFD surface waterbody is moderate or high.

2.3.58 It is noted that a more detailed hydrogeological risk assessment will need to be undertaken once a best performing site area is identified. However, this assessment is considered to be appropriate for the differentiation of potential site areas at Stage 3 – Fine Screening.

2.3.59 It is considered that potential impacts on WFD groundwater body can be mitigated using reasonably practicable tunnel and shaft construction and lining techniques. It is also considered that any potential impact on shallow groundwater and connected surface waterbodies can be mitigated using suitable construction techniques and drainage arrangements on the WWTP site and terminal shaft location.

Surface water impacts

2.3.60 This assessment considers the potential impacts of the WWTP development on WFD classified surface waterbodies. The effluent discharge arrangements are assumed to be similar for all site areas, therefore, they do not have an impact on site selection and have not been considered within this criterion.

2.3.61 The potential impacts identified at each of the shortlisted site areas in Stage 2 – Coarse Screening have been reviewed using the infrastructure requirements.

2.3.62 An assessment has then been made as to whether the potential impacts to WFD surface waterbodies could be mitigated through reasonable technical means during construction and operation of the WWTP and associated infrastructure.

2.3.63 It is possible that development of the WWTP could impact the water quality and flows in watercourses located on or near to the site areas. This could have a negative effect on the status of any WFD classified waterbodies that are downstream of these watercourses or are located in proximity to the site area.

2.3.64 The RAG definitions adopted in the surface water assessment are shown in Table 2.17.

Table 2.17: Surface water impacts - RAG definitions

Green	Amber	Red
Low risk of adverse impact to a WFD surface waterbody.	Potential for adverse impact to a WFD surface waterbody; and Impact can be mitigated by reasonable technical means.	Potential for adverse impact to a WFD surface waterbody; and Impact cannot be mitigated by reasonable technical means.

2.3.65 It is noted that a more detailed hydrological risk assessment will need to be undertaken once a best performing site area is identified. However, this assessment is considered to be appropriate for the differentiation of potential site areas at Stage 3 – Fine Screening.

Green Belt

2.3.66 This assessment considers the relevant policy and guidance around the Green Belt and how this relates to the development at each of the shortlisted site areas.

2.3.67 It is noted that all shortlisted site areas would require transfer infrastructure (pipelines as well as shafts for tunnels) to be located in the Green Belt. However, as the tunnels and pipelines will be below ground with few, if any, above ground features, this assessment focusses on the WWTP development at each of the shortlisted site areas.

2.3.68 The following documents provide guidance which describe what types of development are considered inappropriate in the Green Belt and what factors are important for developments to avoid and/or mitigate.

The National Policy Statement for Waste Water

2.3.69 The National Policy Statement (NPS) for Waste Water (Department for Environment Food and Rural Affairs, 2012) sets out Government policy for the provision of major waste water infrastructure. It will be used by the decision maker as the primary basis for deciding development consent applications for waste water development. The NPS Statement provides some guidance for when development should not be permitted in the Green Belt. The NPS stipulates:

> *"When located in the Green Belt, waste water infrastructure projects many comprise "inappropriate development" which is by definition harmful to the Green Belt and there is a presumption against it."*

National Planning Policy Framework

2.3.70 National Planning Policy Framework (NPPF) Paragraph 146 outlines what forms of development are not inappropriate in the Green Belt (Ministry of Housing, Communities & Local Government, 2019). While the construction of a waste water treatment plant does not meet any of the below criteria, the pipelines and intermediary shafts associated with the proposed development are considered engineering operations and therefore may not be inappropriate development in the Green Belt. Paragraph 146 of the NPPF stipulates:

> *"Certain other forms of development are also not inappropriate in the Green Belt provided they preserve its openness and do not conflict with the purposes of including land within it. These are:*
>
> *a) mineral extraction;*
> *b) engineering operations;*
> *c) local transport infrastructure which can demonstrate a requirement for a Green Belt location;*

d) the re-use of buildings provided that the buildings are of permanent and substantial construction;

e) material changes in the use of land (such as changes of use for outdoor sport or recreation, or for cemeteries and burial grounds); and

f) development brought forward under a Community Right to Build Order or Neighbourhood Development Order."

South Cambridgeshire District Council Adopted Local Plan

2.3.71 The South Cambridgeshire District Council Local Plan (South Cambridgeshire District Council, 2018) was adopted in 2018. It sets out several policies which highlight the particular aspects of the Green Belt which are important to Cambridge. Policy S/4 (Cambridge Green Belt and NH/8 Mitigating the Impact of Development In and Adjoining the Green Belt) of the Local Plan stipulates the following.

> *"A Green Belt will be maintained around Cambridge that will define the extent of the urban area. The detailed boundaries of the Green Belt in South Cambridgeshire are defined on the Policies Map, which includes some minor revisions to the inner boundary of the Green Belt around Cambridge and to the boundaries around some inset villages. New development in the Green Belt will only be approved in accordance with Green Belt policy in the National Planning Policy Framework."*

2.3.72 This policy contains supplementary information that is useful for understanding the policy and for assessing the impact this development would have on the Cambridge Green Belt. This is set out below.

> *"The established purposes of the Cambridge Green Belt are to:*
>
> - *Preserve the unique character of Cambridge as a compact, dynamic city with a thriving historic centre;*
> - *Maintain and enhance the quality of its setting; and*
> - *Prevent communities in the environs of Cambridge from merging into one another and with the city.*
>
> *A number of factors define the special character of Cambridge and its setting, which include:*
>
> - *Key views of Cambridge from the surrounding countryside;*
> - *A soft green edge to the city;*
> - *A distinctive urban edge;*
> - *Green corridors penetrating into the city;*
> - *Designated sites and other features contributing positively to the character of the landscape setting;*
> - *The distribution, physical separation, setting, scale and character of Green Belt villages; and*
> - *A landscape that retains a strong rural character."*

2.3.73 Policy NH/8 of the Local Plan details how development within and adjoining the Green Belt could be mitigated. The following points are excerpts from this policy.

- "*Any development proposals within the Green Belt must be located and designed so that they do not have an adverse effect on the rural character and openness of the Green Belt.*
- *Where development is permitted, landscaping conditions, together with a requirement that any planting is adequately maintained, will be attached to any planning permission in order to ensure that the impact on the Green Belt is mitigated.*
- *Development on the edges of settlements which are surrounded by the Green Belt must include careful landscaping and design measures of a high quality.*

Green Belt is a key designation in the district, which protects the setting and special character of Cambridge. Inappropriate development is by definition harmful to the Green Belt and will not be approved except in very special circumstances and in accordance with the approach set out in the NPPF (2012)."

Cambridgeshire County Council and Peterborough City Council Minerals and Waste Local Plan: Developing a Spatial Strategy for Waste Management Provision

2.3.74 The purpose of *Developing a Spatial Strategy for Waste Management* (Cambridgeshire County Council & Peterborough City Council, 2011) is to give additional background information on how the spatial strategy for waste in the Cambridgeshire and Peterborough Minerals and Waste Local Plan (MWLP) has developed. With regards to development of waste management facilities in the Green Belt, this note provides the following guidance.

- *"Cambridge is also surrounded by the Green Belt so the opportunities for waste-related development at the edge of the urban area, or in those settlements close to the city but which are quite urbanised, are also limited.*
- *In considering the broad spatial direction to be provided, the key locations in the plan area are Cambridge and Peterborough, albeit that it is acknowledged that there are limitations in respect of Cambridge, including the Cambridge Green Belt which surrounds the City."*

Green Belt RAG categories

2.3.75 Using the above information, the RAG categories for the Green Belt assessment were defined as shown in Table 2.18.

Table 2.18: Green Belt - RAG definitions

Green	Amber	Red
The site area is located outside of the Green Belt.	The site area is partially within the Green Belt	The site area is wholly located within the Green Belt

Risk to aviation

2.3.76 This assessment considers the potential impacts of the WWTP development on aviation, in relation to proximity to Cambridge Airport.

2.3.77 Cambridge Airport is both a Civil Aviation Authority (CAA) and Ministry of Defence (MOD) facility. Therefore, statutory safeguarding zones have been defined in the surrounding area to protect the facility.

2.3.78 There are two elements of the WWTP development that relate to these safeguarding zones:

- Heights of buildings

- Potential to attract and support large and, or, flocking bird species

2.3.79 The risks these elements pose and how they have been assessed are provided below.

Building heights

2.3.80 The principal concern in relation to building heights is ensuring that structures, particularly tall buildings, do not cause an obstruction to air traffic movements at MOD aerodromes or compromise the operation of air navigational transmitter/receiver facilities.

