South Norfolk VCHAP - Water Cycle Study

Addendum to the GNLP Water Cycle Study

South Norfolk Council

Project number: 60670875

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Quality information

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1. Study scope

1.1 Project purpose

South Norfolk Council is currently preparing a housing allocations document that will shape development within the District's villages, identifying land for a minimum of 1,200 new homes. This plan is called the South Norfolk Village Clusters Housing Allocations Plan (VCHAP).

This report presents the findings of a Water Cycle Study (WCS) undertaken to support the development of the VCHAP with respect to wastewater services infrastructure required to service that growth and protect the water environment. Herein, the study is referred to as the South Norfolk Village Clusters (SNVC) WCS.

1.2 WCS scope

The impact of planned growth on available water supply, wastewater services infrastructure and the water environment within South Norfolk was considered holistically as part of the WCS produced for the 2019 Greater Norwich Local Plan (the GNLP WCS)[1]: this included cumulative growth totals proposed across the Greater Norwich authorities of Broadland District Council, Norwich City Council and South Norfolk Council to the end of the plan period of 2038.

The GNLP WCS assessed the total quantum of planned growth from South Norfolk which included existing commitments as well as growth numbers expected to come forward from the SNVC. This included assessments of water availability, wastewater treatment capacity, and receiving watercourse capacity. However, specific site details were only available for existing commitments within the District and not for the Village Clusters where growth was yet to be allocated. Therefore, specific site assessments detailed within the GNLP WCS could only be completed for the existing committed sites and in addition, assumptions had to be made on the spatial distribution of the Village Cluster growth in relation to Water Recycling Centre (WRC) locations so that the wastewater treatment capacity assessments could be completed.

The VCHAP has since identified preferred site allocations for the Village Cluster growth and hence the assumptions made in the GNLP WCS have been revisited and re-assessments completed where the VCHAP allocation process has made significant changes to totals assessed within the GNLP WCS. The location of Village Cluster allocations within the South Norfolk Area is shown in Figure 1.

[1] March 2021 (AECOM) Greater Norwich Water Cycle Study

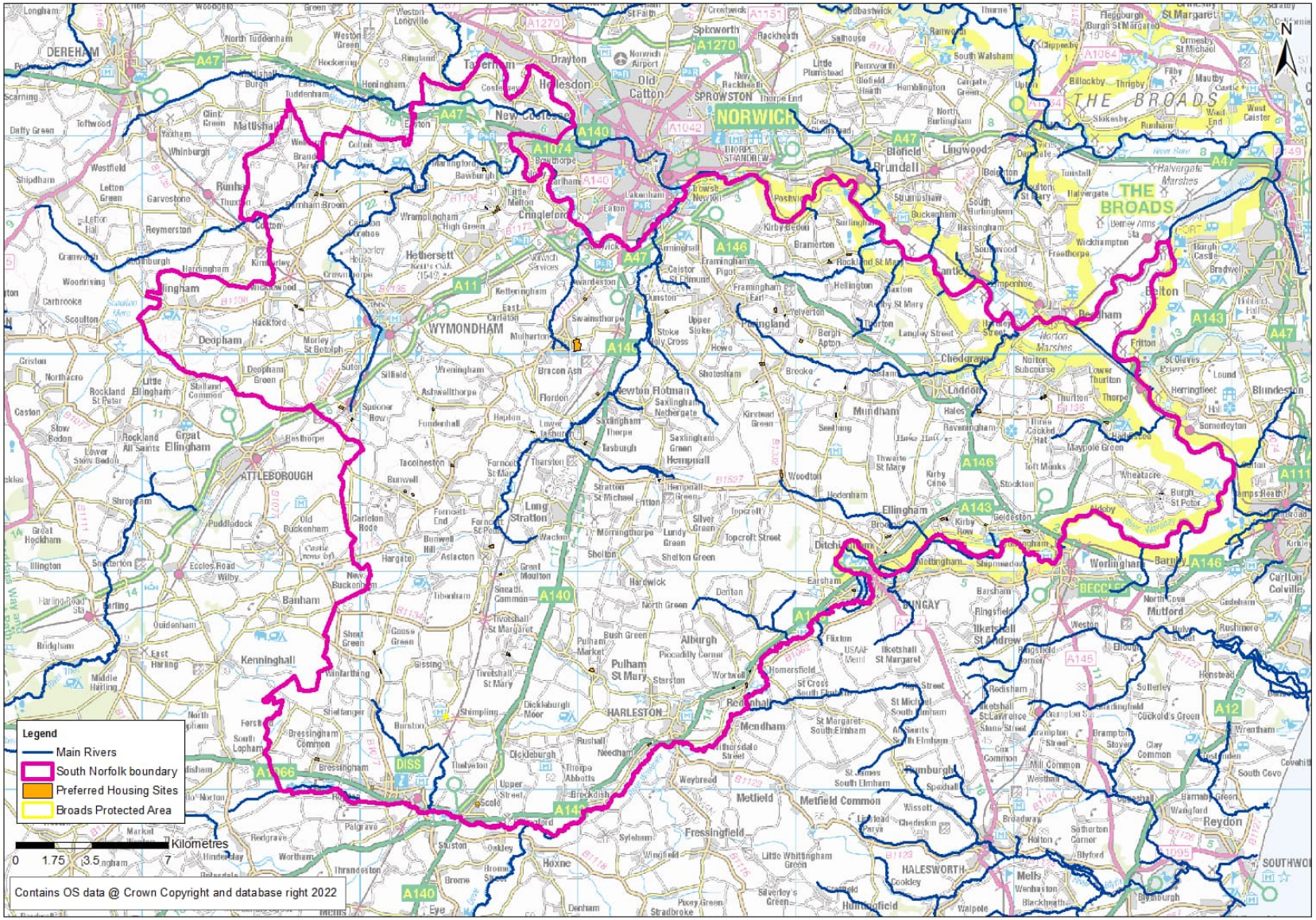


Figure 1: Location of Village Cluster allocations in South Norfolk

This report details the findings of the re-assessment and acts as an addendum to the GNLP WCS, reporting any differences in the conclusions of the GNLP WCS as it relates to the Village Cluster allocations.

