Greater Cambridge Local Plan
Strategic Spatial Options Assessment

Integrated Water Management Study, November 2020

On behalf of **Greater Cambridge Shared Planning**

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List of Abbreviations and Units

Abbreviation	Definition
CIL	Community Infrastructure Levy
ELMS	Environmental Land Management Scheme
GCSPS	Greater Cambridge Shared Planning Service
PBDE	Polybrominated diphenyl ethers
PFOS	Perfluorooctanesulfonic acid
RAPID	Regulators' Alliance for Progressing Infrastructure Development
RBMP	River Basin Management Plan
S106	Section 106 of the Town and Country Planning Act 1990
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
WRC	Water Recycling Centre (Sewage Treatment Works)
WRE	Water Resources East
WRMP	Water Resources Management Plan

Unit	Definition
Ml	Million litres
Ml/d	Million litres per day
l/p/d	Litres per person per day

Executive Summary

Stantec UK Ltd have been commissioned by Greater Cambridge Shared Planning Service (GCSPS) to prepare an Integrated Water Management Study as an evidence study to support the development of the Greater Cambridge Local Plan.

This interim report provides a high-level commentary on the opportunities, constraints and uncertainties for water aspects (flood risk, water supply, wastewater and water quality) for the strategic (non-site specific) spatial options currently being tested by the GCSPS. These initial evidence findings will be reported to the Joint Local Plan Advisory Group in Autumn 2020, and help to inform further engagement with stakeholders. This report has been prepared in advance of completing the main Integrated Water Management Study documents (a Level 1 Strategic Flood Risk Assessment, an Outline Water Cycle Study and a Detailed Water Cycle Study), which due to timing of receipt of data and ongoing studies by others will be completed later in 2020 / 2021.

This report is based on information received to date from stakeholders. Consultation with stakeholders is ongoing and not all questions can be answered at this stage. Where necessary, we have made assumptions that aim to be conservative, technically achievable and represent a “safe” fall-back position. The analysis and findings of this interim report will be revisited in greater depth in the Outline and Detailed Water Cycle Study.

For flood risk, wastewater treatment, and water quality, there are constraints to development due to existing areas of high flood risk, wastewater treatment capacity limitations, and existing diffuse and point source pollution. At minimum, development will need to mitigate any further detrimental impacts on flood risk, wastewater treatment and water quality, to have a neutral impact. However, there are also opportunities for major development to offer betterment to existing conditions, for example by reducing flood risk downstream, reducing point and diffuse pollution, and supporting larger integrated water management schemes including more natural wastewater treatment options.

For water supply, over-abstraction of the Chalk aquifer is having a detrimental impact on environmental conditions, particularly during dry years that may become more frequent due to the impacts of climate change. None of the growth scenarios considered here offer the opportunity to mitigate these existing detrimental impacts. Even without any growth, significant environmental improvements are unlikely to be achievable until major new water supply infrastructure is operational, which is unlikely to occur before the mid-2030s. Therefore, this analysis has focussed on a “no additional detriment” neutral position. To prevent any increase in abstraction and its associated detrimental environmental impacts, mitigation measures will be necessary. All stakeholders agree this should include ambitious targets for water efficiency in new development.

For the three proposed growth trajectories, the analysis has concluded:

- Although there are constraints to development for flood risk, wastewater treatment and water quality in all three trajectories, these could plausibly be addressed with appropriate mitigation measures in compatible timescales to result in either no additional detrimental environmental impacts or betterment where possible.
- The high growth scenario has potential "deal-breaker" constraints due to water supply limitations. The timing of planning, constructing and commissioning new water supply infrastructure is not currently compatible with the Local Plan timescale for the high growth scenario.
- The medium growth scenario is plausibly achievable for water supply but has significant constraints or uncertainties that will be difficult to overcome, technically challenging and/or costly. The proposed growth could be accommodated if regional scale water supply solutions are operational by the mid-2030s, and suitable interim measures are implemented beforehand to mitigate impacts. These will need rapid planning and investment in the early part of the next Asset Management Period (2025 – 2030). There is a high uncertainty associated with the interim measures.
- The minimum growth scenario would be the most sustainable of the three trajectories, in terms of preventing any further detrimental impacts on the water environment. Interim mitigation measures will still be necessary to prevent detrimental impacts before regional scale water supply solutions are operational, but there is a greater certainty for the planning and implementation of these measures due to their smaller magnitude and later timing, compared to the medium growth scenario.

For the eight proposed location options, the analysis has concluded:

- Growth is most preferable concentrated in new settlements or urban extensions that avoid high flood risk areas and can maximise opportunities for high standards of design for flood risk management, efficient water usage and re-use, and multi-functional blue-green infrastructure.
- Growth is least preferable in dispersal to existing villages or densification of urban areas, because of the high existing flood risk in these areas, and the smaller expected size of developments offering fewer transformational opportunities for blue-green infrastructure, flood risk reduction, and high quality resilient water recycling systems.
- While development in the Cambourne area could have good opportunities for water resources with the potential to be supplied by bulk transfer, these are potentially offset by the significant constraints for wastewater treatment at Bourn and Uttons Drove WRC, for which further work would be necessary to identify technically feasible mitigation measures or alternative provision (e.g. re-routing to Papworth WRC).

These conclusions are dependent on assumptions made in this study, in particular regarding linear trajectories of growth, and allowances for growth in non-household water demand. The Outline Water Cycle Strategy, to be completed late 2020, will include scoping of the work required at the Detailed stage to support the Local Plan including assessing growth levels, spatial approach and policy options, and where possible reducing uncertainties and addressing assumptions regarding growth trajectories and non-household demand.

1 Introduction

1.1 Background

1.1.1 Stantec UK Ltd were commissioned by Greater Cambridge Shared Planning Service (GCSPS) to prepare an Integrated Water Management Study as an evidence study to support the development of the Greater Cambridge Local Plan. The Greater Cambridge area represents South Cambridgeshire District Council and Cambridge City Council (“the Councils”, Figure 1).

1.1.2 The Integrated Water Management Study will consist of:

- A Level 1 Strategic Flood Risk Assessment, to support a sequential, risk-based approach to the location of development, required as a standalone document under the National Planning Policy Framework.
- An Outline Water Cycle Study, to identify the baseline / as-existing water situation.
- A Detailed Water Cycle Study, to provide advice on the broad strategy options being considered for the location of growth and the sites coming forward for allocation in the draft Local Plan.

1.2 Assessment of Strategic (Non-Site Specific) Spatial Options

1.2.1 Cambridge City Council and South Cambridgeshire District Council completed public consultation on the Greater Cambridge Local Plan First Conversation (Issues and Options) in early 2020. Building on the initial options set out in the First Conversation, the Councils have identified three growth level options for homes and jobs and eight strategic (non-site specific) spatial options for testing. Description of the options and explanation of how they were developed is set out in the “Greater Cambridge Local Plan: strategic spatial options for testing – methodology” document (GCSPS, 2020).

1.2.2 The Councils have asked consultants producing Local Plan evidence studies, including the Sustainability Appraisal, to assess the strategic options with regard to their initial evidence findings. This report forms one element of that assessment.

1.2.3 The initial evidence findings will be reported to the Joint Local Plan Advisory Group in Autumn 2020, and help to inform further engagement with stakeholders.

1.2.4 Preferred Options public consultation is planned for Summer / Autumn 2021, including a preferred strategy and draft allocations. The process of Local Plan preparation is set out below in Figure 2.

1.2.5 This report provides a high-level commentary on the opportunities, constraints and uncertainties for each strategic spatial option, for water aspects (flood risk, water supply, wastewater and water quality). Due to timings of receipt of data and completion of other studies, this report has been prepared in advance of completing the Integrated Water Management Study documents listed in Section 1.1.2, which will provide further context and evidence for the commentary provided in this report.

1.3 Structure of Report

1.3.1 This report is structured as follows:

- Chapter 2 provides an overview of the strategic spatial options and growth scenarios, including population projections. Further information on these can be found in the Councils draft “Strategic Spatial Options for Testing – Methodology” paper.
- Chapter 3 provides a headline summary of the baseline / as-existing water situation constraints and opportunities. Further information on this will be provided in the Outline Water Cycle Study, anticipated to be completed in late 2020.
- Chapter 4 presents our commentary on the opportunities, constraints and uncertainties for each strategic spatial option.
- Chapter 5 presents our conclusions and recommendations.

1.4 Assumptions and Limitations

1.4.1 Our comments are based on the information we have received from stakeholders to date. Consultation with stakeholders is ongoing and not all questions can be answered at this stage. Where necessary, we have made assumptions that aim to be conservative, technically achievable and represent a “safe” fall-back position. The key assumptions in this study are:

- That growth over the plan period will be linear. In particular, this assumption affects the timings of increased water demand, which are critical in determining whether a proposed growth trajectory could be sustainable (see Appendix A). A faster initial growth rate may invalidate the conclusions of this report.
- That non-household (e.g. commercial, industrial and agricultural) demand for water will grow at the same ratio to household water demand as occurs at present. Appendix A details the allowance made; however, this could be exceeded if planning permission is granted to water-intensive developments.

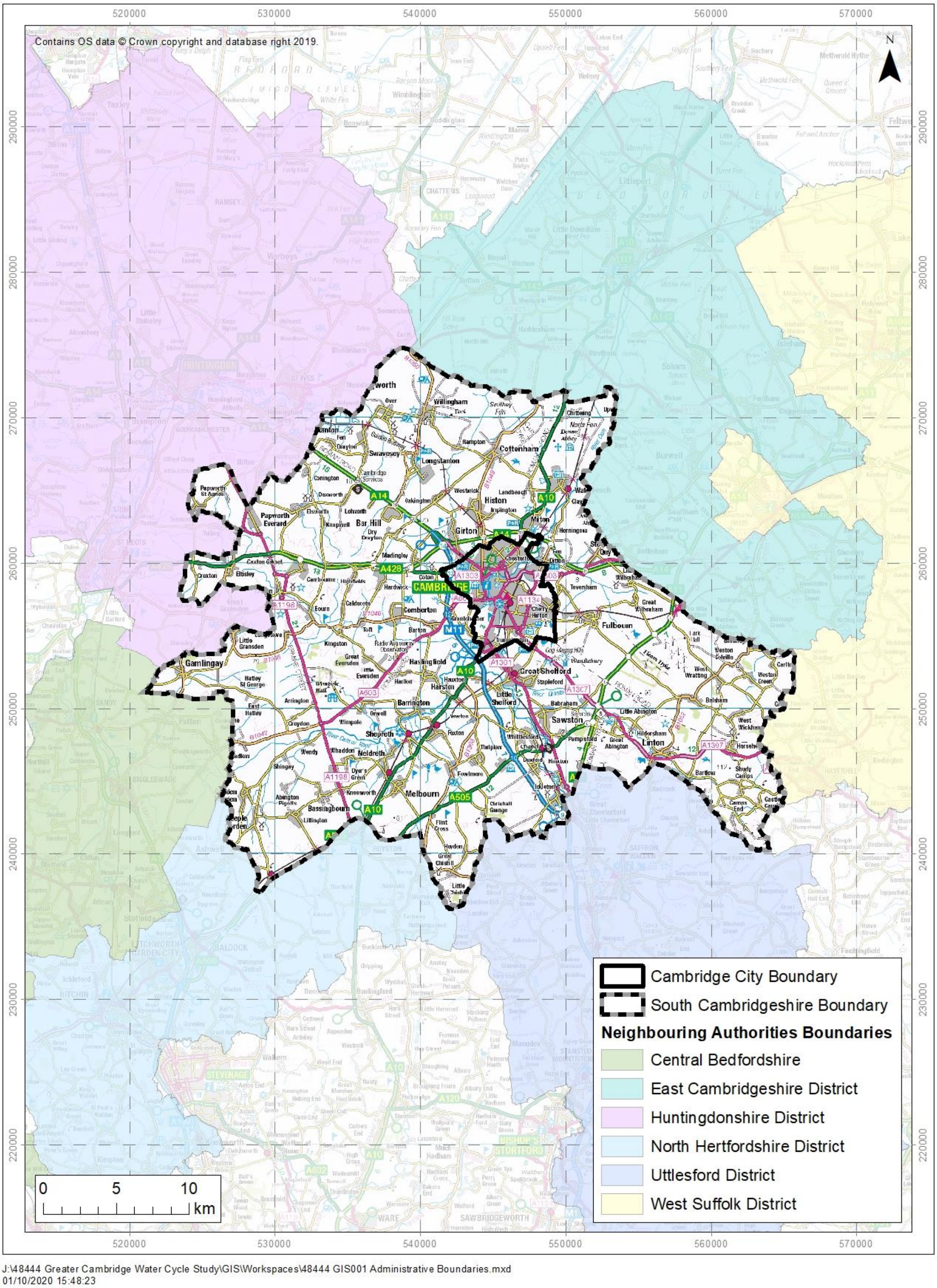

Figure 1: The Greater Cambridge study area (South Cambridgeshire and Cambridge City), and Neighbouring Authorities

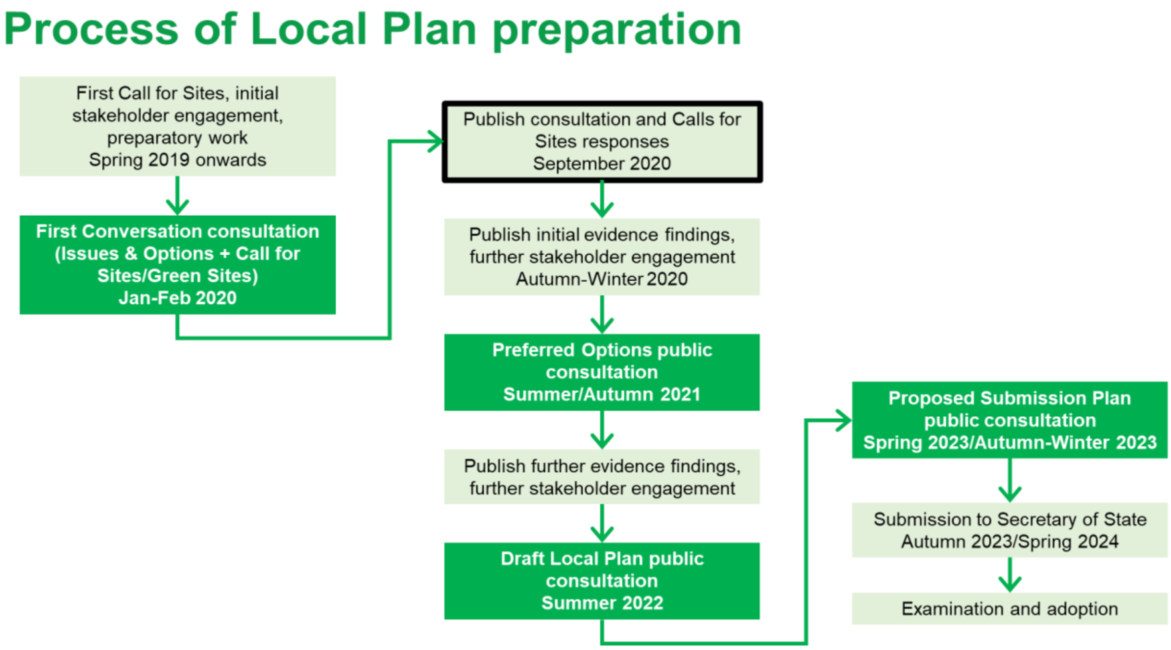

Figure 2: The Local Plan preparation process

2 Strategic Spatial Options and Growth Scenarios

2.1 Overview

2.1.1 The strategic spatial options for testing were provided by GCSPS and are listed in Table 1. For each option, a minimum, medium and maximum growth scenario is applied, for the period 2020 – 2041 (Table 2). The growth trajectories have been defined by GCSPS as follows:

- The minimum growth option is based on the Standard Method, which is the minimum level of growth the councils should be planning for according to national policy[1]. This was determined to be 1,743 homes per annum (36,603 in total, 2020 – 2041). We note amendments to the Standard Method are currently being consulted on[2], and the revised method would reduce to the growth required to 1,518 homes per annum (31,878 in total, 2020 – 2041).
- The medium growth option is based on evidence for higher housing growth potential derived from a central scenario employment forecast, assuming a continuation of the 2011 Census commuting pattern.
- The maximum growth option uses a higher employment forecast, and assumes that the housing demand above the level of the Standard Method is provided for within the Greater Cambridge area, rather than from in-commuting from neighbouring districts.