2.3.81 Air traffic approaches and technical installation at MOD aerodromes are protected with statutory safeguarding zones which identify height consultation zones surrounding MOD aerodromes relative to topography and distance from site area.

2.3.82 The Cambridge Airport Air Safeguarding Zones Heights for Referral were not available as spatial data from the operator of the Airport at the time of writing. Therefore, the locations of the shortlisted site areas within the zones were inferred from the map available on the Cambridge City Council website (Cambridge City Council, Cambridge Airport Air Safeguarding Zones, 2019).

2.3.83 The high-level assumptions for the WWTP (see Section 4.2.1) indicate that highest structure on the site will be the anaerobic digestion tanks, which would have a maximum height of 26m above ground level.

2.3.84 Comparing these maximum heights at each shortlisted site area with the Cambridge Airport Air Safeguarding Zones Heights for Referral indicates that only site area L would require consultation in relation to the height of structures on the WWTP.

Bird strike risk

2.3.85 It is possible that a WWTP site could pose a risk to aviation, as birds attracted to the site due to the presence of open bodies of water could increase the risk of a collision with aircraft in the vicinity. This is a particular concern where such a waterbody is located in the vicinity of a live airfield, where aircraft are present at lower altitudes.

2.3.86 Guidance on Wildlife Hazards around aerodromes (Airports Operation Association, 2016) indicates that any development within a 13km radius of an active public aerodrome should be assessed in relation to the level of risk it may pose to aviation.

2.3.87 The guidance states that:

> *"This 13km zone should be seen as a planning guide…The proposed development would need to either: increase the population of hazardous birds; or to generate flight lines that enter critical airspace, to increase the risk in order for it to be determined as unacceptable."*

2.3.88 There is no guidance on an absolute minimum distance from an airfield for a development that may pose a risk of bird strike.

2.3.89 The only active airfield identified in the region is Cambridge Airport. Therefore, a radius of 13km around the airport has been defined to identify which site areas would require further assessment in relation to bird strike risk.

2.3.90 It is noted that all shortlisted site areas lie within the 13km radius of Cambridge Airport and therefore would require further assessment for bird strike risk by the CAA and MOD.

2.3.91 The RAG definitions adopted in the risk to aviation assessment are provided in Table 2.19.

Table 2.19: Risk to aviation - RAG definitions

Green	Amber	Red
Site area is >13km from any active CAA airports or MOD aerodromes and would not require an assessment of bird strike risk; and Proposed maximum building heights are less than the height consultation zone in which the site area is located.	Site area is <13km from any active CAA airports or MOD aerodromes and would require an assessment of bird strike risk; and Proposed maximum building heights are less than the height consultation zone in which the site area is located.	Site area is <13km from any active CAA airports or MOD aerodromes and would require an assessment of bird strike risk; and Proposed maximum building heights are greater than the height consultation zone in which the site area is located.

2.3.92 The following map has been used in this assessment and can be found in Appendix A.1.

- Risk to aviation - Drawing 409071-MMD-00-XX-GIS-Y-0138.

2.3.93 Cambridge Airport is expected to be relocated by 2030 at which point the criteria detailed above are not likely to pose a constraint on the relocated WWTP. However, as Anglian Water must complete the relocation of the WWTP by 2028, the potential constraints will be relevant during construction period and at least the first two years operation. Therefore, it is considered necessary to assess the site areas against this criterion in Stage 3 – Fine Screening.

Non-traffic impact of construction on local communities

2.3.94 A criterion was developed to assess the impact on local residents and communities from the construction of the different options (excluding traffic impacts). This is related to the possible impacts from the construction of a WWTP at each potential site areas, the waste water transfer tunnel, the treated effluent discharge pipeline and the access roads.

2.3.95 The construction impacts were assessed with regard to noise, dust and disruptions to the amenity of neighbouring residential areas, businesses and communities.

2.3.96 With regard to impacts from tunnel construction, an assessment was carried out on the potential locations of the shafts, and for construction of the treated effluent discharge pipeline, the impacts related to whether the pipeline would be within or adjacent to residential areas, businesses and communities.

2.3.97 An assessment was also carried out for the construction impacts of the new access roads on neighbouring residents, businesses and communities.

2.3.98 The RAG definitions developed to assess the overall non-traffic impact on local communities from the construction of the WWTP are shown in Table 2.20.

Table 2.20: Non-traffic impact of construction on local communities - RAG definitions

Green	Amber	Red
Overall impact on local residents/ businesses/communities from construction expected to be relatively minor. Pipeline route largely avoids residential areas/communities; tunnel shafts outside residential areas; no or minor disruption from construction of new access road; minor or no impact from site construction.	Overall impact on local residents/ businesses/communities from construction expected to be moderate. Pipeline route partially through residential areas/communities or; one or more tunnel shafts within/adjacent to residential areas/communities or; moderate disruption from construction of new access road or; moderate impact from site construction.	Overall impact on local residents/ businesses/communities from construction expected to be high. Pipeline route largely through residential areas/communities or; all tunnel shafts within/adjacent to residential areas/communities or; major disruption from construction of new access road or; significant impact from site construction.

Traffic impact of construction and operation on local communities

2.3.99 This criterion considers the potential impact of increased traffic during construction and operation of the proposed WWTP. Increases in traffic due to the scheme could have a negative impact on local residents, businesses, communities and other sensitive receptors along the proposed access routes. Potential impacts include noise, air quality impacts and increases in congestion and accidents.

2.3.100 It is noted that the traffic-related impacts during operation are likely to be greater than the potential impacts during construction due to the number of expected vehicle movements as outlined in Section 2.2.50. The impacts are likely to be greater if the vehicle movements are concentrated during peak times (7:30-9:30am and 4:30-6:30pm).

2.3.101 This assessment consisted of a high-level desk-top review of the sensitivity of the access routes to each proposed site area from the strategic road network. In this case, the nearest appropriate A14 junction to the proposed site area has been used, i.e. a junction that allows access to, and egress from, the A14 in both directions. It is assumed that the A14 is suitable to carry the necessary traffic (similar to that of the existing WWTP) and therefore has not been included in the assessment.

2.3.102 The assessment was conducted using available aerial imagery, OS mapping and a review of Cambridgeshire County Council's 'My Cambridge' interactive map (Cambridgeshire County Council, My Cambridge, 2019b), and relevant transport and policies only. The following aspects were considered in this assessment:

- The potential areas that would be affected by increased congestion on the route to the site area from construction and operation
- Sensitive receptors along the routes, for example; residential areas/communities, schools, nurseries, playgrounds, local businesses and elderly care facilities
- Safety of other road users, such as pedestrian crossings and cycling routes
- Accident clusters along the routes (Cambridgeshire County Council, 2019)
- Any existing restrictions for heavy good vehicles (HGV) along the routes (Cambridgeshire County Council, Heavy or abnormal loads on the highway, 2019a)
- Air Quality Management Areas (AQMA) on the routes (Department for Environment Food & Rural Affairs, 2019)

2.3.103 It is noted that no site visits or traffic modelling has been used in these assessments. A more detailed assessment of transport and access arrangements should be carried out during future

stages. However, this assessment is considered to be appropriate for the differentiation of potential site areas at Stage 3 – Fine Screening.

2.3.104 The RAG definitions adopted for the traffic impact of construction and operation on local residents are shown in Table 2.21.

Table 2.21: Traffic impact of construction and operation on local communities - RAG definitions

Green	Amber	Red
Overall impact on local residents/communities from option construction and operation expected to be minor: Minor localised disturbance/ delays caused by construction traffic/traffic management measures; and Minor increase in traffic within localised area during construction and/or operation; and Sensitivity of route to site area from strategic network is low.	Overall impact on local residents/communities from option construction or operation expected to be moderate: Moderate traffic delays/congestion during peak hours (7.30-9.30am/4.30-6.30pm) including road closures/diversions during construction; or Moderate increase in traffic during operation; or Sensitivity of route to site area from strategic network is moderate.	Overall impact on local residents/communities from option construction and/or operation has the potential to be severe: Potentially severe traffic delays/congestion diversions/ extinguishments during peak hours (7.30-9.30am/4.30-6.30pm); or Potentially severe Traffic Impacts within and beyond local area during construction and/or operation; or Sensitivity of route to site area from strategic network is high.

2.3.105 The following maps have been used in this assessment and can be found in Appendix A.1.

- Transport and access - Drawings 409071-MMD-00-XX-GIS-Y-0117 to 0123.

Impact on Public Rights of Way

2.3.106 Another aspect of impact on the local community relates to recreation, in particular access to Public Rights of Way. This criterion has been developed to account for any impacts on PRoW in relation to WWTP development within the shortlisted site areas. The RAG definitions adopted for this assessment are shown in Table 2.22.