1.2.1 Addendum presentation

This WCS addendum has been presented for ease of use as a planning led document which is its principal purpose. The initial sections have been written to provide a simplified overview of the technical assessments completed, followed by a short summary of results of the assessment presented as a separate section for each locality where growth is proposed. This makes the document easier to navigate so different users can find the information they need quickly and easily.

More detailed descriptions of the methodologies, assessment process and assessment results are presented within appendices for users of the document who require further detail on the approaches and findings of the study.

Conclusions and recommendations from the study have been made at the end of each section for each locality where growth is proposed. For overarching conclusions and summary, reference should be made to the GNLP WCS.

1.2.2 Study stakeholders

The study has been undertaken using data provided as part of the GNLP WCS and data provided subsequently for the SNVC WCS addendum by stakeholders who formed part of the GNLP WCS delivery working group. The main stakeholders relevant to the SNVC WCS are:

- The Environment Agency – who regulate water quality, wastewater discharges and water resource planning in England.
- Anglian Water Services (AWS) – who provide water supply and wastewater services within the South Norfolk District.

1.2.3 Capacity re-assessments undertaken

Wastewater treatment

Whilst the overall number of dwellings allocated by the VCHAP remains the same as assumed in the GNLP WCS, there are differences in how the growth is distributed spatially (both between and within the village clusters), which are relevant to WRCs and their location in South Norfolk. This is particularly the case for smaller, rural WRCs which treat fewer houses and hence small changes in assumed spatial distribution of new housing can be more significant.

For this reason, wastewater treatment assessments made in the GNLP WCS have been revisited where the allocation of preferred sites in the VCHAP would significantly alter spatial assumptions made in the GNLP WCS. Further detail is provided in section 3.1 (methodology) of this addendum.

Site assessments

Some assessments made in the GNLP WCS could only be undertaken where site boundaries are known. This includes assessment of the capacity of the wastewater networks (or piped systems) serving property as well as an assessment of overall flood risk to site boundaries. Because allocated sites were unknown at the time, these assessments could not be completed for the Village Cluster growth within the remit of the GNLP WCS and hence these assessments have since been completed for the preferred site allocations made within the VCHAP and reported within this addendum. Further detail is provided in section 3.1 (methodology) of this report.

1.2.4 Capacity assessments which remain valid

Water Resources

Assessments made on water supply, water efficiency and water resource availability within the GNLP WCS remain valid and have not been revisited as part of the Village Cluster site review. This is because the total numbers of dwellings allocated by the VCHAP remains the same as assumed in the GNLP WCS assessment. In addition, the location of the housing in the context of how AWS manage supply and demand in the study area does not affect the GNLP WCS water resource assessment methods, nor conclusions; this position was agreed with the Environment Agency at the commencement of the

study in November 2021. The GNLP WCS conclusions on water resources (including water neutrality) remain valid for the VCHAP WCS and reference should be made to the GNLP WCS for these conclusions.

2. Planned growth and dwelling totals

A total of 1,277 dwellings have been assessed as part of the SNVC WCS. Because of potential cumulative impacts, this total includes totals from relevant Neighbourhood Plans. A total of 110 dwellings are to be allocated within the Diss and District Neighbourhood Plan where preferred site boundaries have been identified. Dickleburgh Neighbourhood Plan did not have site boundaries/allocations identified at the time of completing assessments and hence have not been included. Details of the number of dwellings proposed through site allocations within in each Village Cluster is provided in Table 2-1.

Table 2-1: Site allocations and associated village cluster

Village Cluster	Dwelling total
Alpington, Yelverton and Bergh Apton	59
Aslacton, Great Moulton and Tibenham	47
Barford, Marlingford, Colton and Wramplingham	19
Barnham Broom, Kimberley, Carleton Forehoe, Runhall and Brandon Parva	55
Bawburgh	40
Bressingham	40
Brooke, Kirstead and Howe	53
Bunwell	35
Burston (Neighbourhood Plan allocation)	25
Diss (Neighbourhood Plan allocations)	85
Ditchingham, Broome, Hedersham and Thwaite	45
Earsham	24
Gillingham, Geldeston and Stockton	55
Hales and Heckingham, Langley Street, Carleton St Peter, Claxton, Raveningham and Sisland	35
Hempnall, Topcroft St, Morningthorpe, Fritton, Shelton and Hardwick	15
Kirby Cane and Ellingham	37
Little Melton and Great Melton	43
Mulbarton, Bracon Ash, Swardeston and East Carleton	55
Needham, Brockdish, Starston and Wortwell	35
Newton Flotman and Swainsthorpe	25
Pulham Market and Pulham St Mary	50
Rockland St Mary, Hellington and Holverston	50
Seething and Mundham	19
Spooner Row and Suton	40
Stoke Holy Cross, Shotesham and Caistor St Edmund	25
Tacolneston and Forncett End	25
Tasburgh	5
Thurlton and Norton Subcourse	22
Tivetshall St Mary and Tivetshall St Margaret	25
Toft Monks, Aldeby, Haddiscoe, Wheatacre and Burgh St Peter	42
Wicklewood	42

Village Cluster	Dwelling total
Winfarthing and Shelfanger	40
Woodton and Bedingham	50
Wreningham, Ashwellthorpe and Fundenhall	15
TOTAL	**1,277**

3. Study approach and methodology

3.1 Methodology overview

As described in section 1 of this report, the approach to the assessments used for the SNVC WCS follows the same methodologies as used in the GNLP WCS and has only completed re-assessment for wastewater treatment capacity and individual site assessments.

This section of the report provides a brief overview of the assessment approach and methods for wastewater treatment capacity and site assessments. Detailed descriptions of the methodologies taken from the GNLP WCS are set out in Appendix A.

It should also be noted that since completion of the GNLP WCS, AWS published and consulted on a draft Drainage and Wastewater Management Plan[2] (DWMP) in 2022 which sets out at a high level how future management of WRCs and related sewerage networks will be managed to account for current and longer term capacity. The draft DWMP has been referenced with respect to WRC capacity in this addendum, wherever relevant.