Option Number	Option Description
1	Densification of existing urban areas
2	Edge of Cambridge - outside the Green Belt
3	Edge of Cambridge - Green Belt
4	Dispersal - new settlements
5	Dispersal – villages
6	Public transport corridors
7	Supporting a high-tech corridor by integrating homes and jobs (south of Cambridge)
8	Expanding a growth area around transport nodes (Cambourne)

Table 1: Strategic spatial options, defined by GCSPS

[1] https://www.gov.uk/guidance/housing-and-economic-development-needs-assessments
[2] https://www.gov.uk/government/consultations/changes-to-the-current-planning-system

Growth scenario	Employment (jobs)	Housing (dwellings)
Minimum	45,800	36,700
Medium	58,500	42,000
Maximum	79,500	57,000

Table 2: Growth options, 2020-41 (rounded up to the nearest hundred), defined by GCSPS

2.2 Housing and Population Projections

2.2.1 These growth scenarios include growth already allocated in the previous Local Plan. The supply of employment land is greater than that needed in all growth scenarios and therefore it is unlikely that there will be a need to allocate significant employment land. Although some will likely be necessary to address qualitative issues and ensure any new settlements are balanced, in agreement with GCSPS, employment land has not been considered in detail in this review. An allowance has been made in water demand projections for growth in non-household demand, in proportion to household demand (see Appendix A). This allowance is a key assumption of this study and could be exceeded if planning permission is granted to water-intensive developments.

2.2.2 The housing estimates have been increased by 10% to ensure an adequate buffer against uncertainties, and then offset by the existing supply within the planning system, including commitments and a windfall allowance. Table 3 shows the resulting balance of houses to be found for each scenario. Different delivery rate assumptions have been used by GCSPS for the maximum scenario, compared to the minimum and medium. A higher delivery rate was applied to the maximum scenario, to enable the required housing to be delivered within a reasonable number of sites. This means that the maximum scenario involves fewer sites that will be built out quicker, compared to the medium scenario.

2.2.3 GL Hearn consultants have produced population projections for the Councils, associated with the housing figures for each of the growth scenarios (Table 4). These are based on the baseline housing estimates in Table 2 and do not include the 10% housing buffer applied in Table 3. Therefore, to ensure consistency with the balance of homes to be found, we have estimated additional population for the 10% housing buffer using the same occupancy rates as in Table 4. Our resulting population projections are shown in Table 5.

2.2.4 We have assumed a baseline population of 301,253 for the Greater Cambridge area in 2020, in line with the GL Hearn assessment. No information is available regarding timing of growth, and therefore, as directed by GCSPS, a linear growth has been assumed through to 2041 as shown in Figure 3 and Table 6. This linear growth trajectory is a key assumption of this analysis. In particular, this assumption affects the timings of increased water demand, which are critical in determining whether a proposed growth trajectory could be sustainable (see Appendix A). A faster initial growth rate may invalidate the conclusions of this report.

	Minimum	**Medium**	**Maximum**
Housing Growth + 10% buffer	40,300	46,200	62,700
Existing supply	36,400	36,400	36,400
Additional delivery	-	-	8,600
Balance to find	3,900	9,800	17,700

Table 3: Balance of homes to be found, 2020 – 2041, excluding current supply, and assuming faster delivery of existing sites in maximum scenario

Growth scenario	**Housing**	**Additional Population (2020 – 2041)**	**Occupancy rate (persons per dwelling)**
Minimum	36,603	73,943	2.020
Medium	41,915	87,982	2.099
Maximum	56,935	127,545	2.240

Table 4: Additional population projections and occupancy rates, supplied by GL Hearn, 2020 – 2041

Growth scenario	**Housing + 10% buffer**	**Additional Population (2020 – 2041)**	**Occupancy rate (persons per dwelling)**
Minimum	40,263	81,332	2.020
Medium	46,106	96,777	2.099
Maximum	62,629	140,288	2.240

Table 5: Amended population projects including 10% housing buffer, 2020 – 2041

Growth scenario	Annual Housing Growth + 10% buffer	Annual Population Growth + 10% buffer	2041 Total Population	Percentage change over 2020 population
Minimum	1,917	3,873	382,590	+27%
Medium	2,196	4,609	398,033	+32%
Maximum	2,982	6,681	441,552	+47%

Table 6: Annual housing and population growth including 10% buffer and resulting 2041 total population estimate for Greater Cambridge

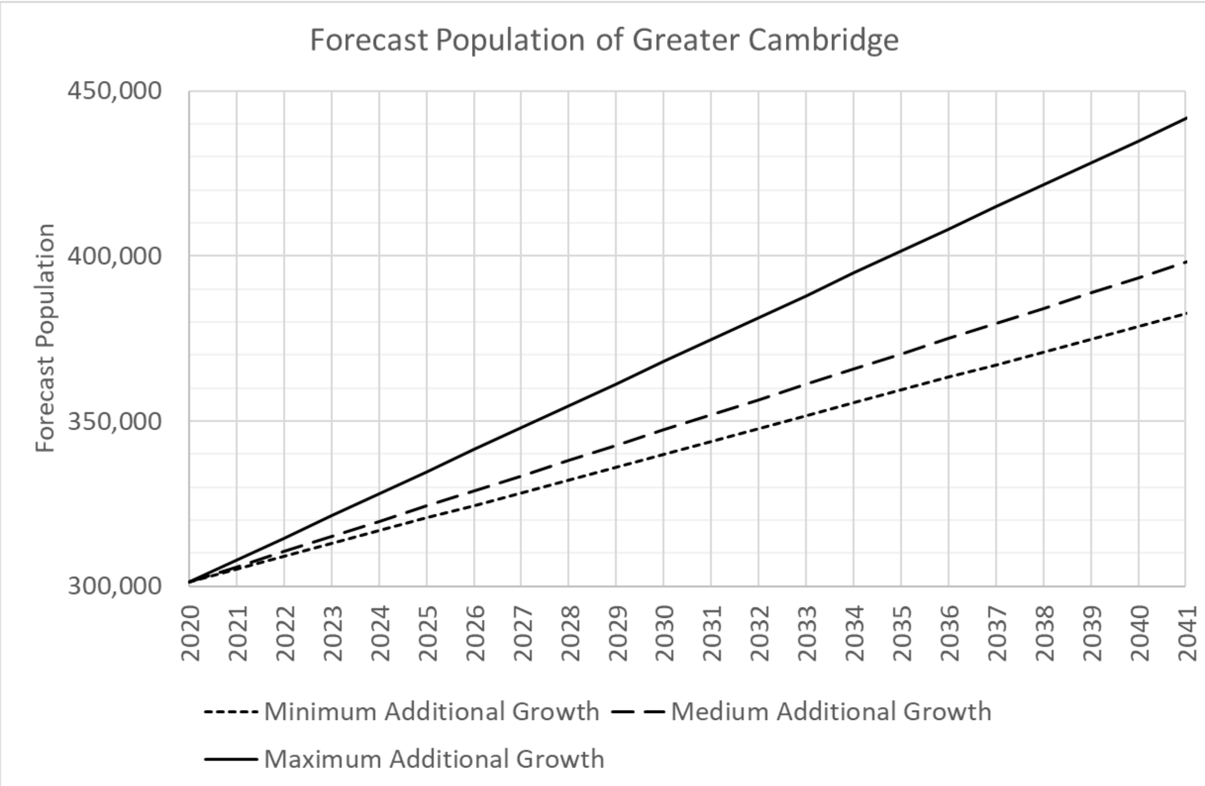

Figure 3: Forecast population of Greater Cambridge under each scenario, assuming linear growth and including 10% housing buffer.

2.3 Water Resource Zone Population Projections

2.3.1 The Water Resource Zone for the Greater Cambridge area, supplied by Cambridge Water, includes some wards of Huntingdonshire (Figure 5 overleaf). To allow a fair comparison of population estimates with the available water supply and demand in this region, we have interpolated the existing and future population of these wards from data supplied by Cambridgeshire Insight (51,393 population in 2018, increasing to 56,530 population in 2041). The resulting total population estimates for the Cambridge Water Resource Zone are shown in Table 7 and Figure 4. This is the total population exerting a demand for water from Cambridge Water, which operates a single system and does not distinguish between customers across administrative boundaries.

Growth scenario	2041 Greater Cambridge Population	2041 Cambridge Water Resource Zone Population
Minimum	382,590	439,120
Medium	398,033	454,563
Maximum	441,552	498,082

Table 7: Forecast 2041 population for Greater Cambridge and for Cambridge Water Resource Zone, including 10% housing buffer

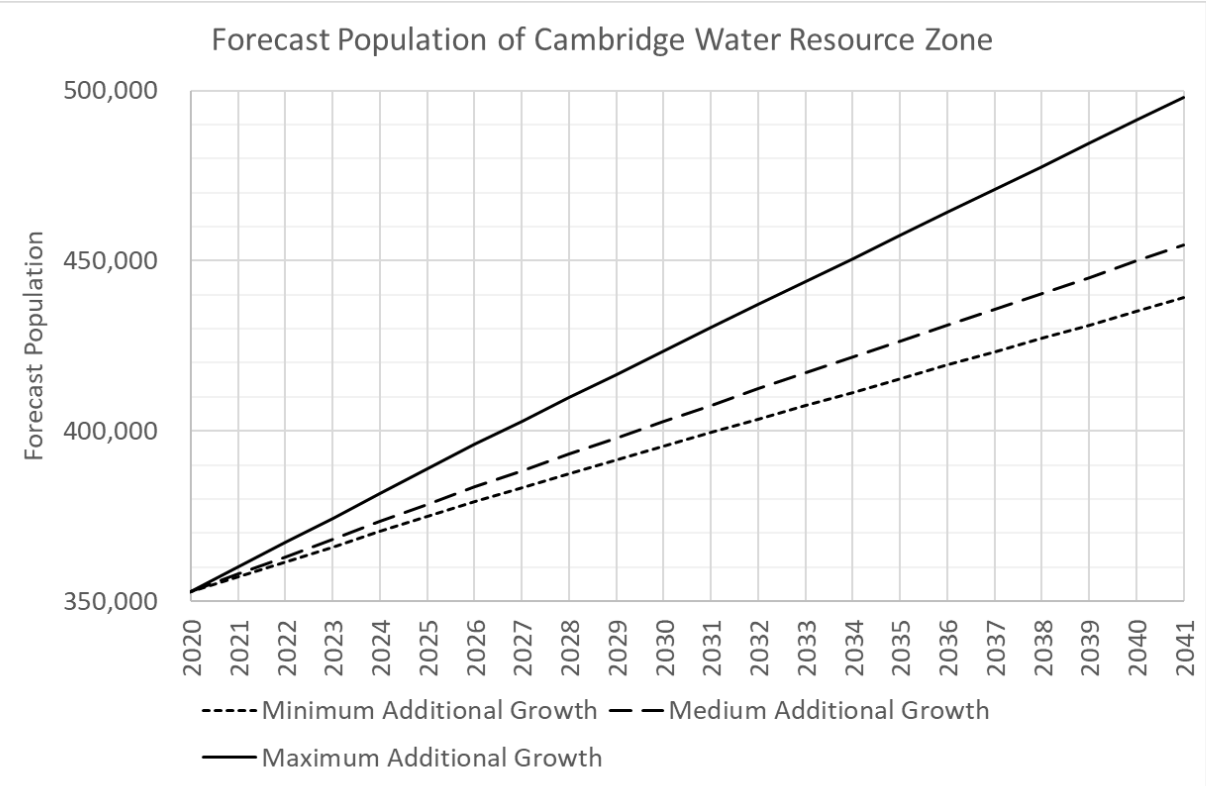

Figure 4: Forecast population of Cambridge Water Resource Zone under each scenario, assuming linear growth and including 10% housing buffer, and with Huntingdon wards included.

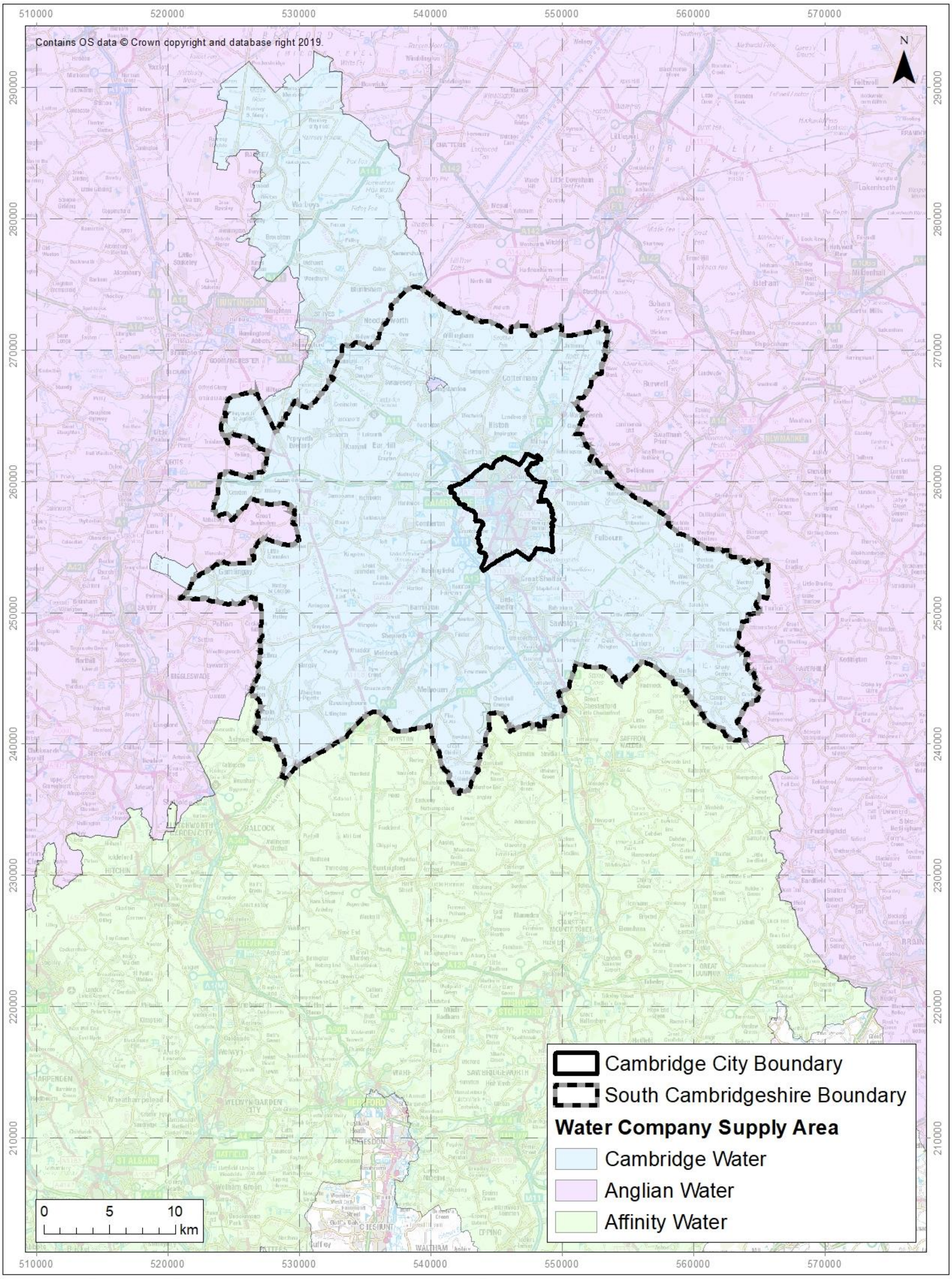

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Figure 5: Comparison between Greater Cambridge administrative boundaries and Water Company supply areas

3 Existing Water Situation: Opportunities, Constraints and Uncertainties

3.1 Context

3.1.1 The Outline Water Cycle Strategy and Level 1 SFRA will set out what is known about the baseline conditions in detail. These reports have not yet been fully drafted, with anticipated completion in late 2020. The headline findings are summarised below, along with the broad opportunities, constraints and uncertainties identified at this stage.

3.2 Flood Risk

	Flood Risk
Headline findings of baseline conditions	• Although fluvial flood risk from Main Rivers is reasonably well understood, there is extensive surface water flood risk and Ordinary Watercourse fluvial flood risk across the district, that is less well understood and affects many existing properties and settlements. Other potential sources of flood risk include groundwater, sewer and reservoir breach flooding. There are some locations where flood risk could represent a significant constraint to further development. These will be identified in the Level 1 SFRA, and the Sequential and Exception Tests applied to direct development to areas of lowest flood risk where possible. • To date, studies have not identified any economically justified strategic schemes that will reduce flood risk at the most at-risk hotspots. Property level resilience is likely to be the most cost-effective solution, in line with the Government's national strategy to promote greater resilience towards flooding[3]. • There may be larger strategic flood storage schemes in the catchment in the future, following the Environment Agency's River Great Ouse catchment storage and conveyance study currently being undertaken. Locations and volumes are currently unknown. Some storage capacity may be created at the future Cambridge Sports Lakes[4] location, pending planning permission and detailed design.