Table 2.22: Impact on Public Rights of Way – RAG definitions

Green	Amber	Red
No public right of way (PRoW) disrupted or affected. Site areas with no formal recreational activities.	PRoW of local importance disrupted or affected. The site area is likely to affect public rights of way.	PRoW of national or regional importance disrupted or affected. The site area is likely to affect major recreational activities.

3 Stage 3 – Fine screening results

3.1 RAG assessments

3.1.1 The detailed RAG screening assessments for each of the Fine screening criteria are provided in Appendix B.

3.1.2 The specific Desk-top appraisals are provided in additional appendices as follows:

- Landscape Appraisal – Appendix C
- Nature conservation and biodiversity – Appendix D
- Archaeology and historic environment – Appendix E
- Contaminated land – Appendix F

3.1.3 A summary of the RAG assessment results for all shortlisted site areas are provided in Table 3.1 and the RAG summary and justification for the site area removed from further assessment is provided in Table 3.2.

3.1.4 A discussion of the RAG assessment results ins provided in Section 3.2.

Table 3.1: RAG summary

Site area	Ease of access	Affordability	Carbon emissions	Landscape and visual amenity	Nature conservation and biodiversity	Historic environment	Contaminated land	Groundwater impacts	Surface water impacts	Green Belt	Risk to aviation	Non-traffic impact of construction on local communities	Traffic impacts of construction and operation on local communities	Impact on Public Rights of Way
A														
B														
C														
H														
I														
J														
L														

Source: Mott MacDonald

Table 3.2: Rejection register

Site area	Ease of access	Affordability	Carbon emissions	Landscape and visual amenity	Nature conservation and biodiversity	Historic environment	Contaminated land	Groundwater impacts	Surface water impacts	Green Belt	Risk to aviation	Non-traffic impact of construction on communities	Traffic impacts of construction and operation on local communities	Impact on Public Rights of Way	Justification
A															Potential impacts on local communities is considered to be high in relation to the transport route to site area being unsuitable for the expected operational traffic, the potential effects of increased traffic on numerous sensitive receptors along the route, the potential for intermediate shafts near residential areas and the moderate visual sensitivity of surrounding visual receptors.
B															Potential impacts on local communities is considered to be high in relation to the transport route to site area being unsuitable for the expected operational traffic, the potential effects of increased traffic on numerous sensitive receptors along the route and the impact on Public Rights of Way within the site area.
C															Potential impacts on local communities is considered to be moderate to high in relation to the transport route to site area being moderately unsuitable for the expected operational traffic, the potential effects of increased traffic on several sensitive receptors along the route, the potential for intermediate shafts near residential areas and the moderate visual sensitivity of surrounding visual receptors.
H															Potential impacts on local communities is considered to be moderate to high in relation to the transport route to site area being moderately unsuitable for the expected operational traffic, the potential effects of increased traffic on numerous sensitive receptors along the route and the moderate visual sensitivity of surrounding visual receptors.

Source: Mott MacDonald

3.2 Discussion of assessment results

3.2.1 The screening assessment results were used to assign a RAG assessment score for each site area against each of the assessment criteria. A relative comparison of the RAG assessment for each site area was then used to identify the best performing site areas for consultation and those that should be removed from any further assessment.

Importance of criteria

3.2.2 For the fine screening assessment of potential WWTP sites there are several criteria that are considered to be of greater importance than others. These criteria in order of importance are as follows:

- Affordability – The CWWTPR project will be funded by a grant from the HIF to facilitate the regeneration of the existing WWTP site. Without the HIF funding the relocation would not be feasible. The HIF grant is finite, and it would not be possible to exceed it. If relocating to one of the potential site areas would cost more than is available from the grant, then the project would no longer be feasible at that site area.
- Impact on local communities – The purpose of the relocation is to facilitate the regeneration of the existing WWTP site for Cambridge's continued growth and the prosperity of the local community. For the relocation to be a success, the impacts on the local community due to the new WWTP should be minimised.
- Green Belt – Green Belt policy stipulates that approval for development within the Green Belt would only be granted in very special circumstances, and as such may be difficult to overcome.
- Carbon – Anglian Water has set an ambitious target for net-zero carbon emissions by 2030, therefore the potential carbon emissions (embodied and operational) of a scheme of this magnitude will be an important contributor to this goal.

3.2.3 The remaining criteria are still important in defining the potential impact of each shortlisted site area. However, they either do not add to the differentiation of the site areas, such as historic environment or, where potential impacts are identified, they are likely to be able to be mitigated by reasonable technical means, such as contaminated land and impacts on public rights of way.

3.2.4 Overall, site areas I, J and L performed better than all of the other site areas in the Fine Screening assessment. This is mainly due to their proximity to the strategic road network and the existing WWTP, when compared with the other shortlisted site areas. The main areas of differentiation between the site areas in relation to the criteria of greater importance are discussed below.

Affordability

3.2.5 The relatively short length of the tunnel to each of the site areas and the return pipeline or tunnel are notable factors in why site areas I, J and L perform better than all other site areas. This is reflected in the estimated cost of developing a new WWTP at these locations, which using current costs estimates would be achievable within the limits of the HIF funding.

3.2.6 In comparison, the development of site areas A, B and C would require longer lengths of transfer tunnel, two or more intermediate shafts, longer lengths of return pipelines or tunnels, as well as greater interaction with the Lower Greensand Principal Aquifer. This results in considerably higher impact on the cost of the development for site areas A, B, and C when compared with those for site areas I, J and L.

3.2.7 Due to the longer length of the tunnels to site areas A, B and C, it would be necessary to construct sections of the tunnel in parallel in order to achieve the programme required for the HIF funding. This would increase the cost due to the need for additional tunnelling plant and workforce.

3.2.8 Estimation of the costs to develop a new WWTP at site areas A, B and C show that it would not be affordable within the limits of the HIF funding.

3.2.9 The longer lengths of tunnel, intermediate shafts, return pipeline or tunnels, for site area H also result in higher costs in comparison with site areas I, J and L. However, the cost to develop a new WWTP at site area would still be achievable within the limits of the HIF funding.

Potential impacts on local communities

3.2.10 The road transport routes from the strategic road network for site areas I and J are short, do not pass through the centre of any villages and the only potentially sensitive receptors to traffic on the route from the A14 are a small number of residents along Butt Lane (the most likely access route for these site areas).

3.2.11 The route for site area L is similar to that for I and J in that it does not pass through the centre of any villages and passes relatively few sensitive receptors including several isolated residential properties (four in total) and a cycle crossing on the route.

3.2.12 The routes for site areas A, B, C and H pass through the centre of at least one village, pass other sensitive receptors, such as schools and nurseries, and include other potential safety concerns such as pedestrian and cycle crossings (A, B and C) and Cycle Lanes (H).

3.2.13 In addition, with the exception of site area J, all of the site areas are considered to have a moderate landscape and visual sensitivity. This indicates that development of a WWTP at these site areas is more likely to have an adverse impact on the visual amenity of local communities and visitors to the area. Due to the existing vegetation in place in the area and the location adjacent to the landfill, development at site area J was considered to present a lower risk of adverse impact on visual amenity.

Carbon emissions

3.2.14 The closest site areas to the existing WWTP and the River Cam, i.e. I, J and L, had the lowest carbon emissions for waste water transfer infrastructure (tunnels, pipelines and pumping stations).

3.2.15 In contrast, site areas A, B and C had the highest estimated carbon emissions, which were all more than 200% of the lowest estimated carbon emissions (site areas I, J and L).

3.2.16 The estimated carbon emissions for site area H were moderate in comparison to the other site areas, at 140% of the lowest estimated carbon emissions.

Green Belt

3.2.17 Site areas I, J, H and L are within the Green Belt, and as such ‘very special circumstances’ would need to be demonstrated to promote one of these site areas for development.

Site areas A, B and C are outside of the Green Belt and therefore potentially more suitable for development of a WWTP in planning policy terms. However, as discussed above, development at site areas A, B and C is considered to be unaffordable, would have a high risk of impacts on the local community, and would result in higher carbon emissions. These factors are considered

to outweigh the potential suitability in planning policy terms. As a result, it is considered that these site areas are not feasible options for development of a new WWTP.

3.2.18 Therefore, the only potentially feasible site areas left are H, I, J and L. Based on these conclusions, a back checking exercise was completed to make sure there were no other potential site areas within the Study Area; this exercise is summarised in Section 3.3.

Removal of site areas from further assessment

3.2.19 It is considered that the affordability of, and potential impacts posed by, the development of site areas A, B and C, in comparison with Site areas I, J and L, outweigh their performance in the Green Belt criterion and provide justification for removing them from further assessment.