3.1.1 Wastewater treatment assessment approach

Introduction

Wastewater is generated whenever water is used through some form of process within domestic and non-domestic properties e.g. through toilet flushing. This wastewater is either captured locally and managed via private assets such as septic tanks, or it is discharged into the sewerage system for transfer to a treatment facility operated by a water company. New development creates additional generation of wastewater which needs to be treated and managed so as to protect the quality of the water environment where it is discharged.

Treatment of wastewater which connects to the sewerage system in South Norfolk is provided via WRCs operated and maintained by AWS, which ultimately discharge treated wastewater to a nearby river water body. Each WRC is connected to development by a network of wastewater pipes (the sewerage system) which collects wastewater generated by homes and businesses and transfers it to the WRC; this is defined as the WRC 'catchment'.

Wastewater generated in South Norfolk is treated at several different WRCs, many of which are small and serve small population centres. After analysing the spatial distribution of sites allocated by the VCHAP, the WRC catchments expected to receive additional wastewater as a result of growth in the village clusters were identified and presented in section 3.2.

Managing treated discharges from WRC

In order to discharge treated wastewater from a population (and other connected uses), all WRCs are issued with a permit to discharge that treated wastewater by the Environment Agency. Larger WRCs will have a numeric (or quantified) permit which sets out defined limits on the volume of treated wastewater that it can discharge and also puts limits on the quality of the treated discharge. These limits are set in order to protect the water quality and ecology of the receiving water body to ensure that it has the environmental capacity to accept the discharge. In this way, the permits also dictate how much wastewater each WRC can accept, as well as the type of treatment processes and technology required at each WRC to achieve the quality limits set as part of the permit. Smaller WRCs generally only have a descriptive permit which do not set numerical limits.

The flow element of the discharge permit determines an approximation of the maximum number of properties that can be connected to a WRC catchment and is referred to as Dry Weather Flow (DWF). When discharge permits are issued, they are generally set with a flow 'headroom', which acknowledges that allowance needs to be made for future development and future connection of additional wastewater volumes generated. This allowance is referred to as 'permitted headroom'. Generally, the quality conditions which are applied to the discharge permit are derived at the time of permit being issued to protect the water quality of the receiving waterbody; however, this does not ensure in all cases that future water quality standards will continue to be achievable, either due to changes in other inputs to the watercourse or due to changes in standards driven by new (and changes to) legislation. The main legislative drivers relevant to the WCS with respect to WRC

[2] Anglian Water Services (2022) Draft Drainage and Wastewater Management Plan; accessed Nov 2022. https://www.anglianwater.co.uk/siteassets/household/about-us/dwmp-draft-technical-document.pdf

discharges are compliance with the Water Framework Directive (WFD) Regulations and the Habitats Regulations and further details on how these legislative instruments affect WRC capacity and permit limits is set out in Appendix A.

The headroom capacity determines how many additional properties can be connected to the WRC catchment before AWS would need to apply for a new or revised discharge permit (and hence how many properties can connect without significant changes to the treatment infrastructure). Identifying available treatment headroom capacity is the key initial test for the assessment of wastewater treatment capacity within this WCS.

WRC capacity assessment

Using the methodology from the GNLP WCS, the treatment headroom capacity at each WRC which would receive growth from the Village Clusters was identified by comparing the volume of flow each WRC currently discharges during dry weather (its current DWF), and the maximum DWF it can discharge as set out in the discharge permit. This defines the current headroom capacity.

The additional wastewater flow which would be generated by growth was then calculated based on allocated dwelling numbers as set out in the VCHAP as well as the planned dwelling numbers and likely employment growth locations identified within the GNLP WCS. It was necessary to include allocated growth from the GNLP WCS in addition to the VCHAP allocations because the headroom capacity of any WRC is driven by the cumulative total of growth within its catchment.

The future additional wastewater flow volume was then compared to the current headroom capacity to determine what the future headroom capacity would be. This process is detailed in full in Appendix A. A summary of results is presented for each WRC receiving growth from the Village Clusters for each locality within sections 4 to 31 of this report, and results of calculations for all WRC locations are presented in a single table within Appendix B.

Where the allocation of sites within the VCHAP resulted in more growth (and hence wastewater generation) within a WRC catchment than was assumed in the GNLP WCS, the future headroom capacity assessment was then used to consider the environmental capacity implications for water bodies which receive treated discharge from the WRC. Where the growth total was the same, or less than had been assumed in the GNLP WCS, then no further assessment was undertaken and the conclusions of the GNLP WCS are assumed to remain valid. In these localities, only site assessments were completed.

Environmental capacity assessment

Where growth totals in a WRC catchment had increased compared to the GNLP WCS, an assessment of impact on receiving watercourse capacity (including water quality and connected water dependent designated habitats) was completed using different methods depending on the outcome of the future headroom capacity assessment.

Different methods were used to acknowledge that there is likely to be a bigger risk of impact where future headroom capacity would be exceeded and so a more detailed assessment of the water quality impacts was required. As per the GNLP WCS approach, three tiers of assessment were completed:

- For WRC with numerical permits, where headroom would be exceeded or would be less than 10% headroom capacity once all allocated sites have connected - these WRCs were assessed using a water quality model referred to as RQP[3] and these findings were used to consider the potential impact on protected sites.
- For WRC with numerical permits, where headroom would not be exceeded and would have greater than 10% headroom capacity once all allocated sites have connected - these WRCs were assessed using a simplified calculation of what would be required to ensure no increase in overall pollution (Load Standstill)[4] and using these findings to consider the impact on protected sites.
- WRC with descriptive consents - an environmental capacity assessment was only undertaken where the population served by the WRC would exceed 250 as a result of allocated growth.

Water quality assessments considered three key water quality parameters relevant to WFD ecological status, namely:

- Biochemical Oxygen Demand (BOD).
- Ammonia.