[3] https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england--2

[4] http://www.cambridgesportlakes.org.uk/

	Flood Risk
Opportunities for development	• Potential for channel improvements and additional flood storage to be delivered within riparian corridors in development sites, focussing on natural flood management techniques and reconnecting watercourses to floodplains. • Potential for daylighting of existing culverted watercourses. • Potential for development on brownfield sites to reduce runoff to greenfield rates or lower, reducing existing surface water and sewer flood risk in local area. • Potential for redevelopments in existing areas of risk to showcase flood resilient communities. • Potential for site-specific hydraulic modelling to contribute to the improved understanding of local flood risk and impacts of climate change beyond site boundaries. • Potential for retrofitting of SuDS to existing developments, including sustainable retrofitting of wastewater utilities to reduce the risk of combined sewer flooding. • Potential for flood management and SuDS schemes to deliver multi-functional benefits including biodiversity enhancements and net gain, green infrastructure, landscape enhancements, and climate change adaption. • Opportunities for landscape-scale enhancements such as distributed natural flood management techniques to benefit and enhance designated wildlife sites.
Constraints to development	• Known surface water and fluvial flood zones are constraints to development, depending on specific site location. Known flood extents will be mapped in the SFRA currently being prepared. • Pumped catchment capacities may present a constraint to runoff rates and required storage volumes, requiring additional long-term storage and mitigation measures.
Uncertainties	• Updated hydraulic modelling may be needed to confirm areas of future fluvial and surface water flood risk due to the impacts of climate change, depending on specific site location. • Risk of fluvial flooding following embankment breach may need updated modelling, depending on specific site

	Flood Risk
	location (River Great Ouse and lower parts of River Cam). • Further investigations of groundwater, sewer and reservoir breach flood risk may be necessary depending on specific site location. • It is currently unclear if / how development S106 / CIL contributions could be used to contribute to flood risk management projects in areas not directly impacted by the specific development site.

3.3 Water Supply

	Water Supply
Headline findings of baseline conditions	• Stakeholders widely agree that the Chalk aquifer that supplies the majority of potable water within the Cambridge Water Resource Zone is already under abstraction pressure, which may be having a detrimental impact on Chalk stream baseflows and causing environmental damage, particularly during dry years. This may be further exacerbated in the future by the potential impacts of climate change (UKCP18, Met Office). Natural England have highlighted the severity of the issue in potentially affecting a number of nationally and internationally designated sites. Cambridge Water's most recent Water Resource Management Plan[5] includes planned reduction in total abstractions where impacts have been identified, and incorporates restrictions to abstraction licences to reduce the risk of further deterioration in the Chalk aquifer. The Environment Agency will be reviewing and most likely looking to further reduce abstraction licences from groundwater in the future to meet WFD and RBMP targets. • There is no environmental capacity for additional development in the new Local Plan to be supplied with water by increased abstraction from the Chalk aquifer. Even the current level of abstraction is widely believed to be unsustainable, potentially causing environmental damage as described above, and pressure is building to reduce abstraction rates significantly, safeguarding natural river flow. Future water demand and supply will need to be balanced in other ways, such as through reduced usage (demand management),

[5] https://www.cambridge-water.co.uk/about-us/our-strategies-and-plans/our-water-resources-management-plan

	Water Supply
	reduced leakage, licence trading, and the development of new supply options at the regional scale (e.g. construction of new water supply reservoirs and importing water from outside of the Cambridge Water supply area). • Water Resources East is coordinating regional efforts to increase water supply, including construction of major new potable water supply reservoirs. In the longer term (2035 onwards), the new infrastructure could provide water to Greater Cambridge. Cambridge water are key (founding) members of Water Resources East and will be direct beneficiaries of any new supply options developed through the Water Resources East planning process. Cambridge Water are not directly involved in the regional RAPID (Regulatory Alliance for Progressing Infrastructure Development) schemes currently being funded through Ofwat (including the South Lincolnshire reservoir scheme) as their overall needs were below the threshold at the time[6]. • The development at Eddington of a rainwater recycling system by Cambridge Water and the University of Cambridge has demonstrated that larger sites can successfully use recycling to reduce demand for potable water to the withdrawn Code for Sustainable Homes Level 5 / 6 standard of 80 l/p/d[7]. However, it would be technically difficult and prohibitively expensive to retrofit this type of infrastructure to existing development. Even for sites with demand management, Cambridge Water still plan to be able to supply the average consumption rate, in case of drought or failure, therefore there is no betterment for resource planning, although environmental benefit through reduced actual usage would occur.
Opportunities for development	• Potential for new development to achieve significantly reduced demand, beyond the Building Regulations standard requirement of 125 l/p/d and optional requirement of 110 l/p/d consumption for new developments[8], making full use of water re-use measures on site including surface water and rainwater harvesting, and grey water recycling.

[6] https://www.ofwat.gov.uk/wp-content/uploads/2019/07/PR19-draft-determinations-Strategic-regional-water-resource-solutions.pdf

[7] https://www.gov.uk/government/publications/code-for-sustainable-homes-technical-guidance

[8] https://www.gov.uk/government/publications/sanitation-hot-water-safety-and-water-efficiency-approved-document-g

	Water Supply
Constraints to development	• There is an additional headroom (supply-demand balance) of between 2 and 4 Ml/d available in the current Water Resource Management Plan taking into account the proposed options to maximise supply and increase demand management. However, the supply-demand balance will be reviewed for the next WRMP (to be published in 2023), and the available headroom may be reduced, particularly where significant non-household or commercial development is proposed and gains planning approval. The Environment Agency would like to see existing headroom prioritised for environmental betterment. • It is therefore assumed that the development trajectory will need to be “water neutral”, i.e. result in no net loss in existing headroom and no increase in abstraction above current levels, to prevent further detrimental environmental impacts. Although reducing water demand within development sites will be essential, full water neutrality will be reliant on wider actions by Cambridge Water supported by Water Resources East, to offset net increases in demand. • To address uncertainties regarding the effects of abstraction on designated sites (including those sites where remedial measures are in place but their efficacy is still being monitored), Natural England recommend a precautionary approach to be adopted. Adverse impacts should be assumed unless evidence is available to demonstrate otherwise.
Uncertainties	• How water is supplied is not within the Local Plan’s remit to impose. To demonstrate sustainability, a commitment will be needed from Cambridge Water that new development will be supplied with water without increasing abstraction or reducing the current available headroom, which could resulting in further detrimental environmental impacts including designated sites and Priority Habitats. • It is currently unclear what volume of additional water demand could be supplied before new regional infrastructure is completed, through short-term measures such as more aggressive leakage and demand management, licence trading, or import of water from outside the region. Consultation with stakeholders is ongoing. Water Resources East will publish its first draft regional plan in summer 2021, although prior to this it will gather and present available data to its Strategic Advisory Group, which includes both councils.

	Water Supply
	• The Environment Agency have not specified what further reductions in abstractions may be required to go beyond the existing cost-benefit tested levels of improvement being actioned through the Water Industry National Environment Programme (WINEP). These further reductions will be explored in the regional plan by Water Resources East, which will set out an overall destination for reducing abstraction and the timescales for implementing further actions. It is assumed that significant decreases in licensed groundwater abstraction rates will not be feasible until alternative potable water sources are available. • It is currently unclear whether the Local Plan would be able to impose a domestic household per capita consumption that is lower than the Building Regulations optional requirement of 110 l/p/d consumption for new developments. Nevertheless, all stakeholders support ambitious water efficiency targets below this optional requirement level.

3.4 Wastewater

	Wastewater
Headline findings of baseline conditions	• Cambridge Water Recycling Centre (WRC) is currently exceeding its discharge quantity permit, reflecting that the current population it serves (213,679) is greater than that planned for. Anglian Water are negotiating a variation in the permit pending construction of a new Cambridge WRC by 2030. • The new Cambridge WRC will be designed to accommodate a total future population of 300,000 (existing population and future growth) without deteriorating water quality in the receiving River Cam. The Development Consent Order for the new WRC will quantify its impact on downstream water quality and habitats. • Elsewhere in Greater Cambridge, there are 23 further WRC treating effluent from smaller towns and villages. Some of these have capacity within their permit to receive additional flows. Others may require investment to improve treatment so that they can treat more flows without detriment to the water environment.

	Wastewater
Opportunities for development	• Anglian Water are currently preparing a Drainage and Wastewater Management Plan, to be published in 2022, which will set out long term plans for the management of wastewater treatment from 2025 to 2050. The timings of the study should allow the new Local Plan proposals to be included and appropriately planned for. • Expansion of capacity at Cambridge WRC will support continued development in the Cambridge urban area or on the urban fringe. The capacity of interconnecting sewers may become an issue but can be remedied through targeted investment in larger sewers or secondary sewers connecting directly to the WRC. • New development could be supported by new green / natural treatment options such as constructed wetlands, at existing or new WRCs, with additional low energy and low carbon benefits. The feasibility of these will be dependent on location and site constraints. • Treated effluent could be used for irrigation, allowing potable water to be prioritised in abstractions. Treated effluent could also be used for potable supplies subject to quality standards and infrastructure. However, re-use of effluent would require assessment to ensure that watercourses currently receiving treated flow are not detrimentally impacted by reduced river flows below sustainable levels, and public health is not impacted (in the context of using treated effluent in the food chain). A regional scale solution could involve re-use of WRC discharges via a downstream Fenland reservoir. Water Resources East are actively investigating these options.
Constraints to development	• Dependent on specific site location, timing of development may need to take into account any necessary WRC or sewerage upgrade works. • Depending on specific WRC impacted by growth, there may be feasibility constraints to increased capacity (e.g. at Uttons Drove and Bourn WRC) associated with the impacts of treated effluent on the receiving water body.
Uncertainties	• It is currently unknown if the Environment Agency will choose to impose lower permit restrictions on WRC outflows, to improve water quality and meet WFD targets. • It is unclear what the capacity and permit situation is at the existing Cambridge WRC prior to completion of the new facility in 2030. Depending on how the current plant permit

	Wastewater
	is amended, there may be capacity issues over the next 10 years. • The current timescale for the new Cambridge WRC is aligned to milestone dates that are fixed in the Housing Infrastructure Fund allocation for the site redevelopment. The current programme is for the new WRC to be operational by March 2028, however this will be dependent on when the Development Control order is granted, and construction can begin. This could constrain the timings of additional development in its catchment. It is currently unclear whether there are any technically feasible solutions to upgrading the existing Cambridge WRC in the interim. • As specific development locations are currently unknown, it is not possible to assess particular opportunities and constraints relating to individual WRC at this stage. • Planned growth in the west of the region (Cambourne West and Bourn Airfield) could be drained to the expanded Papworth WRC via new pipelines, to avoid known constraints at Uttons Drove and Bourn WRCs. This diversion was agreed in principle for the previous Local Plan, but the current status of these potential works is unknown at the time of writing.

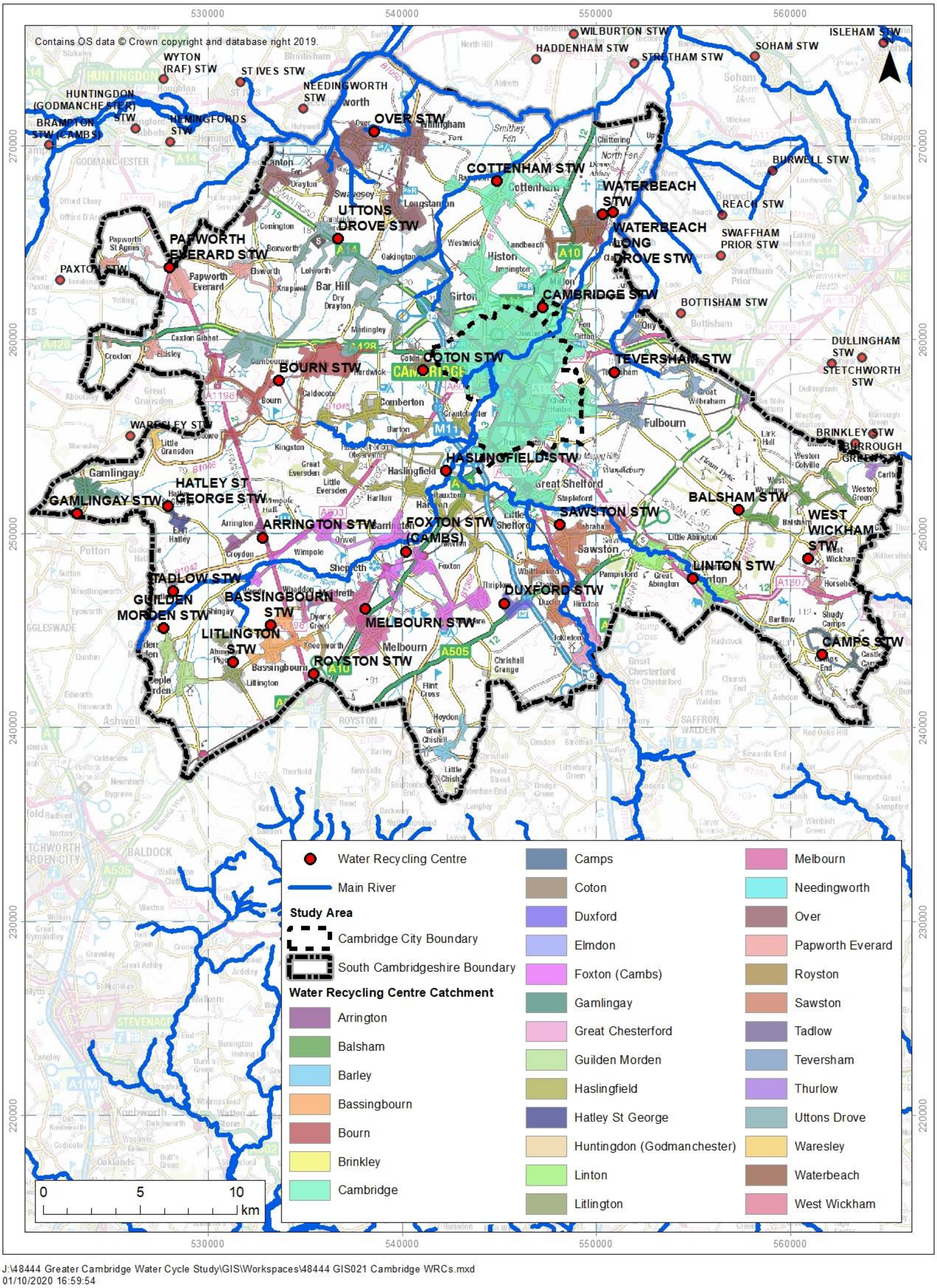

Figure 6: Water Recycling Centre locations and approximate catchments

3.5 Water Quality

Headline findings of baseline conditions	• There are 25 Water Framework Directive (WFD) assessed surface water bodies (e.g. rivers, lakes and wetlands) in the Greater Cambridge area, with the most recent WFD status classifications available from September 2019[9]. Water quality in surface bodies is predominantly "moderate" (22 bodies) with three classified as "poor". No waterbodies as classified as "good". There has been a decline in WFD status since the previous assessment in 2016, when three bodies were classified as "good". Reasons for not achieving good status within the study are predominantly associated with abstraction, wastewater treatment (point source discharges) and agricultural diffuse pollution.
	• The surface water bodies considered poor are: Cam (Audley End to Stapleford, due to point source pollution, abstraction affecting flows, and physical modification), Mill River (due to point source pollution, abstraction affecting flows, and physical modification), and Swavesey Drain (due to drought, low flows, physical modifications, and point source pollution).
	• All the surface water bodies are now failing on Chemical elements in the latest 2019 classifications. This is because of the new inclusion of PBDE and PFOS tests following the Priority Substances Directive (2018). These chemicals, historically used as flame retardants, stain repellents and fire-fighting chemicals, are ubiquitous and exceed environmental quality standards across the UK. The failure rate for PBDE and PFOS does not reflect an actual deterioration in water quality, but an improved approach to assessing these chemicals in water bodies. Many surface water bodies across England have failed to meet the stricter new chemical standards.
	• There are 5 groundwater bodies intersecting the Greater Cambridge area, with the most recent WFD status classifications available from September 2019. The overall status in four of the groundwater bodies is currently poor. The two bodies covering the majority of the Greater Cambridge area are:
	  ○ The Cam and Ely Ouse Woburn Sands, which has good quantitative and chemical status.
	  ○ The Cam and Ely Ouse Chalk, which has poor quantitative and chemical status, due to diffuse

9 https://environment.data.gov.uk/catchment-planning/

	Water Quality
	pollution (agriculture and transport runoff), point source pollution (sewage discharge), and flow (groundwater abstraction). • Natural England have identified that poor water quality is having a detrimental effect on ecology at designated sites and Priority Habitats in and downstream of the region. Low flows due to abstraction may also be affecting water quality due to dilution effects. • Source protection zones (SPZ) occur across much of the Chalk aquifer areas, with requirements for surface water runoff quality, particularly in SPZ1.
Opportunities for development	• Well-designed green / blue infrastructure will contribute to improved water quality and habitat both within sites and downstream, as well as providing wider benefits for people, wildlife, landscape, soils including the remnant peat resource, and mitigating the potential impacts of climate change. • Well-designed developments can also provide an opportunity for betterment to diffuse pollution, by removing land from intensive agricultural usage, if urban sources of pollution such as highways runoff are controlled and mitigated. • The new Cambridge WRC and other WRC upgrades could allow improvements to the quality of water bodies that are currently not meeting “good” standards due to point source pollution. • Other environmental enhancements linked with development, such as reduced agricultural runoff and tree planting for carbon offsetting, could contribute to improved water quality, by reducing diffuse sources of pollution.
Constraints to development	• Although point source pollution managed through permits should not increase, there is a risk of increase of diffuse and point source pollution from other sources increasing due to development, for example highways runoff. Positive countermeasures will be necessary to offset impacts. • Upgrades to WRC and other mitigation measures (such as additional land use change) will be necessary to maintain an overall load standstill / nutrient neutrality. The timing of upgrades will be important to avoid any deterioration in water quality as a result of development.