3.2.20 Although site areas H, I, J and L are all within the Cambridge Green Belt, development of site area H presents a higher risk of impact on the local community, higher carbon emissions and greater risk of impact on a Principal Aquifer in comparison to I, J and L. Therefore, the weaknesses of site area H are considered to provide justification for its removal from further assessment.

Best performing site areas

3.2.21 As a result, site areas I, J and L are the best performing site areas, however, it is considered that it is not possible to differentiate between the assessments for Site areas I, J and L at this fine screening stage of the site selection. Site areas I and J perform marginally better than Site L, due to the proximity of site L to Cambridge Airport and sensitive watercourses. However, the proximity to Cambridge Airport relates to a consultation zone for structures above a certain height and may not result in any constraints being posed on a WWTP at site area L. In addition, it is considered that the potential impacts on watercourses could be mitigated by readily available technical solutions and it would not be appropriate to discount site area L based on these criteria at this stage.

3.2.22 Therefore, it has been concluded that site areas I, J and L should be taken forward to Stage 4 – Final Site Selection in order to identify a single site area.

3.2.23 The results of the Stage 3 – Fine Screening assessment are illustrated on Figure 3.1.

3.3 Stage 1 sensitivity analysis

3.3.1 Based on the conclusions of the Fine Screening assessment, it was deemed appropriate to carry out a back-checking exercise to make sure that there were no other potential site areas within the study area.

3.3.2 In order to do this, a sensitivity analysis was carried out on the Stage 1 – Initial Site Selection constraints mapping exercise.

3.3.3 Firstly, the criteria used at Stage 1 were modified by reducing the buffers around residential properties, protected sites, statutory designated sites and major infrastructure.

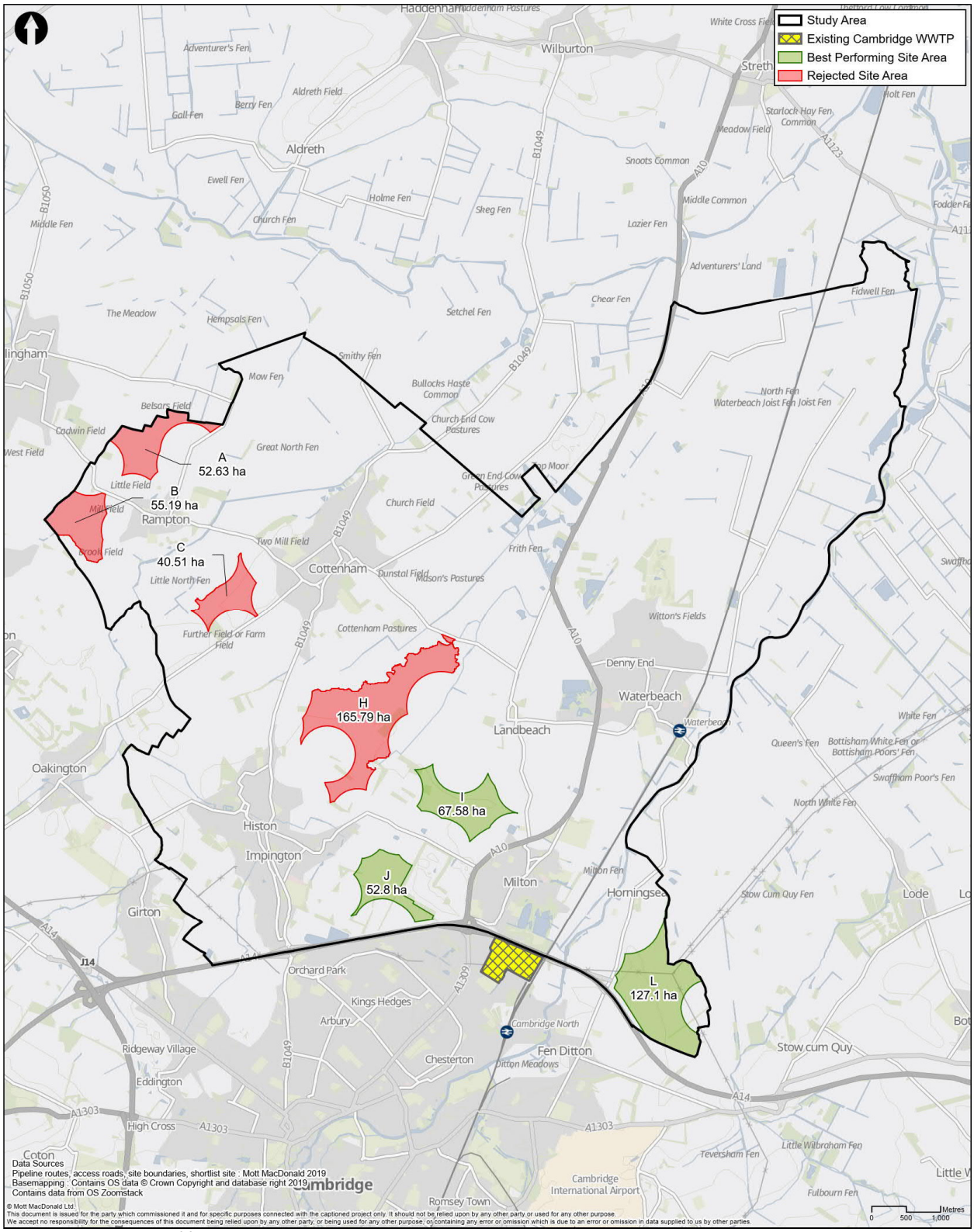
3.3.4 Secondly, the modified criteria were mapped within the Study Area to identify additional unconstrained areas greater than 22ha as well as the expanded longlist site areas.

3.3.5 Finally, the additional unconstrained areas and expanded longlist site areas were assessed against the criteria of greater importance from Stages 2 and 3 to identify if any of the site areas would perform better than site areas I, J and L overall.

3.3.6 The assessment of the expanded longlist site areas and additional unconstrained areas has demonstrated that relaxing the Stage 1 criteria would not alter the outcomes of Stage 2 and would not produce any site areas that would perform equally to, or better than, site areas I, J and L.

3.3.7 A more detailed summary of the sensitivity analysis is provided in Appendix G.

Figure 3.1: Stage 3 Fine Screening assessment results



Source: Mott MacDonald

4 Conclusion and Next Steps

4.1 Conclusions

4.1.1 High-level infrastructure requirements were developed for each of the seven shortlisted site areas, including WWTP site location, tunnel corridors and potential shaft locations as well treated effluent discharge pipeline routes.

4.1.2 The infrastructure requirements for the seven site areas were then assessed against 14 RAG assessments criteria.

4.1.3 The results of all the RAG assessments were compared against one another and the best performing site areas were identified. In the comparison of the site areas, several criteria were considered to be of greater importance than others. These criteria, in order of importance, were:

- Affordability
- Impact on local communities
- Green Belt, and
- Carbon.

4.1.4 The main results of the comparison of the RAG assessments were:

- Overall site areas I, J and L performed better than all of the other site areas. This is mainly due to their proximity to the strategic road network and the existing WWTP (which reduces the length of wastewater transfer tunnels), when compared with all of the other site areas.
- The relatively short lengths of both the tunnel to each of the site areas and the return pipeline or tunnel to the River Cam are also significant factors in why site areas I, J and L perform better than the other site areas, particularly in the assessments for the affordability and carbon criteria.
- Development of a new WWTP at site areas I, J and L would be achievable within the limits of the HIF funding. Whereas, developing a new WWTP at site areas A, B and C would not be affordable within the limits of the HIF funding. Development at site area H would also be affordable within the limits of the HIF funding but would cost more than site areas I, J and L.
- The road transport routes for site areas I, J and L have a relatively low potential impact on local communities compared with those for site areas A, B, C and H.
- The closest site areas to the existing WWTP and the River Cam, i.e. I, J and L, had the lowest carbon emissions for waste water transfer infrastructure (tunnels, pipelines and pumping stations). In contrast, site areas A, B and C had the highest estimated carbon emissions, which were all more than 200% of the lowest estimated carbon emissions (site areas I, J and L).
- Site areas I, J, H and L are within the Green Belt, and as such ‘very special circumstances’ would need to be demonstrated to promote one of these site areas for development. Whereas, site areas A, B and C are outside of the Green Belt and therefore potentially more suitable for development of a WWTP in planning policy terms.
- Development at site areas A, B and C is considered to be unaffordable, would have a high risk of impacts on the local community and would result in higher carbon emissions. These factors are considered to outweigh the potential suitability in planning policy terms. As a result, it is considered that these site areas are not feasible options for development of a new WWTP.