[3] River Quality Planning Tool (RQP) – see Appendix A for further detail including modelling scenarios completed for different impact levels.
[4] Load Standstill calculations – see 0 for further detail.

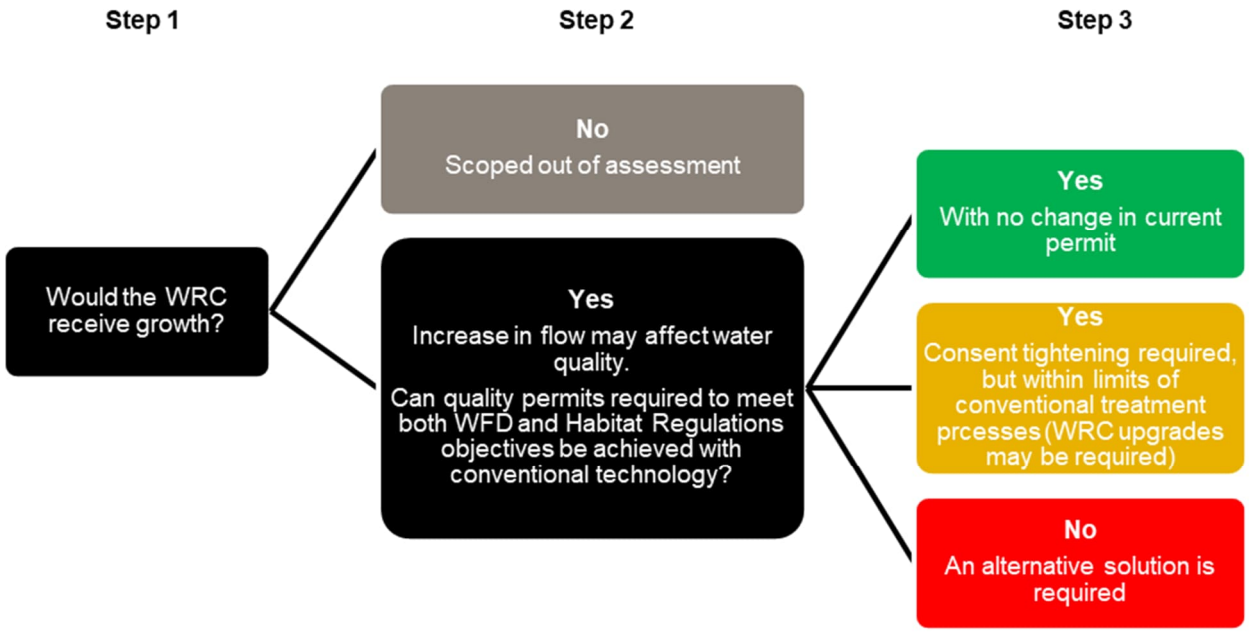
- Phosphate.

The environmental capacity assessments where then used to determine whether a change in quality conditions of a permit would be required to protect water quality and ecology in line with the key legislative drivers (WFD and Habitats Regulations – see Appendix A). The assessment determined whether these permit changes would be achievable using treatment technologies which are available and conventionally applied. This is the key test of whether a future treatment solution would be deliverable at some point in the plan period as described below:

- Where permit changes are minor, or not required at all, it is assumed that growth allocated in that WRC catchment is acceptable and no phasing or infrastructure implications identified.
- Where permit changes only require levels of treatment technologies which are conventionally applied, it is assumed that there will be a treatment solution available, and the growth allocated in that WRC catchment is acceptable. Commentary is provided on implications for infrastructure investment and phasing for proposed development linked to the scale of growth, or when headroom capacity is likely to be exceeded.
- Where permit changes would require treatment technologies which are not conventionally applied, it is concluded that a new solution is required for allocated sites in this WRC catchment; this would require:
  - fewer allocations within the catchment; or,
  - agreement on alternative treatment options such as transfer of wastewater to another catchment.

The environmental capacity assessment is summarised in Figure 2; further detail on this process is included in Appendix A.

Figure 2: Environmental capacity assessment process summary



3.1.2 Site assessment approach

The site assessment process addresses local infrastructure capacity issues relevant to individual or cumulative sites (within a WRC catchment) and covers an assessment of wastewater network capacity issues, flood risk (from fluvial and surface water sources), and potential constraints linked to odour issues associated with building in close proximity to WRC facilities.

A brief methodology for the assessments is outlined below with summaries tabulated for each of the VCHAP allocated sites presented per WRC catchment locality.

Wastewater network

The capacity of the existing sewer network is an important consideration for growth, as in some cases the existing system is already at, or over its design capacity. Further additions of wastewater from growth can result in sewer flooding in the system (affecting property or infrastructure) or, in the case of sewers that are combined (surface water and foul water) can increase the frequency with which untreated overflows to river systems occur, resulting in ecological impact and deterioration in water quality.

As the wastewater undertaker for the study area, AWS has a general duty under Section 94 of the Water Industry Act 1991 to provide effectual drainage which includes providing additional capacity as and when required to accommodate development which has planning permission. However, this legal requirement must also be balanced with the price controls as set by the regulatory body Ofwat which ensure AWS has sufficient funds to finance its functions, but at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

AWS have undertaken an assessment of the capacity of the wastewater network system using local operational knowledge for each of the VCHAP allocated sites in addition to findings reported in their draft DWMP. A Red-Amber-Green (RAG) assessment was provided by AWS and the key indicating the RAG coding applied is provided Figure 3.

The RAG rating reflects potential impacts on early phasing of development sites where commencement of site construction may need to be delayed whilst new infrastructure or upgrades are implemented. There may also be additional developer cost implications through the need for additional requisition of sewerage infrastructure to connect to the mains system.

Figure 3: Colour coding for the RAG assessment of wastewater network capacity assessment

No capacity restrictions in network.	Limited network capacity; likely to be cumulative impacts from all proposed development - New infrastructure may be required, likely to affect early phasing or increase developer requisition costs for some sites in the WRC catchment.	Confirmed capacity restrictions in network, or not in close proximity to sewerage network. New infrastructure will be required, likely to affect early phasing or increase developer requisition costs.