	Water Quality
	• Source protection zones will impact site drainage infrastructure, and development should be avoided in SPZ1.
Uncertainties	• Depending on specific site allocation, more detailed investigations of the impact of development on protected sites may be necessary. • Mitigation measures for achieving nutrient neutrality are an emerging area. It is unclear whether mitigation measures such as removing land from intensive agricultural farming to offset nutrient loading would be achievable at larger scales. Land use change to more water demanding vegetation could have a detrimental impact on groundwater recharge rates.

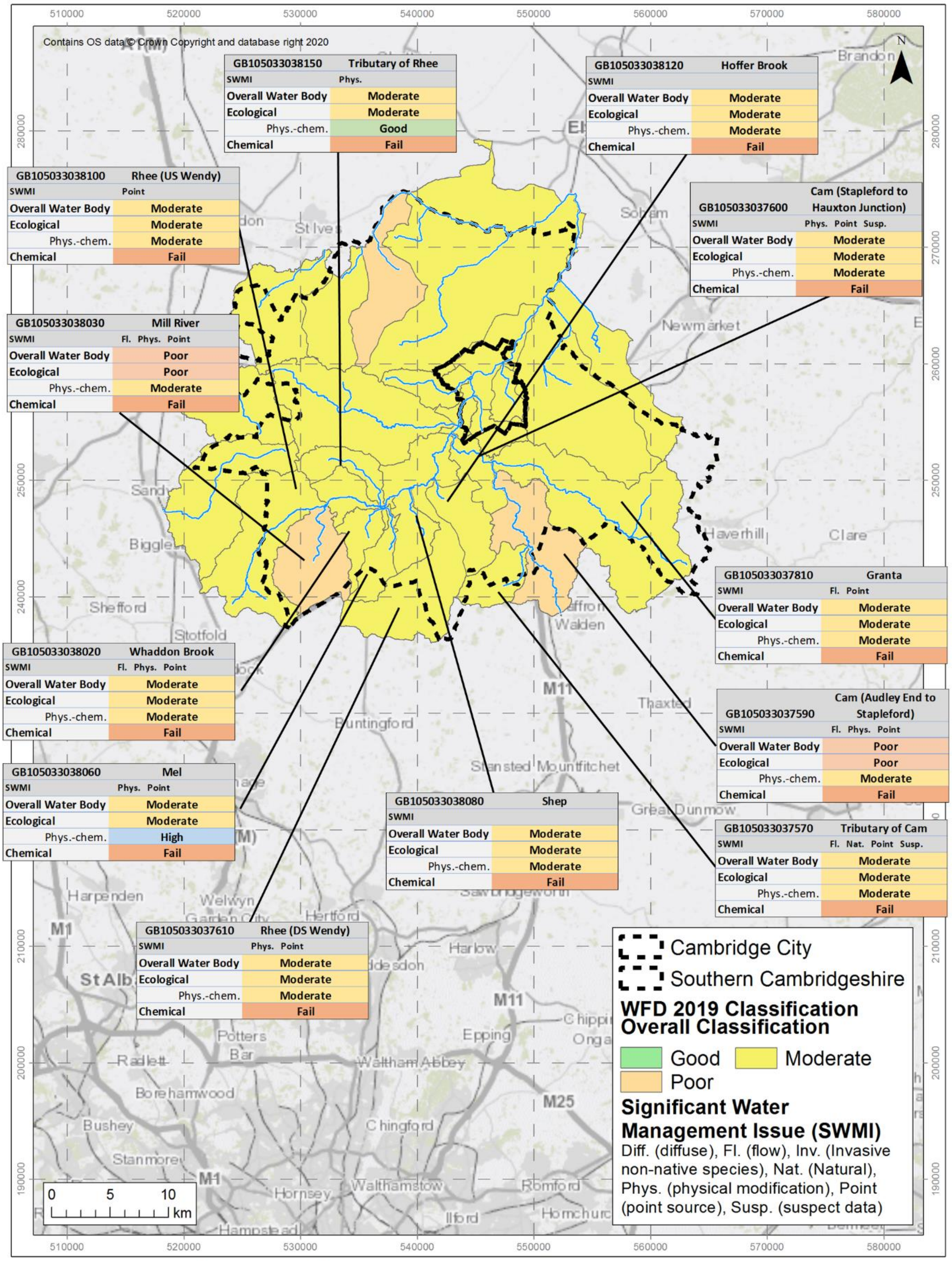

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Figure 7: Surface water bodies status and significant water management issues (southern catchments)

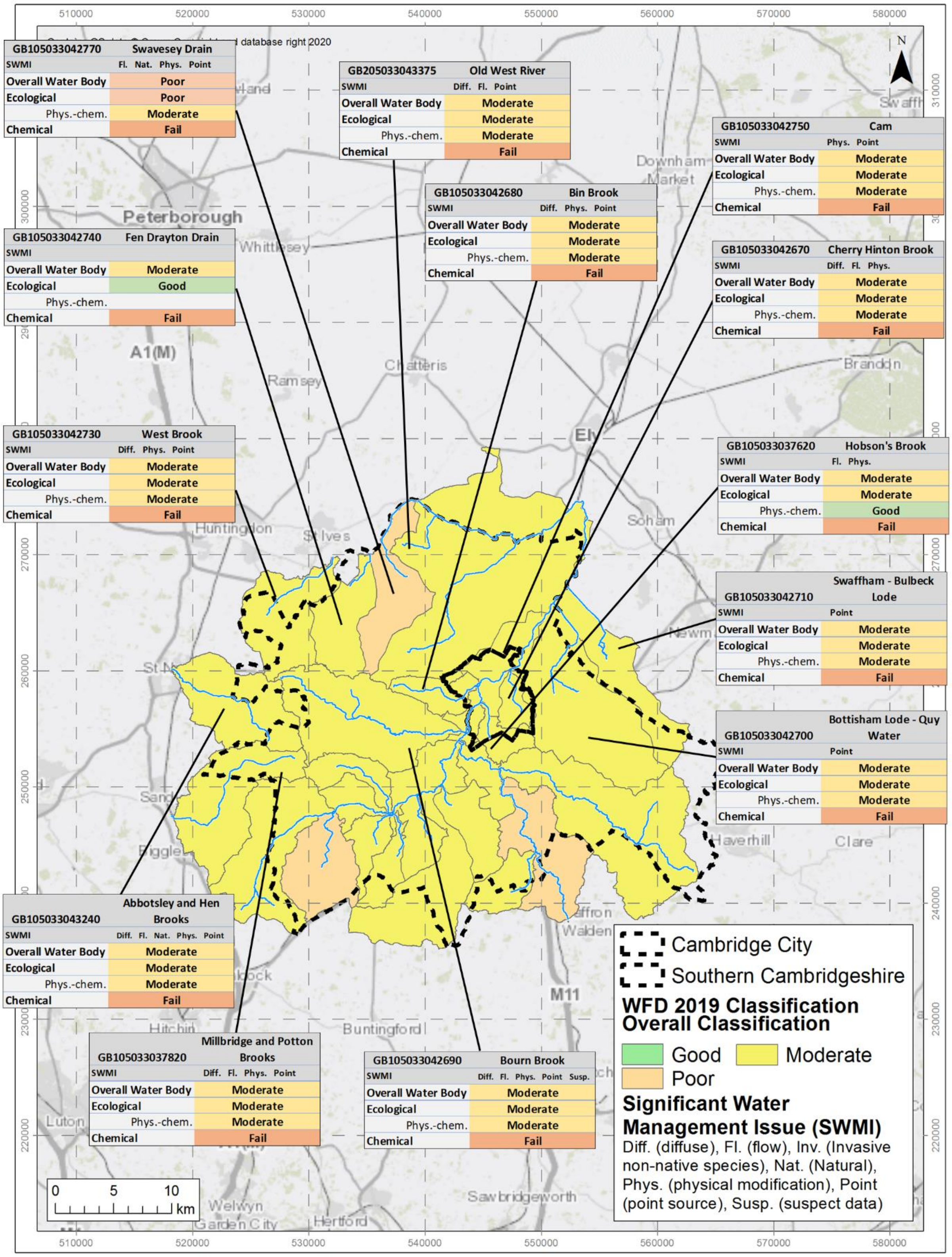

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Figure 8: Surface water bodies status and significant water management issues (northern catchments)

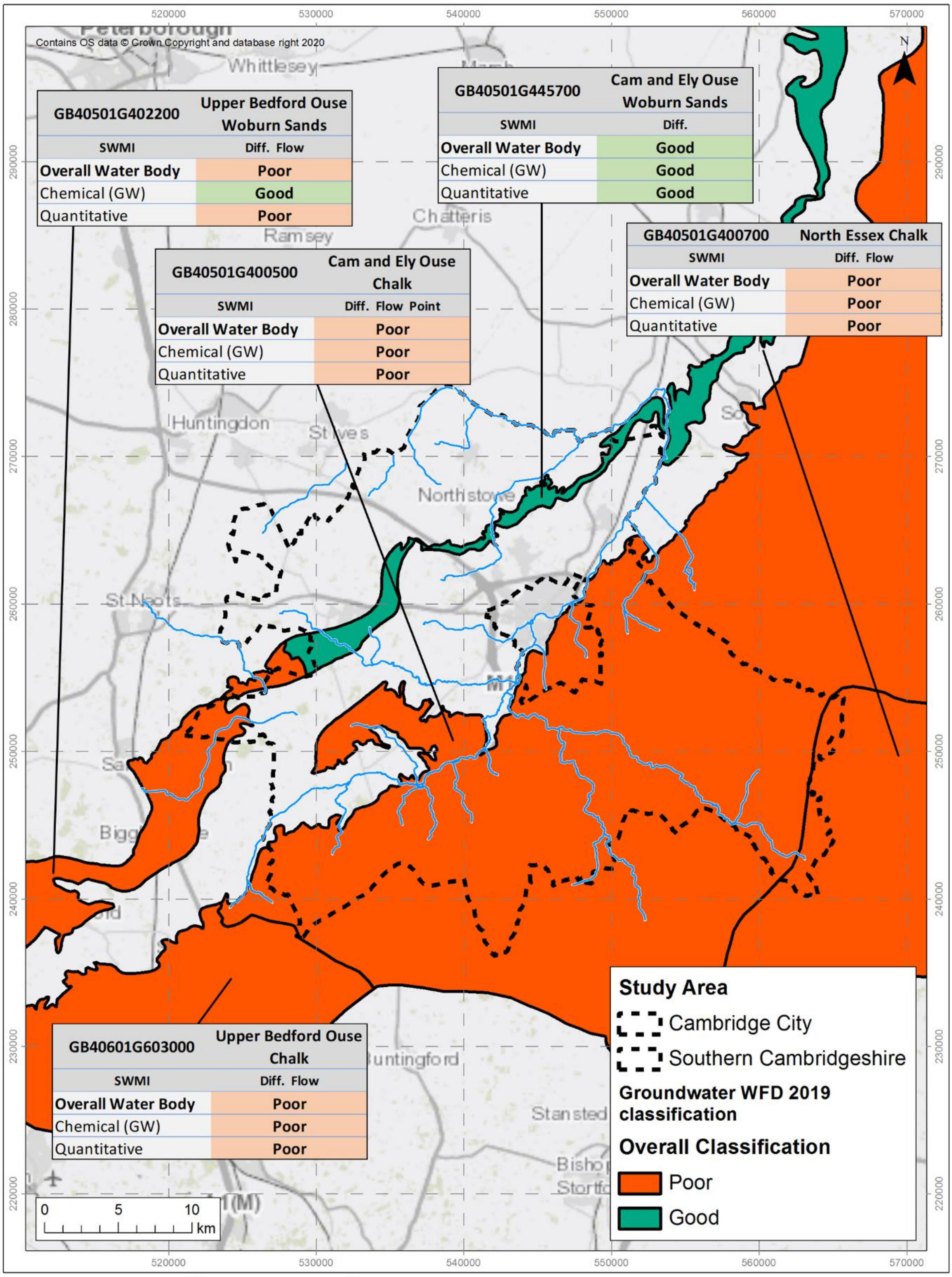

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Figure 9: Groundwater water bodies status and significant water management issues

3.6 Integrated Water Management

<table>
<tr><th></th><th>Integrated Water Management</th></tr>
<tr><td>Headline findings of baseline conditions</td><td>All stakeholders are supportive of a more integrated approach to water management. This holistic approach would reference the wider effects of water-related impacts on the natural environment, including biodiversity, landscape, soils and agriculture, access to green infrastructure and associated health and well-being, and mitigating the potential impacts of climate change.
There are few examples of this being undertaken at present, in part due to the historic division of responsibilities for water management between the stakeholders (e.g. water supply and drainage divided between separate utility companies). The Eddington site is one example where rainwater and surface water run-off have been captured for re-use, and the open water storage ponds form part of the open space with leisure benefits and public art.</td></tr>
<tr><td>Opportunities for development</td><td>There are many opportunities for an integrated approach to water management to be adopted at the new settlement or urban extension scale, for example:
Storage and re-use of site surface water run-off for non-potable domestic uses such as toilet flushing, laundry and garden watering, to reduce potable water use and help manage surface water run-off, and combining water re-use (surface water or rainwater harvesting) with sustainable drainage systems (SuDS).
Re-use of treated WRC effluent to maintain low flows in watercourses, to recharge groundwater aquifers, or to irrigate agricultural land.
Capture and storage of fluvial flood waters, to reduce flood risk downstream, for re-use in domestic applications such as toilet flushing, laundry and garden watering, to recharge groundwater aquifers, or to irrigate agricultural land.
Improvements to riparian corridors, to provide natural flood management, improve water quality and recharge to groundwater. Stream restoration activities can also improve resilience to low flow conditions caused by drought or over-abstraction.
Planting of wet woodlands to offset increases in nutrient loads, improve water quality, slow rates of runoff and increase recharge to groundwater, as well</td></tr>
</table>

	Integrated Water Management
	as potentially contributing towards carbon neutrality. This should be carefully planned as a change of land use to more water demanding vegetation can reduce groundwater recharge rates. o Planted SuDS features, such as bioretention systems, integrated across development sites and catchments to treat surface water runoff and manage flows at all scales, and providing multiple benefits to "green" streetscapes. The SuDS features could also be integrated with water re-use systems to provide non-potable water supply. o Linking water management to broader sustainability and open space strategies, to have an integrated approach where water management measures can provide solutions that also support community and environmental objectives. • Many of these opportunities are currently under active consideration by Water Resources East as part of their planning process and could have wider multi-functional benefits for people and wildlife beyond the water cycle.
Constraints to development	• There are cost implications for development sites, and may be feasibility limitations for some schemes in smaller sites / infill locations. Although there are economies of scale available for larger sites, the principles of integrated water management can be applied at smaller sites. Different solutions may be required for different scales of site, and opportunities will need to be considered at an early stage in site planning.
Uncertainties	• To be fully implemented and integrated, projects will need to be supported outside of the realm of the Local Plan, and require a wider re-think of water management at the regional scale. • There are a number of regulatory, practical and behavioural changes that present significant uncertainty to the effectiveness of some options. • It is currently unclear how aspirations for integrated water management schemes that are not directly linked to specific development sites could be actioned or funded through planning policy or S106 / CIL contributions. • The effectiveness of some of these measures in addressing adverse environmental impacts will need to be demonstrated and monitored, if to be relied upon as

	Integrated Water Management
	confirmed mitigation measures rather than additional benefits. The measures and associated monitoring will need to be agreed and delivery secured before development proceeds.