- Although site areas H, I, J and L are all within the Green Belt, development of site area H presents a higher risk of impact on the local community, higher carbon emissions and greater risk of impact on a Principal Aquifer in comparison to site areas I, J and L.

4.1.5 Based on these findings it is considered that site areas A, B, C and H are not suitable for further assessment.

4.1.6 Site areas I, J and L are the best performing site areas, however, it is considered that it is not possible to differentiate between the assessments for Site areas I, J and L at this fine screening stage. Site areas I and J perform marginally better than site L, due to the proximity of site L to Cambridge Airport and sensitive watercourses. However, the proximity to Cambridge Airport relates to a consultation zone for structures above a certain height and may not result in any constraints being posed on a WWTP at site area L. In addition, it is considered that the potential impacts on watercourses could be mitigated by readily available technical solutions and it would not be appropriate to discount site area L based on these criteria at this stage.

4.1.7 Therefore, it is considered that site areas I, J and L should be taken forward for the final stage of site selection and phase one consultation.

4.1.8 Based on the conclusions of the Fine Screening assessment it was deemed appropriate to carry out a back-checking exercise to confirm that there are no other potential site areas within the study area. This involved modifying the constraints and buffers used in the Stage 1 – Initial Site Selection constraints mapping exercise and assessing the additional and expanded site areas identified. The assessment demonstrated that modifying the Stage 1 criteria would not produce any site areas that would perform equally to, or better than, site areas I, J and L.

4.2 Next steps

4.2.1 Site areas I, J and L should be taken forward for the final stage of site area selection and phase one consultation.

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Appendices

A. Drawings

B. RAG Assessments

B.1 Ease of Access

Site area	Route from A14	Journey time at peak (7:30-9:30am) from nearest A14 J	Approximate width of carriageway	Pinch points	Speed limit at entrance to site (mph)	Visibility at junction with new access road	Existing restrictions	RAG score
A	From Oakington A14 interchange via Oakington, Westwick, Cottenham and Rampton	>10 minutes	Dry Drayton Rd – 6 – 6.5m Water Lane – 5.5 – 6m Station Rd – 6m Oakington Rd – 5.5 – 6m Rampton Rd (Cottenham to Rampton) – 6m Rampton village – 5.5 – 6m Rampton Rd (Rampton to Willingham) – 5.5 – 6m	Traffic calming measures throughout Oakington. Traffic signals at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic signals at junction with Cambridge Busway. Mini Roundabout at Junction between Oakington Road and Rampton Road in Cottenham. Traffic Calming measures on entrance to Rampton on Rampton Road.	60	Straight section of Rampton Road, approx. 250m to 90 degree sweeping bend. Open fields and no vegetation or structures on road verge. Good visibility in both directions.	County HGV policy does not include restrictions on this route.	Red
B	From Oakington A14 interchange via Oakington, Westwick, Cottenham and Rampton	>10 minutes	Dry Drayton Rd – 6 – 6.5m Water Lane – 5.5 – 6m Station Rd – 6m Oakington Rd – 5.5 – 6m Rampton Rd (Cottenham to Rampton) – 6m Rampton village – 6m Rampton Rd (Rampton to Willingham) – 5.5 – 6m	Traffic calming measures throughout Oakington. Traffic signals at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic signals at junction with Cambridge Busway. Mini Roundabout at Junction between Oakington Road and Rampton Road in Cottenham. Traffic Calming measures on entrance to Rampton on Rampton Road.	60	Straight section of Rampton Road, although approx. 150m to 90 degree sweeping bend. Large hedge along verge. Potential for poor visibility towards bend.	County HGV policy does not include restrictions on this route.	Red
C	From Oakington A14 interchange via Oakington and Westwick	5-10 minutes	Dry Drayton Rd – 6 – 6.5m Water Lane – 5.5 – 6m Station Rd – 6m Oakington Rd – 5.5 – 6m	Traffic calming measures throughout Oakington. Traffic signals at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic signals at junction with Cambridge Busway.	60	Straight section of Oakington Road, no significant bends nearby. Open fields and no vegetation or structures on road verge. Good visibility in both directions.	County HGV policy does not include restrictions on this route.	Amber
H	From Histon A14 interchange via Histon	5-10 minutes	Bridge Road – 7 – 10m Water Lane – 7m Glebe Road – 6m to 7m Cottenham Rd – 5.5 – 6m	Traffic signals at junction of Bridge Road and Cambridge Road Traffic signals at junction of Bridge Road and Chequers Road Traffic signals at four way junction on Water Lane in Histon	50 (30mph zone approx. 50m south)	Straight section of Cottenham Road, 100m to slight bends in both direction. Open fields with moderate hedge on road verge. Moderate visibility in both directions.	County HGV policy does not include restrictions on this route.	Amber
I	From Milton A14 interchange via A10 and Butt Lane	<5 minutes	A10 – 10 -12m Butt Lane – 6m	Traffic lights at junction of A10 and Butt Lane	60	Long straight section of Butt Lane, no bends nearby. Open fields, tree and low hedge on road verge. Adjacent to Farm Entrance.	County HGV policy does not include restrictions on this route.	Green
J	From Milton A14 interchange via A10 and Butt Lane	<5 minutes	A10 – 10 -12m Butt Lane – 6m Milton Rd – 5.5 – 6m	Traffic lights at junction of A10 and Butt Lane	60	Long straight section of Butt Lane, no bends nearby. Open fields, minor vegetation and no structures road verge.	County HGV policy does not include restrictions on this route.	Green
L	From A14 junction 35 via Newmarket Road A1303, High Ditch Road and Low Fen Drove Way	5-10 minutes	Newmarket Road – 7-12m High Ditch Road – 5m Low Fen Drove Way bridge over A14 – 5m Low Fen Drove Way – 4m (overgrown)	Junction of Newmarket Road (A1303) with High Ditch Road Low Fen Drove Way, bridge over A14	60	Long straight section of road, no bends. Tree/bush cover on both sides on lead up to access junction, but low vegetation at proposed junction. 100m to larger trees on roadside.	Environmental HGV weight limit along High Ditch Road.	Amber

B.2 Affordability

Site area	RAG Score	Cost as percentage of total HIF fund
A		122%
B		118%
C		104%
H		89%
I		77%
J		84%
L		73%

B.3 Carbon

Site area	RAG Score	Relative percentage when compared with option with the lowest whole life carbon emissions
A		270%
B		260%
C		210%
H		140%
I		110%
J		130%
L		100%

B.4 Landscape

B.4.1 See Appendix C

B.5 Nature conservation and biodiversity

B.5.1 See Appendix D

B.6 Historic Environment

B.6.1 See Appendix E

B.7 Contaminated Land

B.7.1 See Appendix F

B.9 Groundwater impacts

Site area	RAG Score	Comment
A		Number of shafts in Principal Aquifer: 2 Length of tunnel in Principal Aquifer: 3,150m Tunnel will penetrate full lateral thickness of Lower Greensand Group (WFD groundwater body GB40501G445700) and intermediate shafts are also likely to penetrate the Lower Greensand Group. No unconfined Principal Aquifer below the WWTP site No superficial deposits below the site and risk of contamination below site is low.
B		Number of shafts in Principal Aquifer: 2 Length of tunnel in Principal Aquifer: 2,850m Tunnel will penetrate full lateral thickness of Lower Greensand Group (WFD groundwater body GB40501G445700) and intermediate shafts are also likely to penetrate the Lower Greensand Group. No unconfined Principal Aquifer below the WWTP site No superficial deposits below the site and risk of contamination below site is low.
C		Number of shafts in Principal Aquifer: 2 Length of tunnel in Principal Aquifer: 3,000m Tunnel and intermediate shafts will penetrate Lower Greensand Group (WFD groundwater body GB40501G445700). No unconfined Principal Aquifer below the WWTP site North west of site is underlain by River Terrace Deposits classified as a Secondary A aquifer, potential connection with the Old West River WFD surface waterbody GB205033043375. Risk of contamination is low.
H		Number of shafts in Principal Aquifer: 1 Length of tunnel in Principal Aquifer: 2,000m Tunnel, intermediate and terminal shafts will penetrate Lower Greensand Group (WFD groundwater body GB40501G445700). No unconfined Principal Aquifer below the WWTP site Site is underlain by River Terrace Deposits classified as a Secondary A aquifer, no likely connection to WFD surface waterbody. Risk of contamination is low.
I		Number of shafts in Principal Aquifer: 1 Length of tunnel in Principal Aquifer: 200m Tunnel and terminal shafts will penetrate Lower Greensand Group (WFD groundwater body GB40501G445700). No unconfined Principal Aquifer below the WWTP site East of site is underlain by River Terrace Deposits classified as a Secondary A aquifer, likely connection with the Cam WFD surface waterbody GB105033042750. Risk of contamination is low.
J		Number of shafts in Principal Aquifer: 1 Length of tunnel in Principal Aquifer: 500m Tunnel and terminal shafts will penetrate Lower Greensand Group (WFD groundwater body GB40501G445700). No unconfined Principal Aquifer below the WWTP site Majority of site is underlain by River Terrace Deposits classified as a Secondary A aquifer, no likely connection with any WFD surface waterbody. Risk of contamination is moderate.
L		Number of shafts in Principal Aquifer: 1 Length of tunnel in Principal Aquifer: 200m Tunnel and terminal shaft will penetrate Grey Chalk Subgroup (part of WFD groundwater body GB40501G400500 – Cam and Ely Ouse Chalk) Grey Chalk Subgroup underlies the WWTP, which is a Principal Aquifer. However, permeability is likely to be low due to nature of this formation. No superficial deposits below the site. Risk of contamination is low.