Proximity to WRC

AWS have an encroachment policy for WRC and development aimed to provide a buffer around WRC facilities to ensure that the potential for odour impacts are minimised. Where allocated site boundaries are close to defined encroachment areas for a WRC facility, this has been highlighted in the site assessment.

Flood Risk

A RAG assessment has been applied using two data sets. The fluvial flood risk to each of the allocated sites has been considered using the Flood Map for Planning[5] produced by the Environment Agency, whilst surface water flooding has been reviewed for each of the major development sites using the Risk of Flooding from Surface Water (RoFSW)[6] mapping produced by the Environment Agency.

The flooding data sets have been used to determine the extent of site boundaries that are at risk from flooding from different sources with a colour coding applied as per Figure 4. This assessment gives an indication of which sites may need additional mitigation to manage the risk and/or consider sequential layout of the site to ensure only low vulnerability uses are located in the areas of risk. Further information on this for each site can be found in the Strategic Flood Risk Assessment (SFRA) supporting the VCHAP.

Figure 4: Colour coding for the RAG assessment of flood risk to site allocations

Little or no extent of mapped flood risk – no specific intervention likely	Small sections of the site include medium to high risk flood extents – some flood mitigation may be required, or sequential layout of the development to avoid vulnerable development in flood risk areas must be considered	Significant proportion of the site has medium to high risk flood extents, likely to require mitigation such as raised floor levels, flood compensation on conveyance measures.

[5] Environment Agency (2022). Flood Map for Planning. Available at: https://flood-map-for-planning.service.gov.uk/ Accessed: November 2022

[6] Environment Agency (2022). Long term flood risk information. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map. Accessed at: November 2022

3.2 Village clusters - assessment presentation

The assessment of sites and dwellings proposed for Village Clusters has been presented according to which WRC would provide wastewater treatment for each cluster. This is to prevent repetition on the wastewater treatment assessment for larger WRCs (such as Whitlingham Trowse WRC) which serve multiple clusters and have the same wastewater treatment conclusions.

Each WRC catchment which would serve sites allocated within the VCHAP has a subsequent section in this report and these have been presented alphabetically. Table 3-1 summarises which WRC is relevant to which cluster and provides a link to the relevant section of the report to allow the reader to focus on village clusters most relevant to their interest.

Table 3-1: WRCs serving Village Clusters

Village Cluster	WRC catchment and link	Section Number
Alpington, Yelverton and Bergh Apton	Sisland WRC	23
Aslacton, Great Moulton and Tibenham	Long Stratton WRC	17
Barford, Marlingford, Colton and Wramplingham	Barford Chapel Street WRC	5
Barnham Broom, Kimberley, Carleton Forehoe, Runhall and Brandon Parva	Barnham Broom WRC	6
Bawburgh	Whitlingham Trowse WRC	28
Bressingham	Diss WRC	9
Brooke, Kirstead and Howe	Sisland WRC	23
Bunwell	Forncett-Forncett End WRC	13
Burston (Neighbourhood Plan allocations)	Burston Station Road	8
Diss (Neighbourhood Plan allocations)	Diss WRC	9
Ditchingham, Broome, Hedersham and Thwaite	Ditchingham WRC	10
Earsham	Earsham-Bungay Rd WRC	11
Gillingham, Geldeston and Stockton	Ellingham-Braces Lane WRC	12
Hales and Heckingham, Langley Street, Carleton St Peter, Claxton, Raveningham and Sisland	Sisland WRC	23
Hempnall, Topcroft St, Morningthorpe, Fritton, Shelton and Hardwick	Hempnall-Fritton Rd WRC	16
Kirby Cane and Ellingham	Ellingham-Braces Lane WRC	12
Little Melton and Great Melton	Whitlingham Trowse	28
Mulbarton, Bracon Ash, Swardeston and East Carleton	Swardeston-Common WRC	25
Needham, Brockdish, Starston and Wortwell	Harleston WRC	15
Newton Flotman and Swainsthorpe	Saxlingham WRC	21
Pulham Market and Pulham St Mary	Pulham St Mary WRC	19
Rockland St Mary, Hellington and Holverston	Whitlingham Trowse WRC	28
Seething and Mundham	Seething Mill Lane WRC	22
Spooner Row and Suton	Spooner Row WRC	26
Stoke Holy Cross, Shotesham and Caistor St Edmund	Stoke Holy Cross WRC	24
Tacolneston and Forncett End	Forncett-Forncett End WRC	13
Tasburgh	Hempnall-Fritton Rd WRC	16

Village Cluster	WRC catchment and link	Section Number
Thurlton and Norton Subcourse	Norton Subcourse WRC	18
Tivetshall St Mary and Tivetshall St Margaret	Dickleburgh WRC	20
Toft Monks, Aldeby, Haddiscoe, Wheatacre and Burgh St Peter	Haddiscoe Mock Mile Terr WRC	14
Wicklewood	Wymondham WRC	31
Winfarthing and Shelfanger	Winfarthing Chapel Close WRC	29
Woodton and Bedingham	Woodton WRC	30
Wreningham, Ashwellthorpe and Fundenhall	Ashwellthorpe WRC	4

4. Ashwellthorpe catchment

4.1 Village Clusters and sites

The Ashwellthorpe WRC catchment serves the Village Cluster of **Wreningham, Ashwellthorpe** and **Fundenhall.** There is one allocated site in the Ashwellthorpe WRC catchment as shown in Figure 5 and Table 4-1; the site would deliver a maximum of 15 dwellings in the WRC catchment