4 Review of Strategic Spatial Options

4.1 Introduction

4.1.1 We have undertaken a high-level review of the proposed strategic spatial options, firstly considering the minimum, medium and maximum growth scenarios, and secondly considering the eight proposed spatial options. Our comments on constraints and opportunities have been ranked using the categories in Tables 8 and 9.

4.1.2 A preference score (based upon water management impacts only) has been assigned to allow comments to be weighted for different location combinations across the scenarios. A high score is more favourable than a low score. Constraints have been more heavily weighted towards negative scores, to reflect that significant constraints may not be capable of being negated by positive opportunities for betterment.

Colour	Description	Score (for comparison of location options)
Purple	Constraints that will be extremely difficult or not possible to overcome within the timescales of the local plan. This has not been scored to indicate it cannot be offset by opportunities or betterments in other categories.	X
Red	Significant constraints or uncertainties that will be difficult to overcome, technically challenging and/or costly	-4
Amber	Some constraints or uncertainties that can be overcome which are technically and economically feasible	-2
Green	No or minor constraints or uncertainties that are easily overcome	0

Table 8: Constraints categorization and scoring

Colour	Description	Score (for comparison of location options)
Unshaded	No opportunities for enhancement / betterment to existing conditions, or those opportunities are technically challenging and/or costly	0
Pale Blue	Some opportunities for enhancement / betterment to existing conditions, which are technically and economically feasible	1
Dark Blue	Good opportunities for enhancement / betterment to existing conditions, which are readily achievable	2

Table 9: Opportunities categorization and scoring

4.2 Review of Growth Scenarios

Flood Risk

4.2.1 There are no specific comments for flood risk with regards to the differing growth scenarios. The flood risk constraints and opportunities are dependent on specific site location rather than on quantum of development. Although there are large areas at risk of flooding within Greater Cambridge, there are also large areas of low flood risk that could accommodate all growth. Following the Sequential Approach[10], we have assumed that development will be directed to areas of lowest flood risk first. Flood risk therefore does not differentiate between the growth scenarios, although it remains an essential consideration for the location of development.

Wastewater Treatment and Water Quality

4.2.2 There are some existing capacity constraints at existing Water Recycling Centres, which may affect the timing of development. In particular, the relocation of Cambridge WRC may limit development within its catchment until it is complete. Therefore, the maximum scenario may be less achievable, due to timing of upgrades which may prevent the early development needed to achieve the total growth target. However, all growth scenarios are considered technically feasible for achieving load standstill, if suitable mitigation measures were implemented.

Water Resources

4.2.3 Water resources are assessed in Appendix A. The analysis has focussed on a “no additional detriment” neutral position. To prevent any increase in

[10] https://www.gov.uk/guidance/flood-risk-and-coastal-change

abstraction and its associated detrimental environmental impacts, mitigation measures will be necessary to meet the water demand supply balance. These measures might include demand management, leakage reduction and bulk water imports. The feasibility of these measures has been assessed at a high level only in this analysis, and further analysis will be necessary at the detailed Water Cycle Strategy stage to confirm that development could be delivered sustainably. The uncertainties in the magnitude and timing of these measures has been taken into account in our conclusions.

4.2.4 Even without any growth, significant environmental improvements will not be achievable until major new water supply infrastructure is operational to allow comprehensive reductions in groundwater abstraction rates, which is unlikely to occur before the mid-2030s.

4.2.5 Our analysis has concluded that it is plausible for the minimum and medium growth scenarios to be met without further detrimental impact on the water environment, dependent on suitable interim adaptation measures and future major new water supply infrastructure. There is a higher level of uncertainty as to whether this is achievable for the medium growth scenario. However, in line with our approach of making assumptions that are conservative, technically achievable and representative of a “safe” fall-back position, we cannot safely conclude that the maximum growth scenario could be delivered without further detrimental impact on the water environment.

Conclusions

4.2.6 The constraints and opportunities categorisations for the growth scenarios are shown in Table 10 and Table 11, in line with the comments above. Water resources constraints are considered a potential “deal-breaker” for the maximum scenario at this stage. For the minimum and medium scenarios, we consider growth to be feasible but with constraints, some of which may be difficult to overcome, technically challenging and/or costly, particularly for the medium scenario which has a higher level of uncertainty compared to the minimum scenario.

4.2.7 These conclusions are dependent on assumptions regarding the linear trajectory of growth, and the allowance made for growth in non-household demand. If the rate of growth is increased for the minimum and medium scenarios before the mid-2030s, these scenarios could result in further detrimental impact on the water environment if the additional water demand cannot be met without increasing groundwater abstraction. Similarly, the allowance made for growth in non-household demand is based on existing ratios of non-household to household demand, and could be exceeded if planning permission is granted to water-intensive developments resulting in unsustainable growth.

<table>
<tr><th>Growth Scenario</th><th>Flood Risk</th><th>Wastewater</th><th>Water Quality</th><th>Water Resources</th></tr>
<tr><td>Minimum</td><td rowspan="3">No specific comments – dependent on location rather than quantum of development</td><td rowspan="3">Amber – growth can be accommodated in new Cambridge WRC works, but dependent on timing. May be RED constraints in other WRC catchments which lack capacity, depending on specific location.</td><td rowspan="3">Amber – load standstill considered technically achievable with suitable mitigation measures. More dependent on specific location than quantum of development.</td><td>Amber - growth could be accommodated with feasible adjustments to next Water Resource Management Plan to mitigate impacts.</td></tr>
<tr><td>Medium</td><td>Red growth can be accommodated if regional scale solutions are operational by mid 2030s. Interim measures will be necessary beforehand to mitigate impacts, which will need rapid planning and investment in the early parts of AMP8 cycle (2025 2030).</td></tr>
<tr><td>Maximum</td><td>Purple growth cannot be accommodated in existing water supply regime without detrimental impacts, requiring new regional scale water resource solutions that will not be available in time. Interim measures are unlikely to be able to mitigate scale of impact.</td></tr>
</table>

Table 10: Constraints categorization for growth scenarios

<table>
<tr><th>Growth Scenario</th><th>Flood Risk</th><th>Wastewater</th><th>Water Quality</th><th>Water Resources</th></tr>
<tr><td>Minimum</td><td colspan="4" rowspan="3">No specific comments – dependent on location and size of development, rather than overarching growth trajectory.</td></tr>
<tr><td>Medium</td></tr>
<tr><td>Maximum</td></tr>
</table>

Table 11: Opportunities categorization for growth scenarios

4.3 Review of Location Options

Flood Risk

4.3.1 The flood risk constraints are dependent on specific site allocation, and therefore have not been possible to assess in detail for spatial options where specific sites are not yet defined. Nevertheless, the following generalised assessment has been made:

- Cambridge urban area: considered significantly constrained due to the extent of existing fluvial, surface water and sewer flood risk, that may make individual sites more difficult to deliver, depending on location. Mitigation of the existing flood risk is complex due to the large drainage system under multiple ownership with no single record system.
- North East Cambridge: considered minimally constrained due to small extents of fluvial and surface water flood risk, that should be easily managed on site.
- Edge of Cambridge, Outside of Green Belt: considered to have some constraints due to surface water flood risk, but should be feasible to safely manage within site with mitigation works.
- Edge of Cambridge, Green Belt: considered significantly constrained due to the extent of existing fluvial and surface water flood risk, that may make individual sites more difficult to deliver, depending on location.
- New settlements: under the expectation that these will be located on areas of low or medium flood risk (following the Sequential Test), we consider there to be some constraints due to fluvial or surface water flood risk that should be feasible to safely manage within site with mitigation works.
- Existing villages: considered significantly constrained due to the extent of existing fluvial and surface water flood risk, that may make individual sites more difficult to deliver, depending on location. Smaller sites may fall below the minimum practical threshold for controlling discharge rates. The exception is for villages sited along the A428 public transport corridor or within 5 km of Cambourne, for which we consider there to be some constraints due to fluvial or surface water flood risk that should be feasible to safely manage within site with mitigation works.

4.3.2 The flood risk opportunities have been assessed as follows:

- Cambridge urban area and North East Cambridge: good opportunities to retrofit SuDS and other flood risk reduction measures to brownfield sites, reducing risk of flooding to site and elsewhere.
- Edge of Cambridge and New Settlements: requires specific site allocations to confirm, nevertheless potentially good opportunities to use large-scale features in large sites and on-site attenuation to reduce flood risk

downstream (e.g. on Coldham's Brook, Bin Brook, Histon and Impington, and Girton wetspots on edge of Cambridge).

- Rural centres and minor rural centres: requires specific site allocations to confirm, nevertheless may be opportunities to use on-site attenuation in the larger sites to reduce flood risk downstream.
- Group and infill villages: requires specific sites to confirm, however sites unlikely to be large enough to offer significant betterment.

Wastewater Treatment

4.3.3 The wastewater treatment constraints have been assessed as follows:

- Cambridge urban area, North East Cambridge, and Edge of Cambridge: growth can be accommodated in new Cambridge WRC, but there may be some constraints due to the timing of the new works becoming operational. Interim mitigation measures or Anglian Water permit amendments may be necessary to allow development beforehand.
- Development at Cambourne and nearby villages: significant constraints due to existing capacity and treated effluent discharge constraints at Bourn and Uttons Drove WRC that would require addressing. These could be technically challenging and/or costly, particularly for Uttons Drove WRC which discharges into the volume limited Swavesey Drain catchment. However, previous scoping work for Cambourne West and Bourn Airfield sites have indicating the potential for a new pipeline to Papworth WRC, where capacity is available. Although the progress of this scheme is currently unknown, we therefore consider there to be a solution for this area that is technically and economically feasible.
- All other locations: growth can be accommodated dependent on specific location and timing, compared to any necessary mitigation works to overcome local constraints. These are considered technically feasible. More detailed analysis to be undertaken once specific locations are known.

4.3.4 There are no specific opportunities for wastewater treatment that vary with location. All WRC locations have the potential for treated effluent to be reused in other ways, for example for agricultural irrigation or groundwater recharge (if treated appropriately). However, in some locations, treated effluent comprises an important component of low flows in the receiving watercourses, and therefore diversion to other uses would need careful assessment.

Water Quality

4.3.5 All location options are considered to have some constraints depending on specific location and timings, but are technically feasible for achieving load standstill, if suitable mitigation measures were implemented to ensure no detrimental impact on point source pollution from WRC.

4.3.6 Opportunities for water quality improvements will be dependent on specific site locations. Where watercourses lie within site boundaries, improvements could be made to enhance riparian corridors within larger buffer zones, including more varied and naturalised physical properties, leading to water quality improvements and increased habitat. These opportunities are likely to be more feasible for larger sites, and therefore opportunities have been weighted towards the larger sites.

Water Resources

4.3.7 There are no known specific constraints for water resources for the different location options. It is assumed that Cambridge Water will be able to flex its abstraction and delivery of water across the supply area to avoid any local increases in abstraction above recent actual rates, and to prioritise the least damaging of its sources. This will be explored further at the detailed Water Cycle Strategy stage. Water resources constraints therefore are considered more dependent on the quantum rather than the location of the development.

4.3.8 It is assumed that all sites will include a baseline provision towards reducing water demand, such as water efficient fixtures and fittings and water butts. The economic viability and drought resilience of household scale rainwater harvesting for non-potable use (e.g. flushing toilets) is less certain than site scale installations, and therefore preference is given to larger sites for the economies of scale and resilience that can be provided. Water resources opportunities have been assessed as follows:

- Cambridge urban area, group villages and infill villages: small size of sites likely to limit opportunities for high quality water recycling systems.
- North East Cambridge, Cambridge Airport, Edge of Cambridge, New Settlements: good opportunities to implement high quality water recycling across large sites.
- Rural centres and minor rural centres: may be some opportunities to implement high quality water recycling on larger sites.
- Areas located near Cambourne: good opportunities for area to be supplied via bulk water imports, as a separate water supply zone.

Conclusions

4.3.9 The detailed constraints and opportunities categorizations for each location option are listed in Appendix B, in line with the comments above. Each spatial scenario involves a different distribution of housing between location options. This distribution was used to weight the score for each location, before combining into a total score for each spatial option. These distributions varied between the minimum, medium and maximum scenarios, and therefore separate scores were calculated for each growth trajectory. An example calculation is included in Appendix B. The combined preference scores are shown in Table 12. Please note these reflect only how the distribution of housing between locations varies for each scenario, excluding the magnitude of growth (Table 10).

Spatial Scenario	Score and (rank) for housing distribution 2020 – 2041			Average score and (rank), all growth scenarios
	Minimum spatial pattern	Medium spatial pattern	Maximum spatial pattern	
2. Edge of Cambridge - outside the Green Belt	0.8 (1)	-0.1 (2)	0.9 (1)	0.5 (1)
4. Dispersal - new settlements	0.0 (3)	0.0 (1)	0.0 (2)	0.0 (2)
6. Public transport corridors	0.8 (1)	-2.4 (5)	-0.4 (3)	-0.6 (3)
8. Expanding a growth area around transport nodes (Cambourne)	-2.1 (6)	-2.1 (3)	-0.6 (5)	-1.6 (4)
7. Supporting a high-tech corridor by integrating homes and jobs (south of Cambridge)	-1.8 (4)	-3.7 (7)	-0.5 (4)	-2.0 (5)
3. Edge of Cambridge - Green Belt	-2.0 (5)	-2.1 (4)	-2.0 (7)	-2.0 (6)
1. Densification of existing urban areas	-2.1 (7)	-3.1 (6)	-1.4 (6)	-2.2 (7)
5. Dispersal – villages	-5.6 (8)	-5.6 (8)	-5.6 (8)	-5.6 (8)

Table 12: Combined preference score for spatial scenarios, presented in rank order. NB these scores are based only on the spatial pattern of housing as it varies between the scenarios, excluding the magnitude of growth.

4.3.10 The top two ranked spatial options have little preference between them. These options (2. Edge of Cambridge Outside the Green Belt and 4. Dispersal to New Settlements) have known or expected low flood risk, and large sites with good opportunities for blue-green infrastructure, flood risk reduction and high-quality resilient water recycling systems.

4.3.11 Although Option 8 (Expansion at Cambourne) has good opportunities for water resources with the potential to be supplied by bulk transfer, these are potentially offset by the constraints for WRC at Bourn and Uttons Drove, which are weighted more strongly than the opportunities. While an extension of Cambourne could plausibly be routed to Papworth for wastewater treatment, options may be more limited for village sites in this option which are more heavily weighted in the medium growth scenario. Therefore, if this option were to be selected, further work would be necessary to confirm what mitigation measures are technically feasible at these sites, or what alternative provision could be developed.

4.3.12 The lowest two ranked spatial options are Option 1 (Densification of existing urban areas), and Option 5 (Dispersal to villages). These options have the highest existing flood risk, and the smaller expected size of developments is likely to present fewer transformational opportunities for blue-green infrastructure, flood risk reduction and high-quality resilient water recycling systems.

4.3.13 In general, the medium growth scenario scores lowest out of the three growth trajectories (excluding the score of the growth trajectory itself). This is because the scenario involves more “spill over” of development into less preferable locations. In some spatial scenarios, the maximum growth scenario is the most preferable (purely on locational analysis), because development is concentrated into fewer sites than in the minimum and medium scenarios.

4.3.14 This analysis has considered the distribution of housing only. No assessment has been made of the proposed locations for non-residential development. The majority of these sites were allocated in the previous Local Plan, and it is assumed that any further sites allocated in this plan will be embedded within or near to the proposed residential sites to balance any new settlements.