B.11 Surface water impacts

Site area	RAG Score	Comment
A		Not within 500m of a WFD water body and field drains located within the site but these are more than 1km from a WFD watercourse. Risk of adverse impact to any WFD surface waterbody is considered to be low
B		Not within 500m of a WFD water body and field drains located within the site are more than 1km from a WFD watercourse. Reynolds Ditch is 400m from the site boundary to the south and connects to the Old West River WFD surface waterbody GB205033043375. Risk of adverse impact to any WFD surface waterbody is considered to be moderate, however, it is likely that the risk can be mitigated by reasonable technical means through the implementation of an appropriate drainage strategy and construction environmental management plan.
C		Not within 500m of a WFD waterbody. Field drains within the site are connected to the Smithy Fen Engine Drain, this runs parallel to the Old West River WFD surface waterbody GB205033043375 but is not believed to be connected to this waterbody within 1km of the site. Risk of adverse impact to any WFD surface waterbody is considered to be low
H		Not within 500m of a WFD water body and field drains within 50m of the site are not connected to a WFD water body within 1km Risk of adverse impact to any WFD surface waterbody is considered to be low
I		Not within 500m of a WFD water body and field drains within 50m of the site are not connected to a WFD water body within 1km Risk of adverse impact to any WFD surface waterbody is considered to be low
J		Not within 500m of a WFD water body and field drains within 50m of the site are not connected to a WFD water body within 1km Risk of adverse impact to any WFD surface waterbody is considered to be low
L		Western boundary of site is approximately 600m from the Cam WFD surface waterbody GB105033042750 and south-eastern boundary is approximately 600m from the Bottisham Lode – Quy Water WFD surface waterbody GB105033042700. Field drains within the site boundary connect to Quy Water, the flow route of the drain between the site and the Quy Water is approximately 750m. Risk of adverse impact to any WFD surface waterbody is considered to be moderate, however, it is likely that the risk can be mitigated with an appropriate drainage strategy and construction environmental management plan.

B.13 Green belt

Site area	RAG Score	Comment
A		Site area A would be outside the Green Belt and the proposed building would not be required to meet the above policies. However, the proposed development includes a pipeline and several intermediary shafts which would pass through the Green Belt. NPPF Para.146 explains that development such as engineering operations are not considered inappropriate development and therefore none of the proposed development would be required to meet the Local Plan Green Belt Policies.
B		Site area B would be outside the Green Belt and the proposed building would not be required to meet the above policies. However, the proposed development includes a pipeline and several intermediary shafts which would pass through the Green Belt. NPPF Para.146 explains that development such as engineering operations are not considered inappropriate development and therefore none of the proposed development would be required to meet the Local Plan Green Belt Policies.
C		Site area A would be outside the Green Belt and the proposed building would not be required to meet the above policies. However, the proposed development also includes a pipeline and several intermediary shafts which would pass through the Green Belt. NPPF Para.146 explains that development such as engineering operations are not considered inappropriate development and therefore none of the proposed development would be required to meet the Local Plan Green Belt Policies.
H		Site area H is entirely within the Green Belt. The proposed development would most likely constitute inappropriate development. The planning application would need to demonstrate very special circumstances for this project to be appropriate. The proposed development would also need to provide mitigations in order to: • Preserve the unique character of Cambridge as a compact, dynamic city with a thriving historic centre; • Maintain and enhance the quality of its setting; and • Prevent communities in the environs of Cambridge from merging into one another and with the city.
I		Site area I is entirely within the Green Belt. The proposed development would most likely constitute inappropriate development. The planning application would need to demonstrate very special circumstances for this project to be appropriate. The proposed development would also need to provide mitigations in order to: • Preserve the unique character of Cambridge as a compact, dynamic city with a thriving historic centre; • Maintain and enhance the quality of its setting; and • Prevent communities in the environs of Cambridge from merging into one another and with the city.
J		Site area J is entirely within the Green Belt. The proposed development would most likely constitute inappropriate development. The planning application would need to demonstrate very special circumstances for this project to be appropriate. The proposed development would also need to provide mitigations in order to: • Preserve the unique character of Cambridge as a compact, dynamic city with a thriving historic centre; • Maintain and enhance the quality of its setting; and • Prevent communities in the environs of Cambridge from merging into one another and with the city.
L		Site area J is entirely within the Green Belt. The proposed development would most likely constitute inappropriate development. The planning application would need to demonstrate very special circumstances for this project to be appropriate. The proposed development would also need to provide mitigations in order to: • Preserve the unique character of Cambridge as a compact, dynamic city with a thriving historic centre; • Maintain and enhance the quality of its setting; and Prevent communities in the environs of Cambridge from merging into one another and with the city.

B.14 Risk to aviation

Site area	RAG Score	Comment
A		Within wildlife safeguard zone as site area is 11.4km from airport boundary. Within Safeguarding Zones – Heights for Referral for any structure greater than 90m above ground level.
B		Within wildlife safeguard zone as site area is 11.2km from airport boundary. Within Safeguarding Zones – Heights for Referral for any structure greater than 90m above ground level.
C		Within wildlife safeguard zone as site area is 9.2km from airport boundary. Within Safeguarding Zones – Heights for Referral for any structure greater than 90m above ground level.
H		Within wildlife safeguard zone as site area is 6.6km from airport boundary. Within Safeguarding Zones – Heights for Referral for any structure greater than 90m above ground level.
I		Within wildlife safeguard zone as site area is 4.6km from airport boundary. Within Safeguarding Zones – Heights for Referral for any structure greater than 45m above ground level.
J		Within wildlife safeguard zone as site area is 4.5km from airport boundary Within Safeguarding Zones – Heights for Referral for any structure greater than 45m above ground level.
L		Within wildlife safeguard zone as site area is 1.0km from airport boundary Within Safeguarding Zones – Heights for Referral for any structure greater than 15m above ground level.

B.16 Non-traffic impact of construction on local residents and communities

Site area	RAG Rating	Comments/Justification
A		Construction (site): Low impact on surrounding residential areas Construction (road): No residential properties/community facilities in the vicinity Construction (pipeline): Pipeline largely avoids residential areas Construction (tunnel): Moderate possibility of shafts adjacent to residential areas
B		Construction (site): Northstowe new town (under construction) 300m from south-west of site area, potential noise and dust problems if new homes occupied, mitigated by prevailing winds. Construction (road): No residential properties/community facilities in the vicinity Construction (pipeline): Pipeline largely avoids residential areas Construction (tunnel): Low possibility of shafts adjacent to residential areas
C		Construction (site): Site area is 500m south west of Cottenham village, potential noise and dust problems for residential/business properties and community facilities due to prevailing wind direction. Construction (road): No residential properties in the vicinity Construction (pipeline): Pipeline largely avoids residential areas Construction (tunnel): Moderate possibility of shafts adjacent to residential areas
H		Construction (site): No ProWs on/near site area; site area is approx. 200m north of office/business premises at Manor Farm, but indicative WWTP boundary is further away and impacts are unlikely. Construction (road): A few residential properties in the vicinity Construction (pipeline): Pipeline largely avoids residential areas Construction (tunnel): Low possibility of shafts adjacent to residential areas
I		Construction (site): Site area is 500m south west of Landbeach village, potential noise and dust problems due to prevailing wind direction. The Milton Maize Maze local attraction is located 200m from the south eastern boundary. A cemetery is located 500m from the from the south eastern boundary. Construction (road): One residential property in the vicinity Construction (pipeline): Pipeline largely avoids residential areas, a cemetery is located 100m from the corridor Construction (tunnel): No intermediate shafts
J		Construction (site): Low impact on surrounding residential areas. Business premises located 300m to north of site area, potentially subject to noise/air quality – mainly warehousing uses and unlikely to be highly sensitive. Construction (road): A few residential properties in the vicinity Construction (pipeline): Pipeline largely avoids residential areas Construction (tunnel): No intermediate shafts
L		Construction (site): Only one residential property in proximity to site area in prevailing wind direction, low impact on surrounding residents. Construction (road): One residential property potentially affected on Low Fen Drove Way Construction (pipeline): Pipeline avoids residential areas Construction (tunnel): No intermediate shafts