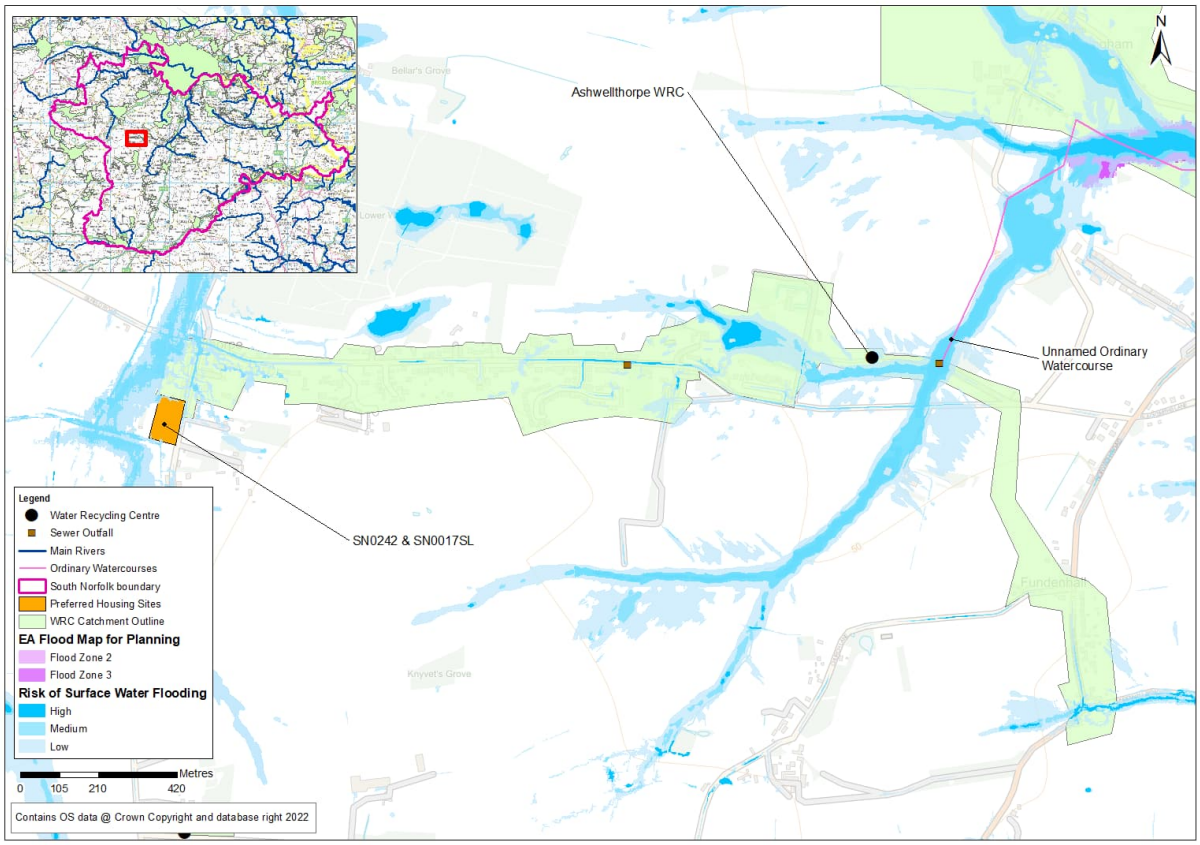


Figure 5: Ashwellthorpe WRC catchment, allocated site and hydrological context

Table 4-1. Allocated site relevant to the Ashwellthorpe WRC catchment

Site Reference	Site Address	Dwelling No.
SN0242 & SN0017SL	Land to the west of New Road	15

4.2 WRC headroom capacity

4.2.1 GNLP WCS assumptions

The GNLP WCS did not make any assessment of dwellings in the Ashwellthorpe WRC catchment. The VCHAP has subsequently allocated 15 dwellings within the Village Cluster of Wreningham, Ashwellthorpe and Fudenhall. As a result, the impact of an additional 15 dwellings on capacity has been considered in this WCS addendum.

4.2.2 Capacity re-assessment

This allocation of 15 additional dwellings has been calculated to reduce the remaining WRC capacity at Ashwellthorpe WRC to 14%. However, there is sufficient headroom capacity at the WRC to treat wastewater.

4.3 Environmental capacity assessment

As there is greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that only very small (less than 5%) changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are well within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to the River Tas catchment from this WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads Special Area of Conservation (SAC) and Broadlands Special Protection Area (SPA).

4.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the site in the Village Cluster are shown in Table 4-2.

Table 4-2: Site capacity assessments and flood risk for the site in Ashwellthorpe WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0242 & SN0017SL	15	Capacity issues in the network due to surface water ingress	None identified	0% - No part of the site infringes on FZ2	0% - No part of the site infringes on FZ3	1% - very small area flooding in north-west of site.	1% - very small area flooding in north-west of site.	5% - very small area of flooding to the north and south of site.

4.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Wreningham, Ashwellthorpe and Fundenhall.

However, there are known issues affecting the capacity of the sewerage network in the village of Ashwellthorpe likely to be caused by the impact of surface water ingress into the foul sewer system in combination with completion and occupation of new development in the village. The additional site may exacerbate this capacity problem, and developers will need to liaise early with AWS to identify the preferred connection solutions and whether this requires requisition of new sewers. Development here must ensure that surface water is managed on site and attenuated appropriately to limit ingress of surface water from the development into the sewerage network.

5. Barford Chapel Street catchment

5.1 Village Clusters and sites

The Barford Chapel Street WRC catchment serves the Village Cluster of **Barford, Marlingford, Colton** and **Wramplingham.** There is one allocated site in the Barford Chapel Street WRC catchment as shown in Figure 6 and Table 5-1; the site would deliver a maximum of 19 dwellings in the WRC catchment.