5 Conclusions and Recommendations

5.1.1 Our analysis has indicated that:

- None of the growth scenarios offer the opportunity to offset existing detrimental impacts on the water environment due to over-abstraction of the Chalk aquifer.
- There are potential “deal-breaker” constraints to the high growth scenario, due to water resource limitations. The timing of planning, constructing and commissioning new water supply infrastructure is not currently compatible with the Local Plan timescale for the high growth scenario.
- Although there are constraints to development in the minimum and medium growth scenarios, for water resources, wastewater treatment and water quality, these could plausibly be addressed with appropriate mitigation measures in compatible timescales to result in no additional detrimental environmental impacts. Therefore, both these scenarios are considered technically achievable for a neutral impact, although there remain uncertainties and risks with mitigation measures that will require further analysis. All stakeholders support the adoption of ambitious water efficiency targets for new development to reduce additional demand.
- The minimum growth scenario would be the most sustainable of the three trajectories, in terms of preventing any further detrimental impacts on the water environment. This scenario would allow the greatest proportion of any additional water made available through further mitigation measures such as demand management and leakage reduction to be used for environmental benefit. In the medium scenario, some of this water would be required for potable supplies and more aggressive mitigation measures would therefore be necessary to provide the same level of environmental benefit as the minimum scenario.
- The most preferable spatial options are either Option 2 (Edge of Cambridge Outside Green Belt) or Option 4 (Dispersal to New Settlements). These options have known or expected low flood risk, and large sites with good opportunities for blue-green infrastructure, flood risk reduction and high-quality resilient water recycling systems.
- The least preferable spatial option is Option 5 (Dispersal to Villages). This option has the highest existing flood risk, and the smaller expected size of developments is likely to present fewer transformational opportunities for blue-green infrastructure, flood risk reduction and high-quality resilient water recycling systems.

5.1.2 The current National Planning Policy Framework states that policies should be reviewed at least once every 5 years and updated as necessary. As there are uncertainties and risks regarding the impact of potential mitigation measures for growth, we recommend the choice of growth scenario is reviewed following the outcomes of ongoing work by Water Resources East, Cambridge Water and Anglian Water, and the Environment Agency.

5.1.3 We recommend that growth is concentrated in new settlements or urban extensions that avoid high flood risk and have high standards for the design of flood risk management, water usage and re-use, and blue-green infrastructure. We have found that in some scenarios, the maximum growth trajectory is most preferable for choice of location alone, due to development being concentrated in fewer sites. This concentration of development is dependent on faster site delivery rates being achieved than at present. Therefore, we recommend that options for achieving this faster build-out rate applied to the minimum or medium growth trajectories are explored.

5.1.4 These conclusions are dependent on assumptions regarding the linear trajectory of growth, and the allowance made for growth in non-household demand. If the rate of growth is increased for the minimum and medium scenarios before the mid-2030s, these scenarios could result in further detrimental impact on the water environment if the additional water demand cannot be met without increasing groundwater abstraction. Similarly, the allowance made for growth in non-household demand is based on existing ratios of non-household to household demand, and could be exceeded if planning permission is granted to water-intensive developments, resulting in unsustainable growth.

5.1.5 The Outline Water Cycle Strategy, to be completed late 2020, will include scoping of the work required at the Detailed stage to support the Local Plan including assessing growth levels, spatial approach and policy options, and where possible reducing uncertainties and addressing assumptions regarding growth trajectories and non-household demand.

Appendix A Water Demand and Supply Projections

A.1 Water Supply

A.1.1 The available water supply in the Cambridge Water Resource Zone is shown in Figure 10, based on the Cambridge Water Resource Management Plan (2019 WRMP). This indicates:

- A deployable output of 92 to 95 Ml/d, which increases due to new sources being brought online in 2024.
- "Water available for use", calculated as the deployable output minus water losses and outage allowance, and taking in account imports and exports of water, of 86 to 90 Ml/d.
- "Water available minus target headroom", calculated as the water available for use minus the target headroom which includes a required climate change component, of 84 to 87 Ml/d.

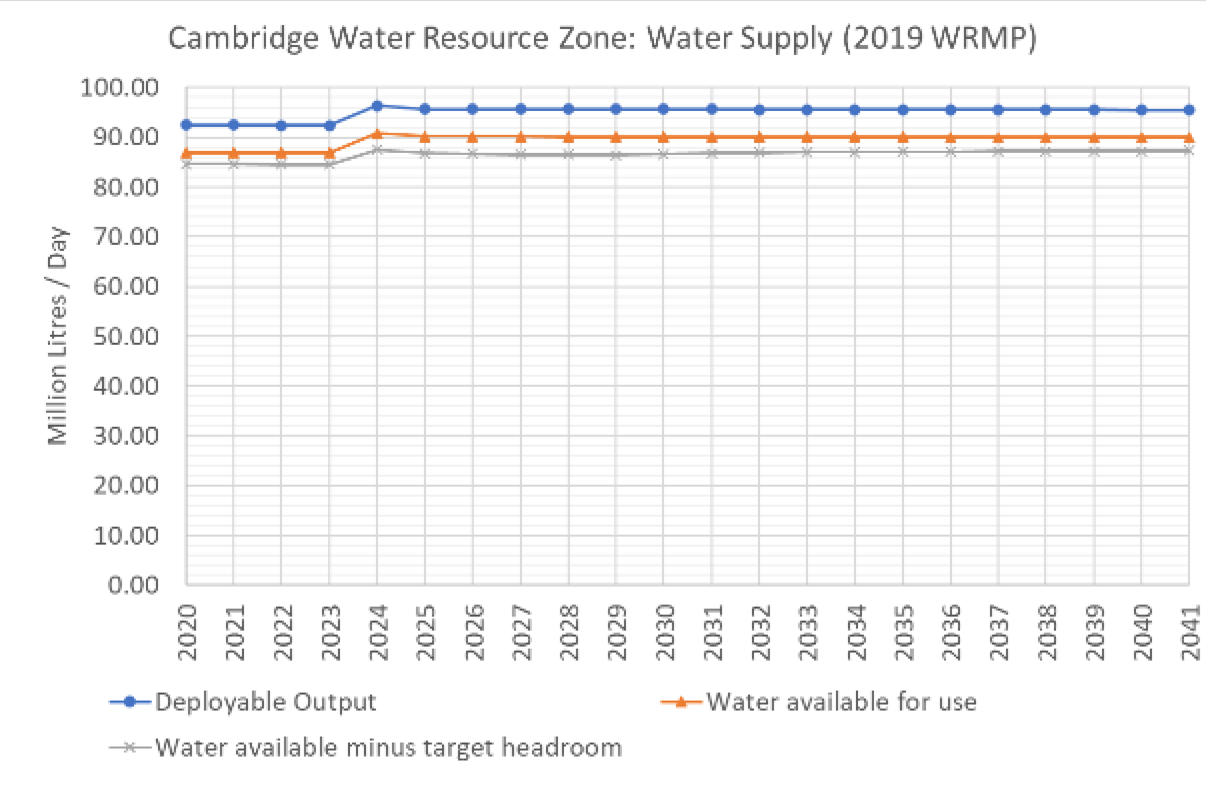

Figure 10: Water supply trajectory for Cambridge Water Resource Zone (2019 WRMP)

A.1.2 All of the water supply is sourced from groundwater abstraction. We note that all stakeholders agree that the groundwater aquifer is currently over-abstracted and causing environmental detriment. It is highly likely that future caps on abstraction will be enforced by the Environment Agency, with the shortfall in water supply to be provided by other sources. However, it is currently unclear what the magnitude or timing of those caps might be.

A.1.3 The calculation of the water supply and its sustainability will be reviewed in more detail in the Outline Water Cycle Strategy.

A.2 Water Demand

A.2.1 The Cambridge Water 2019 WRMP sets out the future population for which water demand has been planned, based on the future growth projections at the time. This is compared to the Greater Cambridge strategic option growth trajectories in Figure 11 (assumed linear as directed by Greater Cambridge Shared Planning). The WRMP population forecasts exceed the proposed growth trajectories in the first half of the 2020s, assuming a higher rate of growth from existing allocations.

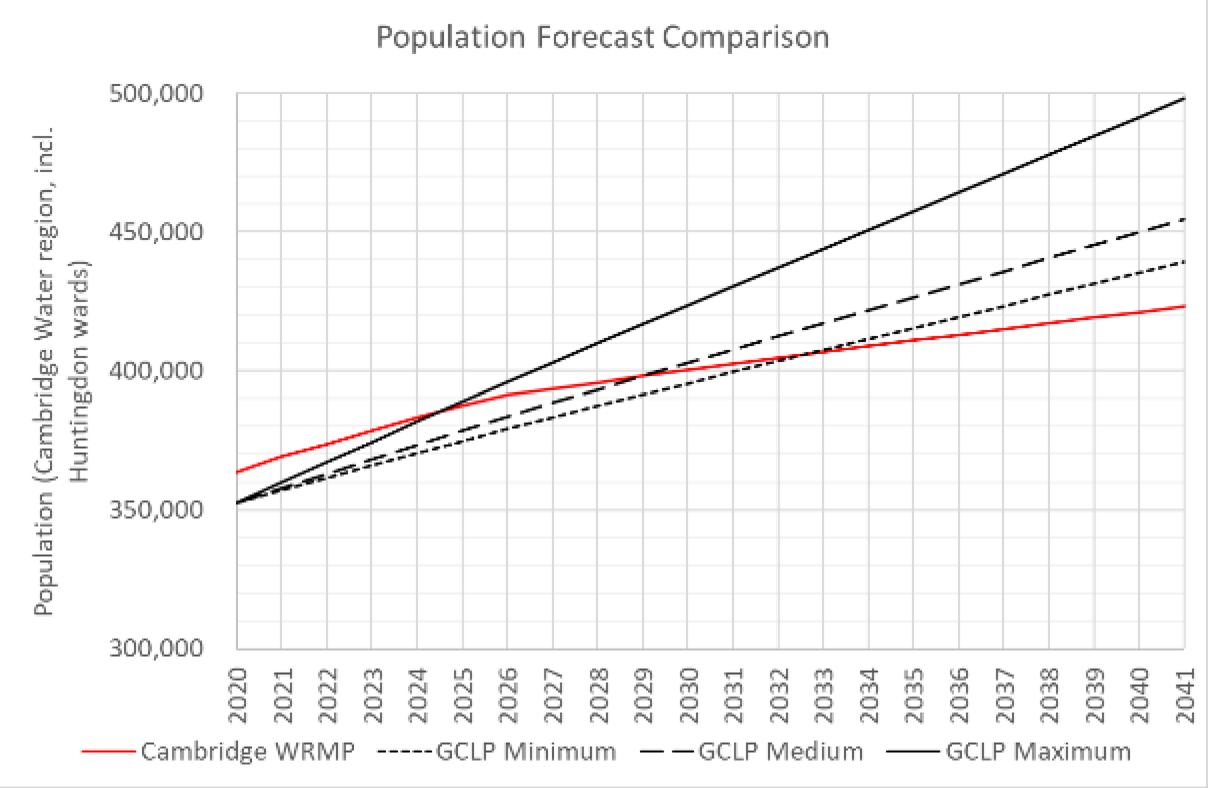

Figure 11: Comparison between assumed population growth in Cambridge WRMP and Local Plan growth trajectory options

A.2.2 The Cambridge WRMP water demand trajectory is shown in Figure 12. Total demand remains stationary at approximately 82 Ml/d. Although household demand increases from 48 to 52 Ml/d, this increase is offset by ambitious reductions in leakage and other uses (decreasing from 12.5 Ml/d to 8.5 Ml/d). The household demand is also reduced by demand management measures. There is assumed to be no increase in non-household usage, which stays constant at approximately 42% of household use proportionally.

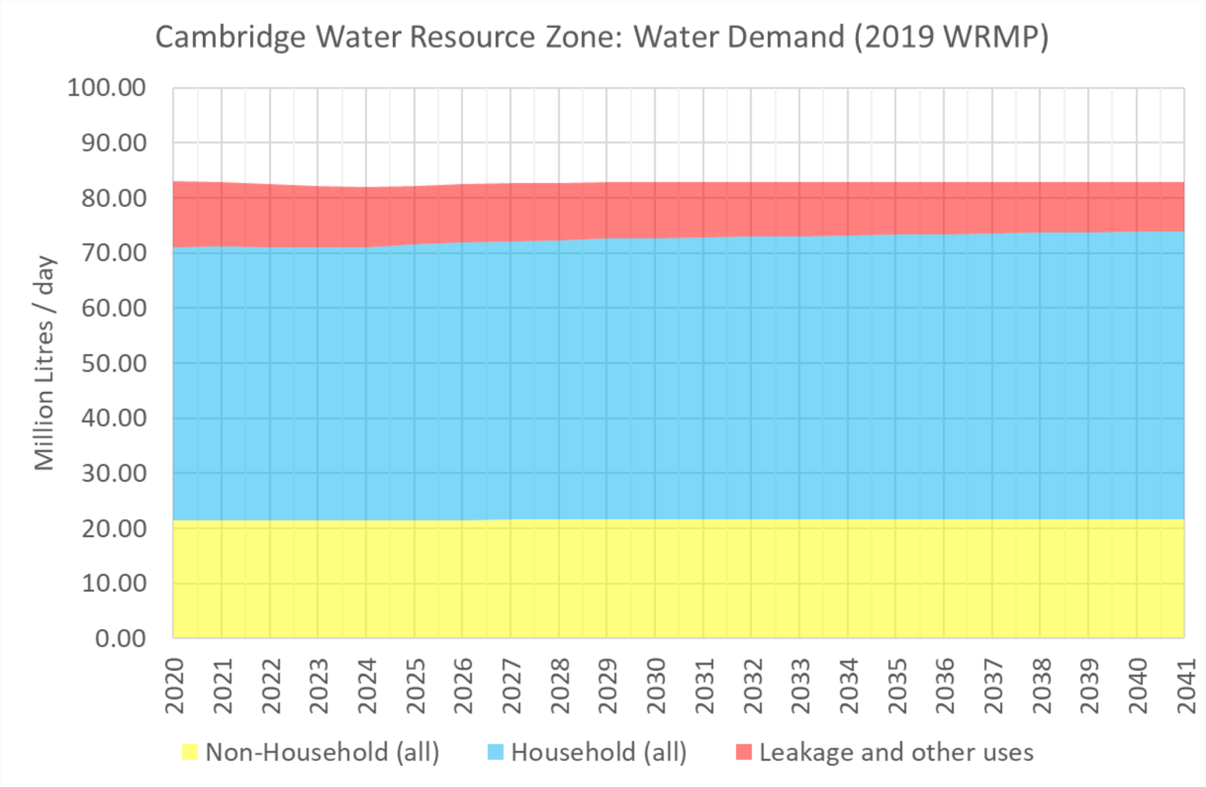

Figure 12: Future water demand (Cambridge WRMP projections)

A.2.3 We have calculated additional water demand for each of the growth trajectories as follows:

- Where the projected population is less than the Cambridge WRMP population projection, no additional demand was assumed.
- Where the projected population is greater than the Cambridge WRMP population projection, the additional population has been used to estimate additional demand, for a range of water consumption scenarios:

    a. Using the standard Building Regulations consumption requirement for new development of 125 l/p/d

    b. Using the optional Building Regulations consumption requirement for new development of 110 l/p/d

    c. Assuming a reduced consumption of 80 l/p/d is achievable (withdrawn Code for Sustainable Homes Level 5 / 6, and design standard at Eddington).

A.2.4 In addition, non-household demand was assumed to increase at a rate of 40% of the additional household demand (current rate, see paragraph A.2.2) for scenario (a) above, and applied at the same rate to scenarios (b) and (c) above. Although this allowance is considered conservative by Cambridge Water, there are significant uncertainties associated with non-household demand, particularly for any new hi-tech industry that could be water intensive.

A.2.5 The resulting additional demand by 2041 is summarised in Figure 13 and Table 13. Consumption management to 80 l/p/d results in a reduced additional water demand of up to 3 Ml/d in the maximum growth scenario, which is a significant betterment. All stakeholders support the adoption of ambitious water efficiency targets for new development, regardless of growth scenario.