B.17 Traffic impact on construction and operation on local residents and communities

Site area	Route from A14	Potential congested areas	Sensitive receptors	Safety concerns	Air Quality Management Areas (AQMA)	RAG
A	From Oakington A14 interchange via Oakington, Westwick, Cottenham and Rampton	Traffic lights at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic lights at junction with Cambridge Busway. Traffic Calming measures on entrance to Rampton on Rampton Road.	Oakington: Residents and businesses on Dry Drayton Road and Water Lane, and Oakington CofE Primary School Westwick: Residents on Station Road, Scallywags Day Nursery. Cottenham: Residents on Oakington Road and Rampton Road Rampton: Residents on Church End, The Green and High Street, community resources including village green and Rampton Village Hall	Pedestrian crossings in Oakington. Busway cycleway crossing between Oakington and Westwick No accident clusters on route	A14 corridor AQMA at beginning of route on Dry Drayton Rd.	Red
B	From Oakington A14 interchange via Oakington, Westwick, Cottenham and Rampton	Traffic lights at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic signals at junction with Cambridge Busway. Traffic Calming measures on entrance to Rampton on Rampton Road.	Oakington: Residents and businesses on Dry Drayton Road and Water Lane, and Oakington CofE Primary School Westwick: Residents on Station Road, Scallywags Day Nursery. Cottenham: Residents on Oakington Road and Rampton Road Rampton: Residents on Church End, The Green and High Street, community resources including village green and Rampton Village Hall	Pedestrian crossings in Oakington. Busway cycleway crossing between Oakington and Westwick No accident clusters on route	A14 corridor AQMA at beginning of route on Dry Drayton Rd.	Red
C	From Oakington A14 interchange via Oakington and Westwick	Traffic signals at junction of Cambridge Road and Dry Drayton Road in Oakington. Traffic signals at junction with Cambridge Busway.	Oakington: Residents and businesses on Dry Drayton Road and Water Lane and Oakington CofE Primary School Westwick: Residents on Station Road, Scallywags Day Nursery.	Pedestrian crossings in Oakington. Busway cycleway crossing between Oakington and Westwick No accident clusters on route	A14 corridor AQMA at beginning of route on Dry Drayton Rd.	Red
H	From Histon A14 interchange via Histon	Congestion along Bridge Road, Water Lane and Glebe Road in Histon and Impington. Traffic Lights at Junction of Water Lane with Impington Lane.	Histon and Impington: Residents and businesses on Bridge Road, Water Lane, Glebe Road and Cottenham Road. Histon and Impington Junior School. Community resources including Homefield Park, Histon Green, Histon and Impington Cemetery.	Cycle Lanes on Bridge Road Combined footpath and cycleway on Cottenham Road at proposed entrance to site. No accident clusters on route	A14 corridor AQMA at beginning of route on Bridge Rd.	Red
I	From Milton A14 interchange via A10 and Butt Lane	Traffic lights at junction of A10 and Butt Lane	Residents and businesses on Butt Lane, including at Sunrise Farm	Combined footpath and cycleway on Butt Lane on opposite side of proposed entrance to site. No accident clusters on route.	No AQMA on route	Amber
J	From Milton A14 interchange via A10 and Butt Lane	Traffic lights at junction of A10 and Butt Lane	Residents and businesses on Butt Lane, including at Sunrise Farm	Combined footpath and cycleway on Butt Lane on same side as proposed entrance to site. No accident clusters on route	No AQMA on route	Amber
L	From A14 junction 35 via Newmarket Road A1303, High Ditch Road and Low Fen Drove Way	Junction exit and Newmarket Road	Three residential properties on Newmarket Road set back from the road One residential property at junction of High Ditch Road and Low Fen Drove Way	Cycle lane on Newmarket Road with crossing at turning from Newmarket Road onto High Ditch Lane. Accident cluster at A14 junction	No AQMA on route	Amber

B.18 Impact on Public Rights of Way

Site area	RAG Rating	Comments/Justification
A		ProW 189/1 runs along the western boundary of the proposed site, only minor disruption during construction likely.
B		ProW 189/8 crosses the proposed site and would need re-routing almost entirely. ProW 189/4 runs along the southern boundary of the proposed site, only minor disruption during construction likely.
C		No ProWs cross, or are adjacent to, the site.
H		No ProWs cross, or are adjacent to, the site.
I		ProW 143/3 (Mere Way) adjacent but only minor disruption anticipated.
J		ProW 143/3 (Mere Way) adjacent but only minor disruption anticipated.
L		No ProWs cross, or are adjacent to, the site.

C. Landscape and visual amenity appraisal

D. Nature conservation and biodiversity appraisal

E. Historic Environment appraisal

F. Contaminated Land Assessments

G. Stage 1 Sensitivity Analysis

G.1 Introduction

G.1.1 Due to the three best performing site areas being located in the Green Belt, it was deemed necessary to carry out a sensitivity analysis to test whether relaxing the constraints used in Stage 1 – Initial Site Selection would identify additional potential site areas or would change the outcomes of Stage 2 or 3.

G.1.2 Therefore, the Stage 1 criteria have been reviewed and modified to test the sensitivity of the unconstrained area to the changes in the constraints and buffers employed.

G.2 Modified criteria

G.2.1 The community criterion used in Stage 1 initial site selection comprised a 400m buffer around all residential properties, including isolated single properties. This constraint had the largest impact on the potential areas for development within the study area. Therefore, relaxing this criterion would have the most impact on unconstrained areas.

G.2.2 It is considered that it may be possible, although not preferable, for the project to acquire individual properties and thus create additional potential site areas for the new WWTP. These additional site areas might have lower overall impact than site areas I, J and L. Therefore, for the sensitivity analysis, this criterion was changed by applying the 400m buffer around settlements rather than individual properties. The 400m buffer was retained as this complies with Anglian Water's asset encroachment policy which is based on the company's experience and best practice.

G.2.3 As discussed in the Stage 1 report, commercial properties were not included within this criterion as, unlike residential properties, it is considered that not all types of commercial property would experience the same impact if the WWTP was located nearby. Therefore, they have not been included in the modified criteria either.

G.2.4 The other Stage 1 criteria were also reviewed and those considered to have a significant impact within the study area were modified. Using professional judgement, the buffers around the constraints were reduced to what was considered to be a reasonable minimum. The details of these criteria and how they were modified are provided in Table G.1.

Table G.1: Adjusts to other Stage 1 criteria

Criteria	Original definition	Modified definition
Major infrastructure	100m buffer applied around A roads, B roads, railways and other significant transport routes (guided busway). 20m buffer applied around C roads.	100m buffer around railways 20m buffer around A, B, C and unclassified roads and guided busway
Protected Areas and Statutory Designated sites	500m buffer applied around Areas of Outstanding Natural Beauty, Ancient Woodland, Local Nature Reserves, National Parks, Ramsar sites, Special Areas of Conservation, Special Protection Areas, Sites of Special Scientific Interest, World Heritage sites, Scheduled Ancient Monuments, Listed Buildings (all grades), Registered Parks and Gardens and Registered Battlefields.	Buffer reduced to 250m around Areas of Outstanding Natural Beauty, Ancient Woodland, National Parks, Ramsar sites, Special Areas of Conservation, Special Protection Areas and Sites of Special Scientific Interest. Buffer removed around Local Nature Reserves. 250m buffer applied around World Heritage sites, Scheduled Ancient Monuments, Grade II Listed Buildings, Registered Parks and Gardens and Registered Battlefields. 500m buffer around Grade I and II* Listed Buildings.
Airfields & Runways	Used extent of airfields without buffers.	No change
Flood Zones	Environment Agency Flood Zones 2 and 3 applied without buffers.	
Landfill Sites	Current and historic landfill sites applied without buffers.	
Oil & Gas Pipelines, Major Electrical Transmission Routes	100m buffer applied around National Grid infrastructure.	
Watercourses	100m buffer applied around main rivers designated by the Environment Agency.	

G.3 Mapping results

G.3.1 The modified criteria were combined and mapped within the Study Area in order to identify the unconstrained areas. The expected footprint of 22ha was then used to identify additional site areas of sufficient size for the new WWTP. The results of the mapping exercise are provided in Table G.2, which details the number of additional site areas with an area greater than 22ha identified, both within and outside of the Green Belt.