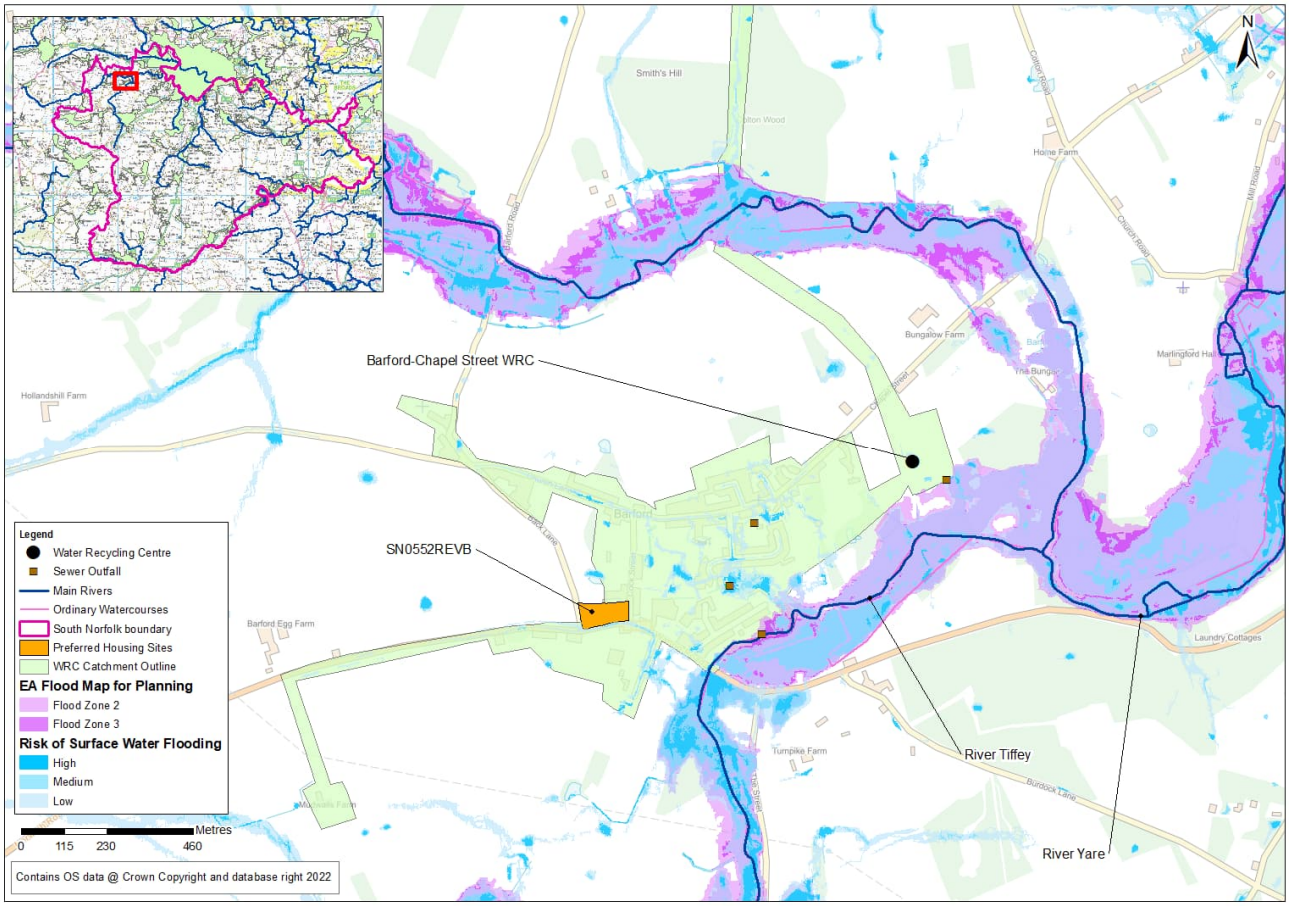


Figure 6: Barford WRC catchment, allocated site and hydrological context

Table 5-1. Allocated site relevant to the Barford WRC catchment

Site Reference	Site Address	Dwelling No.
SN0552REVB	Land at Cock Street and Watton Road, Barford	19

5.2 WRC headroom capacity

5.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 15 new dwellings within the Barford Chapel Street WRC catchment of which, none were assumed to come forward from the Village Cluster. The VCHAP has subsequently allocated 19 dwellings within the Village Cluster of Barford, Marlington, Colton and Wramplington. As a result, the impact of an additional 19 dwellings on capacity has been considered in this WCS addendum.

5.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of 15 additional dwellings to 2038 would be within the existing headroom capacity for Barford WRC. A further 19 dwellings allocated in the VCHAP (a total of 34 including GNLP growth) would not exceed the available headroom, with 20% capacity remaining at the WRC. Therefore, there is sufficient headroom capacity at the WRC to treat wastewater from the Village Cluster.

5.3 Environmental capacity assessment

As there is greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that only small (less than 10%) changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are well within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to the River Tiffey catchment from this WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA.

5.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the site in the Village Cluster are shown in Table 5-2.

Table 5-2: Site capacity assessments and flood risk for the site in the Barford WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0552REVB	19	Reported local network capacity issues	None identified	0% - the site is beyond the extent of FZ2	0% - the site is beyond the extent of FZ3	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

5.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Barford, Marlingford, Colton and Wramplingham.

Localised network issues have been reported in Barford. AWS have a scheme in place to rectify local issues related to river water ingress into the sewer system; however, it is recommended that developers of the allocated site liaise early with AWS to identify the preferred connection solutions and whether this requires requisition of new sewers prior to commencement of site construction. Development here must ensure that surface water is managed on site and attenuated appropriately to limit ingress of surface water from the development into the sewerage network.

6. Barnham Broom catchment

6.1 Village Clusters and sites

The Barnham Broom WRC catchment serves the Village Cluster of **Barnham Broom, Kimberley, Carleton Forehoe, Runhall & Brandon Parva**. There are three allocated sites in the Barnham Broom WRC catchment as shown in Figure 7 and Table 6-1; the sites would deliver a maximum of 55 dwellings in the WRC catchment.