Growth scenario	**Non-Household**	**Household**			**Total (household + non-household)**		
		125 l/p/d	110 l/p/d	80 l/p/d	125 l/p/d	110 l/p/d	80 l/p/d
Minimum	0.93	2.25	1.98	1.44	3.18	2.91	2.37
Medium	1.73	4.18	3.68	2.68	5.91	5.41	4.41
Maximum	3.99	9.62	8.47	6.16	13.61	12.45	10.14

Table 13: Additional water demand projections (Ml/d) in 2041, for non-household and household demands (different consumption scenarios)

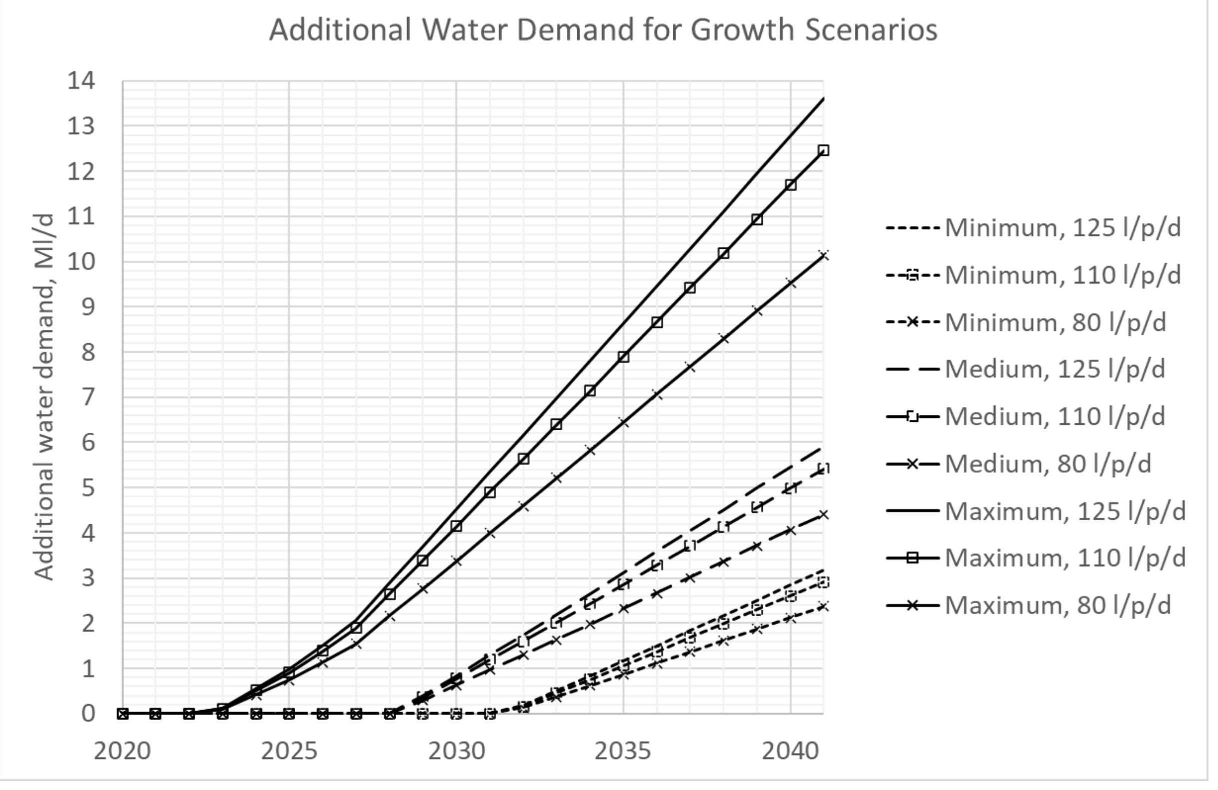

Figure 13: Additional water demand projects for growth scenarios, different consumption scenarios

A.3 Supply Demand Balance

A.3.1 The demand trajectories are compared to the water supply (minus target headroom) in Figure 14 to Figure 16. These show:

- In the minimum growth scenario, water demand begins to exceed planned water demand in the early 2030s. Total water demand does not exceed the water supply (minus target headroom) in the plan duration (to 2041).
- In the medium growth scenario, water demand begins to exceed planned water demand in the late 2020s. Total water demand exceeds water supply (minus target headroom) in the late 2030s, depending on demand management scenario. Reducing demand from 120 l/p/d to 80 l/p/d gives an extra 3 years before water supply is exceeded.
- In the maximum growth scenario, water demand begins to exceed planned water demand in the mid-2020s. Total demand exceeds water supply (minus target headroom) in the late 2020s, depending on demand management scenario. Reducing demand from 120 l/p/d to 80 l/p/d gives an extra 2 years before water supply is exceeded.

A.3.2 The supply-demand balance will be reviewed for the next WRMP (to be published in 2023) and the available headroom may be reduced, particularly where significant non-household or commercial development is proposed and gains planning approval. The Environment Agency would like to see existing headroom prioritised for environmental betterment. As data is not available for these potential changes to supply and demand, it has not been possible to include them in this analysis. However, they indicate that the current supply-demand headroom should not be assumed to be available for new development.

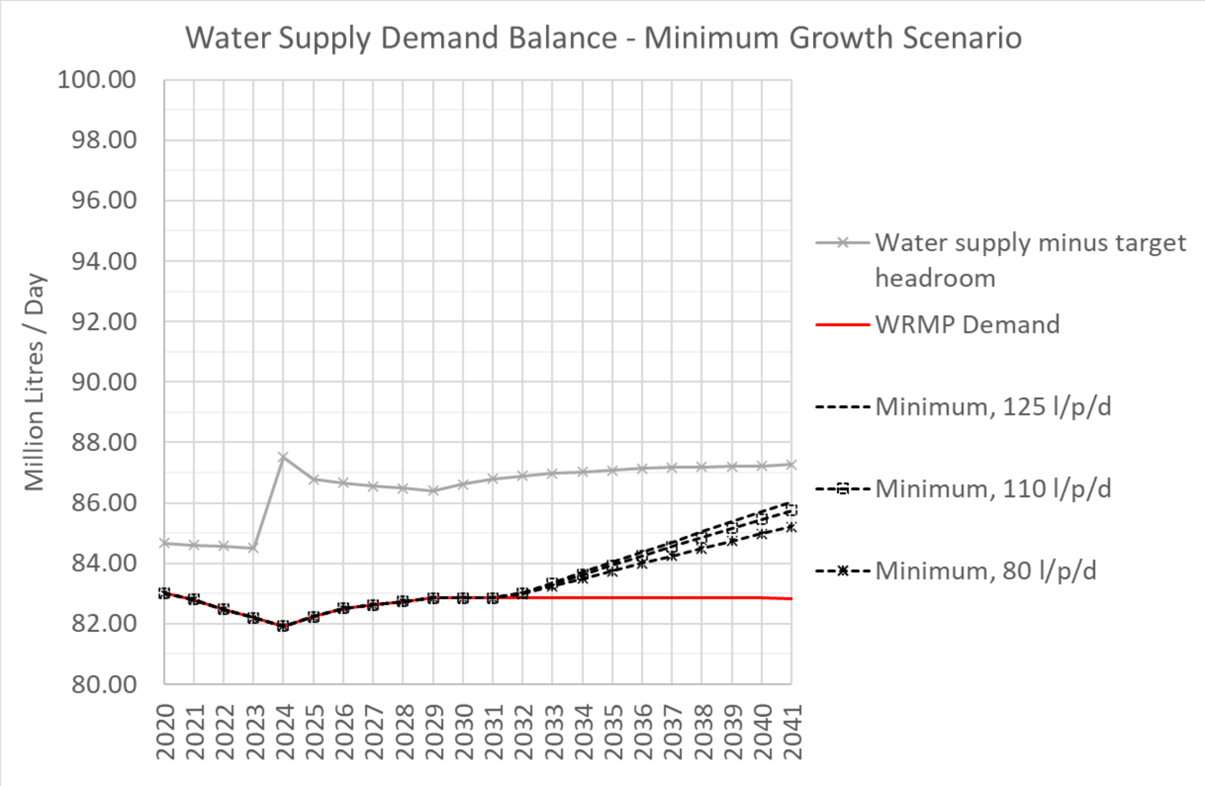

Figure 14: Water supply demand balance, minimum growth scenario

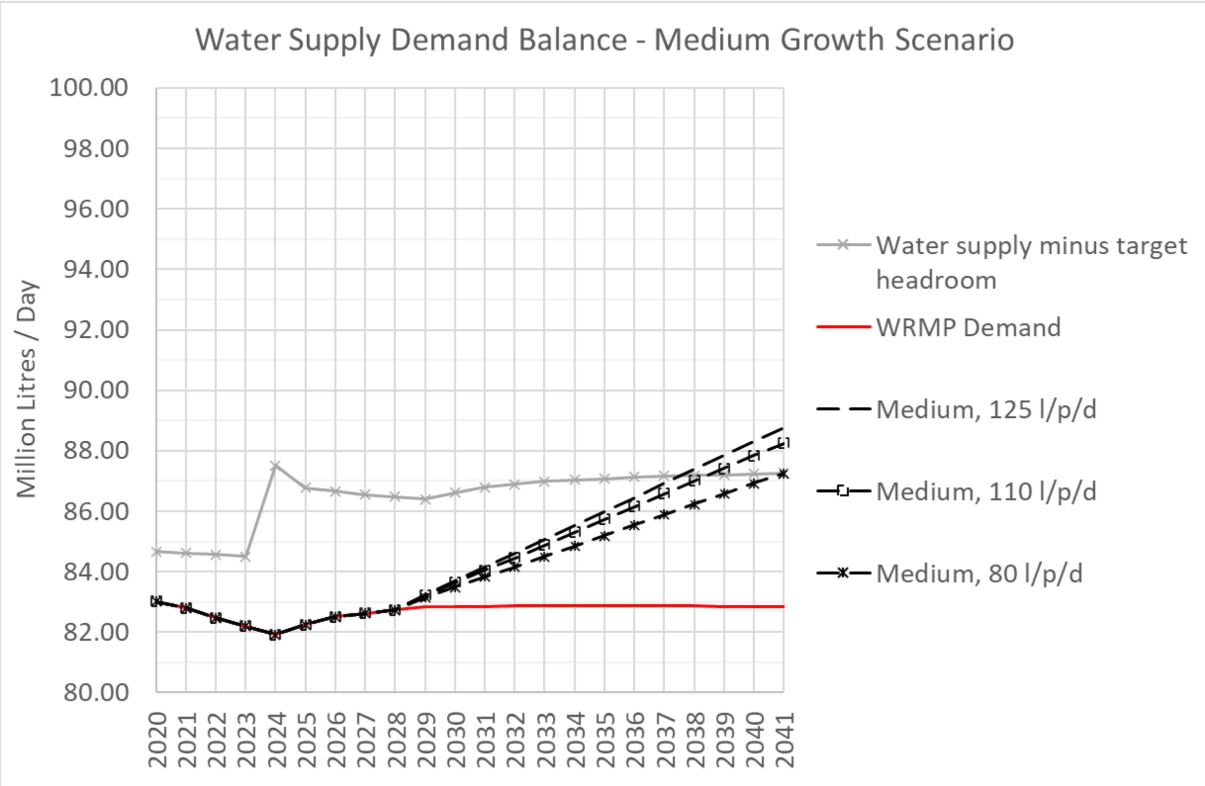

Figure 15: Water supply demand balance, medium growth scenario

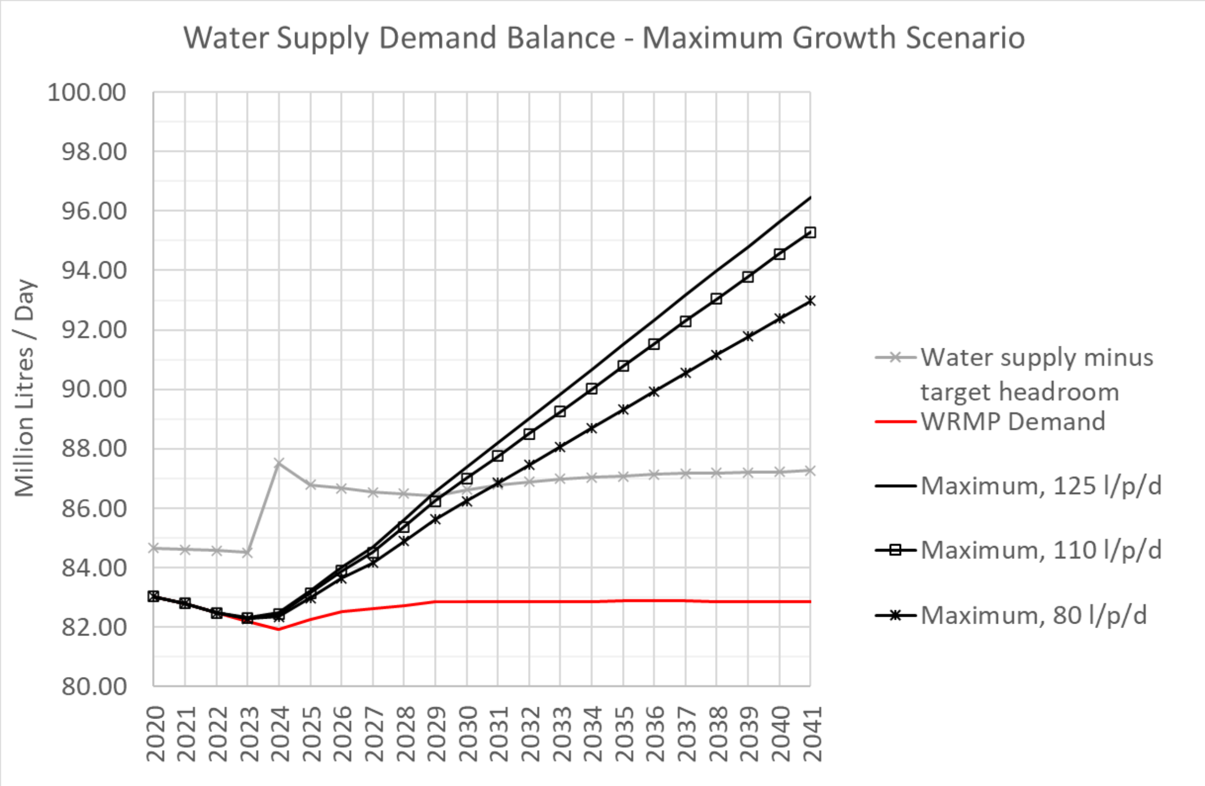

Figure 16: Water supply demand balance, maximum growth scenario

A.4 Opportunities for New Water Sources

A.4.1 The supply demand balances in the previous section do not take into account any further reduction in abstraction rates to meet environmental targets. All stakeholders agree that the groundwater aquifer is currently over-abstracted, causing environmental detriment. It is highly likely that future caps on abstraction will be enforced by the Environment Agency, with the shortfall in water supply to be provided by other sources. However, the magnitude and timing of future abstraction reductions is unclear.

A.4.2 Water Resources East (WRE) are responsible for regional scale water supply planning. Discussions with WRE have indicated:

- Major new water supply infrastructure is being planned for the Anglian Region, including:
  - A new water supply reservoir in Lincolnshire, which, if funded, would be operational from 2035.
  - A new water supply reservoir in the Fenland / Ouse Washes area, which, if funded, could be operational from 2040 (or earlier depending on the design), and will be geographically closer to the Greater Cambridge area.

These new reservoirs can be designed to include allowance for significant reductions in abstraction rates and for increased demand due to additional growth in the Greater Cambridge area. Currently, Cambridge Water does not have an allocation in the Lincolnshire reservoir project. However, WRE, Cambridge Water and Anglian Water are currently in discussion about new resource schemes and inter-company transfers. The potential demand for water in Greater Cambridge will form part of WRE's regional modelling to inform the strategy being developed.

- Interim measures are being considered to reduce abstraction and increase supply from other sources before 2035, including:
  - Further water efficiency, demand management and aggressive leakage management measures. In particular, all stakeholders support aspirations for ambitious water efficiency targets for new developments, seeking to go beyond the Building Regulations optional requirement of 110 l/p/d. The feasibility of this will be explored further in the Outline and Detailed Water Cycle Strategy reports.
  - Prioritisation of abstraction from the Chalk aquifer for public water supply, through licence trading. Other existing abstractors (e.g. agricultural irrigation) would be supplied instead through new on-farm reservoirs and potentially treated effluent.
  - Reconnection of modified streams to their floodplains, and capture and storage of higher winter flows, leading to improved river flow and increased groundwater recharge through land use management schemes (e.g. ELMS pilot project in Granta / Bourn catchment).
  - Considering bulk water transfers within the region. Water quality and chemistry concerns mean that it is not practical to transfer mix water sources within the existing network. However, it is plausible that discrete settlements near to the Cambridge Water boundary (e.g. Cambourne area) could be separated from the existing network and supplied by bulk imports. Both Anglian Water and Affinity Water currently have no capacity for bulk water transfers in their current WRMPs, and further work would be needed by WRE to broker transfer agreements for the AMP8 cycle (2025 – 2030). For example, Anglian Water's new Strategic Pipeline and Grid will bring water from North Lincolnshire to Suffolk and beyond, passing near to the Cambridge Water region by 2025.

Following discussions with WRE, it is plausible that these measures combined could allow in the order of 5 Ml/d additional water supply, or potentially higher. However, there is a high uncertainty due to the distributed and diffuse nature of the measures, which are difficult to quantify at this stage (e.g. impacts of land use management changes during drought periods). Therefore, these measures are unlikely to allow significant reductions in abstraction rates or allow significant additional growth.