Table G.2: Sensitivity analysis results

Scenario	Unconstrained areas >22ha		
	Within Green Belt	Outside of Green Belt	Total
Original criteria	9	5	14
Modified criteria	13	11	24

G.3.2 The results indicate that there are 10 additional site areas with an area greater than 22ha, and of these, 4 would be within and 6 outside of the Green Belt. The locations of the additional site areas are shown on Figure G.1 (labelled S1-S10).

G.3.3 As well as identifying additional site areas, revising the Stage 1 criteria also increased the size of the unconstrained areas for the originally identified areas. For example, site area J almost doubled in size from 52ha to 102ha, which is illustrated on Figure G.1.

G.3.4 It is considered necessary to assess all the additional unconstrained areas and expanded site areas against the criteria of greater importance from Stage 2 and 3 in order to identify if they are

likely to perform equally to, or better than, site areas I, J and L. Therefore, a high-level comparison of the areas against the criteria has been conducted.

G.4 Assessment of expanded longlist site areas

G.4.1 The expanded longlist site areas have been reviewed to assess their performance against the criteria of greater importance in Stage 2 and 3 to identify whether using the modified Stage 1 criteria would change the outcomes of Stage 2 or 3.

G.4.2 Reviewing these expanded site areas indicated that in all cases the additional area does not improve the performance of these site areas against the criteria of greater importance for the following reasons:

- The site areas further away from the existing WWTP, such as A, B, C, G, K, M and N still have the same issues of unaffordability, potential traffic impacts and high carbon emissions.
- The expanded areas do not improve the performance of site areas that contain allocated site areas or community facilities, such as D, E and F, as the expanded area is not sufficient to move the WWTP away from these constraints.
- For almost all of the site areas, the expanded areas would allow greater flexibility to orientate the WWTP. However, the additional areas would also either bring the WWTP closer to residential areas or would require the acquisition of and loss of occupied residential properties. Both of which are not desirable in terms of impacts on local communities.

G.5 Assessment of unconstrained areas

G.5.1 The additional unconstrained areas greater than 22ha in size have been assessed in relation to their performance against the criteria of greater importance in Stage 2 and 3 to identify whether use of the modified Stage 1 criteria would result in additional site areas passing Stages 2 and 3. A summary of the findings of this assessment is provided below:

- S1, S2 and S3 – These site areas perform similarly to A, B and C as they are located outside of the Green Belt. However, they would be unaffordable, the long length of tunnels and pipelines required would result in high construction complexity and carbon emissions and the traffic impacts on local residents would be moderate to high.
- S4 – This site area is located outside of the Green Belt. However, the potential impact on the local community is high as the site area is within 0-200m of 8 residential properties, which would either need to be acquired or would be at high risk of amenity impacts. It is also within 400m of an important community and residential facility (Emmaus) and 300m of a nursery. In addition, the site area would only score moderately for affordability, construction complexity and carbon emissions.
- S5 and S6 – These site areas would potential perform similarly to I, J and L in terms of cost, carbon and traffic impacts and they are also in Green Belt. However, the potential impact on the local community at these site areas is higher as they are located within 0-200m of more than 10 residential properties, which would either need to be acquired or would be at high risk of amenity impacts. S5 and S6 are also located between three villages of Landbeach, Waterbeach and Milton, which would increase the risk of visual amenity impacts. In addition, S6 also encompasses part of a recreation facility.
- S7 and S8 – These site areas encompass the Cambridge Science Park, St John's Innovation Centre and the existing WWTP and therefore are not feasible.
- S9, S10 and S11 – These site areas score similarly to M and N. The key constraints for these site areas are that they are all within Green Belt and they would also be unaffordable. Furthermore, the long length of tunnels and pipelines required and sensitive geology of the

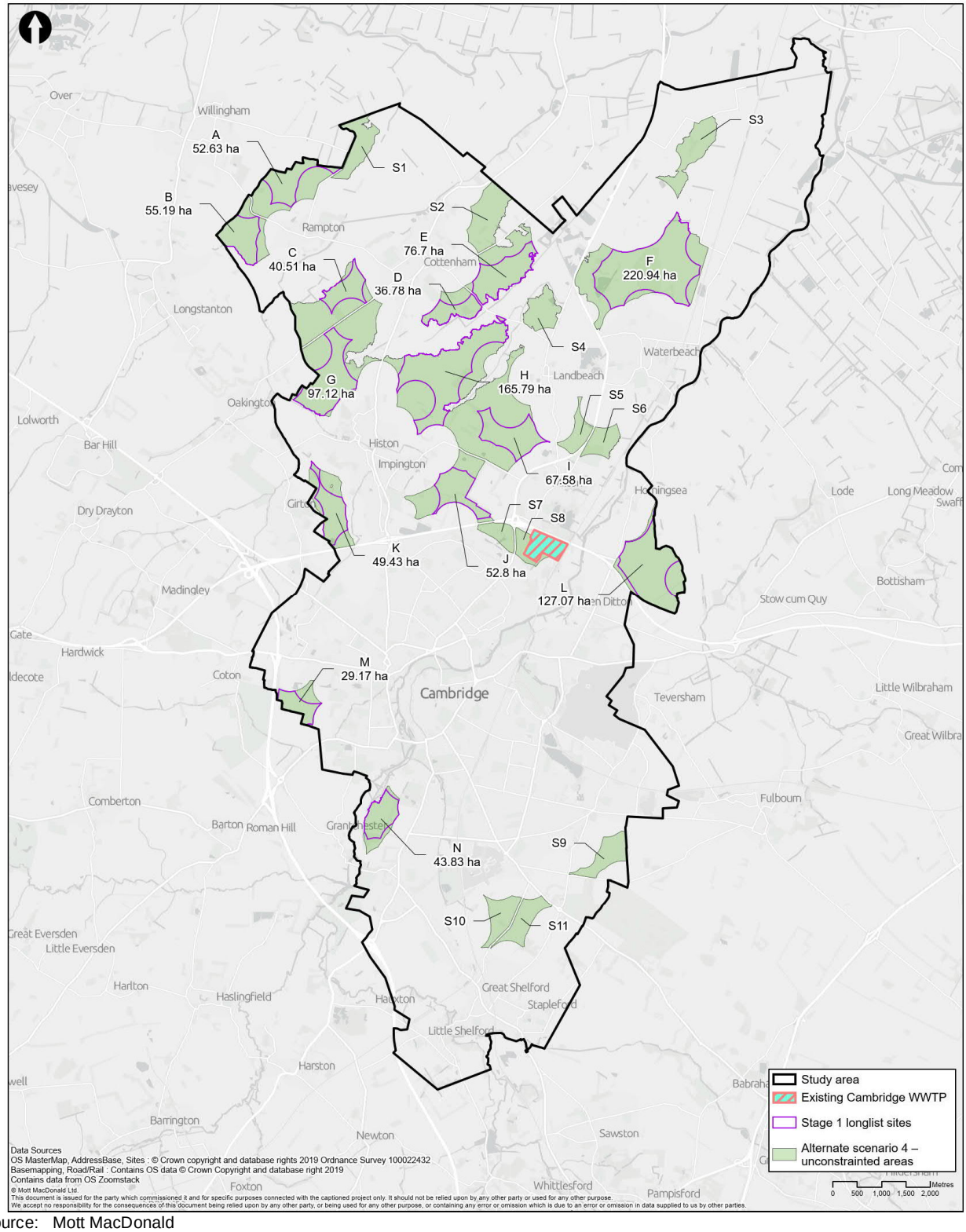
area (chalk groundwater springs are in the vicinity) would result in high construction complexity and carbon emissions, and the traffic and non-traffic impacts on local residents would be high due to their proximity to the edge of Cambridge, Addenbrookes Hospital and residential areas. In addition, they are all located around the highest locations in Cambridge, which would be likely to cause impacts on visual amenity.

G.6 Conclusions

G.6.1 The review of the expanded longlist site areas has demonstrated that relaxing the Stage 1 criteria would not improve the performance of any of the longlisted site areas such that the outcomes of Stage 2 or 3 would change.

G.6.2 The assessment of the additional unconstrained areas has demonstrated that relaxing the Stage 1 criteria would not produce any additional site areas that would perform equally to, or better than, site areas I, J and L.

Figure G.1: Stage 1 sensitivity analysis



Source: Mott MacDonald

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You can view all our DCO application documents and updates on the application on The Planning Inspectorate website:

https://infrastructure.planninginspectorate.gov.uk/projects/eastern/cambridge-waste-water-treatment-plant-relocation/