A.4.3 WRE are currently undertaking work to agree the environmental destination for the region (i.e. the volume of water which will need to be retained in the environment and not abstracted), and the environmental ambitions for the sustainable abstraction of water, the timescales over which changes need to occur, and the regional supply of water including growth. This work will be published in Summer 2021 and can include allowance for the Greater Cambridge preferred growth trajectory, once known.

A.5 Conclusions

A.5.1 All stakeholders agree that growth in the Greater Cambridge area should not be reliant upon increased abstraction or reductions to existing available headroom. At present there is no growth scenario that will mitigate or reduce existing detrimental impacts on the environment. To deliver a neutral position, we require development to have no additional detrimental impact on the environment.

A.5.2 The minimum growth scenario begins to exceed current planned water demand in the early 2030s. This allows a 10-year period in which interim adaptation measures can be implemented, to prevent the existing headroom being reduced due to growth. Although this timescale is ambitious for the water industry, it is not unachievable. The minimum growth scenario also does not exceed current supply projections. It is therefore considered plausible that this growth scenario can be met without further detrimental impact on the water environment.

A.5.3 The medium growth scenario begins to exceed current planned water demand in the late 2020s. This allows a 5 to 10-year period in which interim adaption measures can be implemented, to prevent the existing headroom being reduced due to growth. The medium growth scenario exceeds current supply in the late 2030s, however by then, the new Lincolnshire water supply reservoir is expected to be operational. It is therefore plausible that this growth scenario can be met without further detrimental impact on the water environment. However, it may require more aggressive interim adaptation measures, such as bulk water imports to supply discrete settlements. Cambridge Water currently do not have an allocation on the new Lincolnshire reservoir, and this would require urgent agreement. The required infrastructure and mitigation measures would need to be implemented during the AMP8 planning cycle (2025 – 2030).

A.5.4 The maximum growth scenario begins to exceed current planned water demand in the mid-2020s, and exceeds current supply in the late 2020s. This scenario would require rapid and significant interim adaptation measures to provide water without increasing abstraction rates. It would not be possible to construct new bulk transfer infrastructure during the current AMP7 planning cycle (2020 – 2025), and therefore it may not be possible to prevent the existing headroom being reduced due to growth, dependent on the early implementation and success of other measures (e.g. licence trading and land use management). These would need to begin to be implemented before the conclusions of the WRE programme of work. Rapid infrastructure planning and construction would be necessary during the early stages of AMP8 to allow significant bulk water imports of up to 10 Ml/d before the new Lincolnshire water supply reservoir is operational in 2035. Therefore, at this stage we **cannot safely conclude** that it would be plausible for this growth scenario to be met without further detrimental impact on the water environment.

A.5.5 These conclusions are based on the assumption of linear growth trajectories. For all growth scenarios, it is recommended that the growth trajectory is delayed or skewed towards the later years of the plan (mid 2030s onwards). The later growth will have more opportunities to reduce water demand and build new supply sources and transfer infrastructure. Conversely, if growth rates are increased before the mid-2030s, these conclusions will be invalidated and there is a risk that development in the minimum and medium scenarios could cause further detrimental impact on the water environment.

A.5.6 These conclusions also assume that non-household growth in water demand will remain in current proportion to household growth. Cambridge Water have indicated that this assumption is reasonable and conservative, however it will be invalidated if water-intensive industrial developments are granted planning permission. Growth in non-household demand will be explored further at the detailed Water Cycle Strategy stage.

Appendix B Location Opportunities and Constraints Categorisation and Scoring

<table>
<tr><th>Broad supply location</th><th>Flood Risk</th><th>Wastewater</th><th>Water Quality</th><th>Water Resources</th><th>Total Constraints Score</th></tr>
<tr><td>Cambridge urban area</td><td>Red existing fluvial flood and surface water flood risk may make individual sites difficult to deliver, depending on location.</td><td rowspan="4">Amber – growth can be accommodated in new Cambridge WRC works, but dependent on timing.</td><td rowspan="4">Amber – load standstill likely to be achievable with some mitigation measures at new WRC works. Interim mitigation may be necessary before new works is operational.</td><td rowspan="12">No specific comments. Water resources dependent on quantum rather than location of development.</td><td>-8</td></tr>
<tr><td>North East Cambridge</td><td>Green - minimal flood risk from fluvial or surface water sources, that should be easily managed on site.</td><td>-4</td></tr>
<tr><td>Cambridge Airport (safeguarded land)</td><td>Amber - some surface water flood risk, but should be feasible to safely manage within development.</td><td>-6</td></tr>
<tr><td>Green Belt Fringe</td><td>Red existing fluvial flood and surface water flood risk may make individual sites difficult to deliver, depending on location.</td><td>-8</td></tr>
<tr><td>New settlements on public transport corridors</td><td rowspan="2">Amber - expected that new settlements will be located on areas of low or medium flood risk, where it is feasible to safely manage risk within development.</td><td rowspan="2">Amber – growth can be accommodated dependent on specific location and timing. May be RED constraints in specific WRC catchments which lack capacity.</td><td rowspan="8">Amber - load standstill likely to be achievable, depending on mitigation measures at relevant WRC - may be RED constraints in specific locations.</td><td>-6</td></tr>
<tr><td>New settlements on road network</td><td>-6</td></tr>
<tr><td>Cambourne Extension</td><td>Amber - some surface water flood risk, but should be feasible to safely manage within development.</td><td>Amber - although Bourn and Uttons Drove WRC have capacity limitations, Bourn Airfield and Cambourne West sites propose a new piped link to Papworth where growth could feasibly by accommodated.</td><td>-6</td></tr>
<tr><td>Rural centres</td><td rowspan="5">Red existing fluvial flood and surface water flood risk may make individual sites difficult to deliver, depending on location.</td><td rowspan="5">Amber – growth can be accommodated dependent on specific location and timing. May be RED constraints in specific WRC catchments which lack capacity.</td><td>-8</td></tr>
<tr><td>Minor rural centres</td><td>-8</td></tr>
<tr><td>Group villages</td><td>-8</td></tr>
<tr><td>Infill villages</td><td>-8</td></tr>
<tr><td>Villages sited along existing or proposed public transport corridors</td><td>-8</td></tr>
</table>

<table>
<tr><th>Broad supply location</th><th>Flood Risk</th><th>Wastewater</th><th>Water Quality</th><th>Water Resources</th><th>Total Constraints Score</th></tr>
<tr><td>Villages in Southern Cluster core</td><td></td><td></td><td rowspan="3"></td><td rowspan="3"></td><td>-8</td></tr>
<tr><td>Villages sited along the A428 public transport corridor</td><td rowspan="2">Amber - some surface water flood risk, but should be feasible to safely manage within development. Dependent on specific site location.</td><td rowspan="2">Red both Bourn and Uttons Drove WRC have capacity limitations that would require addressing. More difficult to divert smaller sites in existing villages to Papworth (the proposed solution for Bourn Airfield and Cambourne West)</td><td>-8</td></tr>
<tr><td>Minor Rural Centre/Group villages sited within 5km of Cambourne</td><td>-8</td></tr>
</table>

Table 14: Constraints categorization and score for each location option

<table>
<tr><th>Broad supply location</th><th>Flood Risk[11]</th><th>Wastewater</th><th>Water Quality</th><th>Water Resources</th><th>Total Opportunities Score</th><th>Combined Constraints and Opportunities Score</th></tr>
<tr><td>Cambridge urban area</td><td rowspan="2">**Dark Blue** good opportunities to retrofit SuDS and other flood risk reduction measures to brownfield sites, reducing risk of flooding to site and elsewhere.</td><td rowspan="12">No specific opportunities.</td><td>**Unshaded** - small size of sites likely to limit opportunities.</td><td>**Unshaded** - small size of sites likely to limit scale and affordability of opportunities for water recycling, although some options will still be available.</td><td>2</td><td>-6</td></tr>
<tr><td>North East Cambridge</td><td rowspan="6">**Dark blue** good opportunities for blue green infrastructure</td><td rowspan="6">**Dark Blue** good opportunities to implement water recycling across large site.</td><td>6</td><td>2</td></tr>
<tr><td>Cambridge Airport (safeguarded land)</td><td>**Dark Blue** good opportunities to use large scale on site attenuation to reduce flood risk downstream on Coldham's Brook, and offer significant betterment.</td><td>6</td><td>0</td></tr>
<tr><td>Green Belt Fringe</td><td>**Dark Blue** requires specific site allocations to confirm, however good opportunities to use large scale features in larger sites to reduce flood risk downstream (e.g. Bin Brook, Histon & Impington, and Girton known wetspot locations), and offer significant betterment.</td><td>6</td><td>-2</td></tr>
<tr><td>New settlements on public transport corridors</td><td rowspan="2">**Dark Blue** good opportunities to use large scale features in new settlements to reduce flood risk downstream and offer significant betterment. Requires specific site allocations to confirm.</td><td>6</td><td>0</td></tr>
<tr><td>New settlements on road network</td><td>6</td><td>0</td></tr>
<tr><td>Cambourne Extension</td><td rowspan="3">**Pale Blue** - requires specific site allocations to confirm. However, opportunities to use on-site attenuation in new settlements to reduce flood risk downstream, and offer some betterment depending on scale.</td><td>5</td><td>-1</td></tr>
<tr><td>Rural centres</td><td rowspan="2">**Pale blue** - some opportunities dependent on site size and feasibility.</td><td rowspan="2">**Pale Blue** – dependent on site size and feasibility, some opportunities for water recycling may not be feasible or affordable.</td><td>3</td><td>-5</td></tr>
<tr><td>Minor rural centres</td><td>3</td><td>-5</td></tr>
<tr><td>Group villages</td><td rowspan="2">**Unshaded** - requires specific site allocations to confirm. However, sites unlikely to be large enough to offer significant betterment.</td><td rowspan="2">**Unshaded** - small size of sites likely to limit opportunities.</td><td rowspan="2">**Unshaded** - small size of sites likely to limit scale and affordability of opportunities for water recycling, although some options will still be available.</td><td>0</td><td>-8</td></tr>
<tr><td>Infill villages</td><td>0</td><td>-8</td></tr>
<tr><td>Villages sited along existing or proposed public transport corridors</td><td>**Pale Blue** - requires specific site allocations to confirm. However, opportunities to use on-site attenuation in larger sites to reduce flood risk downstream and offer some betterment depending on scale.</td><td>**Pale blue** - some opportunities dependent on site size and feasibility.</td><td>**Pale Blue** – dependent on site size and feasibility, some opportunities for water recycling may not be feasible or affordable.</td><td>3</td><td>-5</td></tr>
</table>

[11] Multi-functional SuDS to manage site run-off would be expected to be provided on all sites, irrespective of scale. These comments focus on opportunities for on-site schemes to provide more significant betterment to flood risk downstream.

Broad supply location	Flood Risk[11]	Wastewater	Water Quality	Water Resources	Total Opportunities Score	Combined Constraints and Opportunities Score
Villages in Southern Cluster core					3	-5
Villages sited along the A428 public transport corridor				**Dark blue** potential for areas around Cambourne to be supplied via bulk water imports.	4	-4
Minor Rural Centre/Group villages sited within 5km of Cambourne					4	-4

Table 15: Opportunities categorization and score, and combined constraints and opportunities score, for each location option.

Example scoring calculation for Option 1: Densification of Urban Areas

The percent of houses in each location per scenario (minimum, medium and maximum) is multiplied by the location score (combined constraints and opportunities score). The weighted scores are summed to give a total score per scenario (minimum, medium and maximum). The number of houses in each location is as defined in the "Greater Cambridge Local Plan: strategic spatial options for testing – methodology" document (GCSPS, 2020), and reflects high-level assumptions made at this early stage to allow comparison of spatial options. The score therefore reflects the comparative distribution of houses between locations in each spatial option.

Location	Number of Houses in Each Location			Percentage of Houses in Each Location			Location Score	Location score multiplied by percentage of houses in each location		
	Min	Med	Max	Min	Med	Max		Min	Med	Max
Cambridge urban area	2000	5600	6800	51%	57%	38%	-6	-3.08	-3.43	-2.31
North East Cambridge	1900	1900	8000	49%	19%	45%	2	0.97	0.39	0.90
Cambridge Airport (safeguarded land)		1900	2900	0%	19%	16%	0	0.00	0.00	0.00
Green Belt Fringe		400		0%	4%	0%	-2	0.00	-0.08	0.00
New settlements on public transport corridors				0%	0%	0%	0	0.00	0.00	0.00
New settlements on road network				0%	0%	0%	0	0.00	0.00	0.00
Cambourne Extension				0%	0%	0%	-1	0.00	0.00	0.00
Rural centres				0%	0%	0%	-5	0.00	0.00	0.00
Minor rural centres				0%	0%	0%	-5	0.00	0.00	0.00
Group villages				0%	0%	0%	-8	0.00	0.00	0.00
Infill villages				0%	0%	0%	-8	0.00	0.00	0.00
Villages sited along existing or proposed public transport corridors				0%	0%	0%	-5	0.00	0.00	0.00
Villages in Southern Cluster core				0%	0%	0%	-5	0.00	0.00	0.00
Villages sited along the A428 public transport corridor				0%	0%	0%	-4	0.00	0.00	0.00
Minor Rural Centre/Group villages sited within 5km of Cambourne				0%	0%	0%	-4	0.00	0.00	0.00
Total	**3900**	**9800**	**17700**	**100%**	**100%**	**100%**	**N/A**	**-2.10**	**-3.12**	**-1.40**

Appendix C Independent Reviewer Report

C.1.1 Due to the level of concern regarding water resources and the impact that abstraction may already be having on the environment, GCSPS required the Integrated Water Management Study to include an independent review of water resources aspects of the study, by a nationally recognised expert in this field.

C.1.2 Dr Geoff Parkin PhD FCIWEM C.WEM FGS was contracted to act as independent reviewer of the water resources components of this project, through his consultancy company Geoff Parkin Hydro Ltd. Geoff is a nationally and internationally recognised expert in water resource management, with over 30 years' experience in groundwater modelling and assessment through research, teaching, and working with regulators, water companies, local authorities and local community groups. His extensive international experience includes high profile projects on Integrated Water Resources Management (IWRM) for shared Israeli-Palestinian aquifers, transboundary water management involving all of the riparian countries in the Nile basin, and currently as co-investigator of a major international Global Challenge Research Fund (GCRF) study on Water Security and Sustainable Development. In the UK, he works closely with the Environment Agency, water companies including Anglian Water Services, and local authorities, on projects including for example groundwater modelling for resource management in East Anglia, reservoir decommissioning, and multi-source flooding. Until recently he was director of MSc programmes in Hydrology/Hydrogeology and Water Management at Newcastle University, and is now Head of Water Group in the School of Engineering. He is a member of the International Association of Hydrogeologists national committee and sits on the steering group of a national EA-led review of groundwater flooding. Geoff is a regular speaker at relevant industry events, and as a previous flood victim (Morpeth 2008), he has contributed actively to local issues including writing a flood section for the Local Neighbourhood Plan.

Geoff Parkin Hydro Ltd

To: Greater Cambridge Shared Planning

Copy: Clare Waller, Stantec UK Ltd

2nd November 2020

Independent Reviewer's Report on Greater Cambridge Integrated Water Management Study : Strategic Spatial Options Review

Dear Sir/Madam

As requested, this is to confirm that I have reviewed the draft report *"Greater Cambridge Integrated Water Management Study : Strategic Spatial Options Review"* as independent reviewer on behalf of Stantec UK Ltd. I reviewed Draft V003C of the report, after comments from stakeholders had been received and incorporated. My high-level and detailed comments have been considered and subsequently incorporated into the report by Stantec prior to submission to Greater Cambridge Shared Planning.

The scope of my review was to focus specifically on water resources aspects, although I have read and considered other relevant aspects of the overall report. In general, I agree with the overall conclusions in that flood risk is the most significant constraint on locations rather than water resources, and that the high growth scenario is problematic from a water resources perspective. I note, however, that findings from this high-level interim report should be treated with appropriate caution at this stage, until completion of the main Integrated Water Management Study. The outcomes from this interim study depend on certain assumptions which should be considered further during the full study, specifically including those of linear trajectories of growth, and non-household demand.

I also noted and welcomed the approach outlined in the draft report on an integrated water management strategy, highlighting regulatory, practical and behavioural change issues needed to achieve this, and the need for monitoring to support adaptive change.

I look forward to providing further contributions as needed to support this important and challenging work by Greater Cambridge Shared Planning and Stantec UK Ltd in developing a sustainable water strategy for the Cambridge area.

Best regards

Geoff Parkin

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