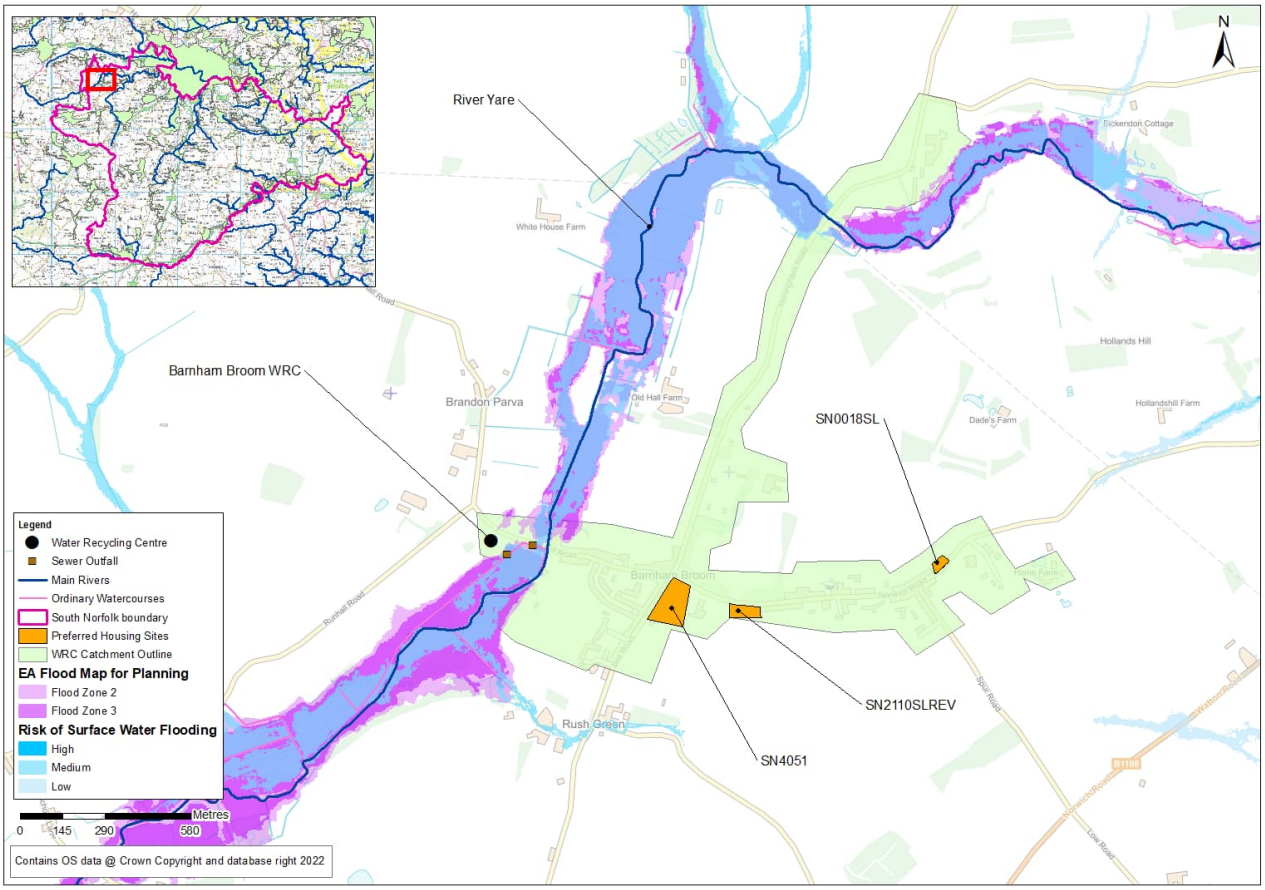


Figure 7: Barnham Broom WRC catchment, allocated sites and hydrological context

Table 6-1. Allocated sites relevant to Barnham Broom WRC catchment

Site Reference	Site Address	Dwelling No.
SN0018SL	Land north of Norwich Road	5
SN2110SLREV	Land south of Norwich Road	10
SN4051	Land on the corner of Bell Road and Norwich Road	40

6.2 WRC headroom capacity

6.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 67 new dwellings within the Barnham Broom WRC catchment, of which 25 were assumed to come forward from the Village Cluster. The VCHAP has subsequently allocated 55 dwellings within the Village Cluster. As a result, the impact of an additional 30 dwellings on capacity has been considered in this WCS addendum.

6.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would cause the flow permit for the WRC to be exceeded. A further 30 dwellings allocated in the VCHAP (a total of 97 including GNLP growth) would exacerbate this situation. Therefore, additional environmental capacity assessment was required.

6.2.3 Environmental capacity assessment

Because the headroom capacity of Barnham Broom WRC would be exceeded due to growth (new permit required), this assessment used modelling (RQP) and considered impacts of additional treated flow on the receiving watercourse - the River Yare (u/s confluence with Tiffey – Lower) WFD waterbody[7].

Full results of the water quality modelling for Barnham Broom WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality of the River Yare at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be achievable within the limits of conventionally applied treatment processes.
- The current overall and future target WFD status of the River Yare (u/s confluence with Tiffey – Lower) WFD waterbody would not deteriorate even without significant changes to the quality limits on the new discharge permit required.

Managing the pollutant load through a new discharge permit and implementation of minor improvements to the discharge quality from Barnham Broom WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA. Implementing these minor improvements, in addition to other improvements from other WRC at a catchment level would ensure no deterioration from the current quality in the catchment as a result of growth in this WRC catchment.

6.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 6-2.

Table 6-2: Site capacity assessments and flood risk

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0018SL	5	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	00% - no mapped flood extent on site	0% - no mapped flood extent on site
SN2110SLREV	10	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN4051	40	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

6.4 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Barnham Broom, Kimberley, Carleton Forehoe,

[7] WFD Waterbody ID GB105034051290

Runhall & Brandon Parva. The larger site (SN4051) may require sewerage infrastructure upgrades to be implemented prior to occupation; this may affect early phasing or increase developer requisition costs.

Barnham Broom WRC which serves the Village Cluster will require a new permit early in on the VCHAP plan period, however the modelling has shown that any changes required to meet legislative drivers are minor and are unlikely to require significant investment in treatment processes at the WRC, hence there should be no phasing implications for the allocated sites in this Village Cluster.

7. Beccles-Marsh Lane catchment

7.1 Village Clusters and sites

The Beccles-Marsh Lane WRC catchment serves the Village Cluster of **Gillingham, Geldeston and Stockton.** There is one allocated site in the Beccles-Marsh Lane WRC catchment as shown in Figure 8 and Table 7-1; the site would deliver a maximum of 35 dwellings in the WRC's catchment.

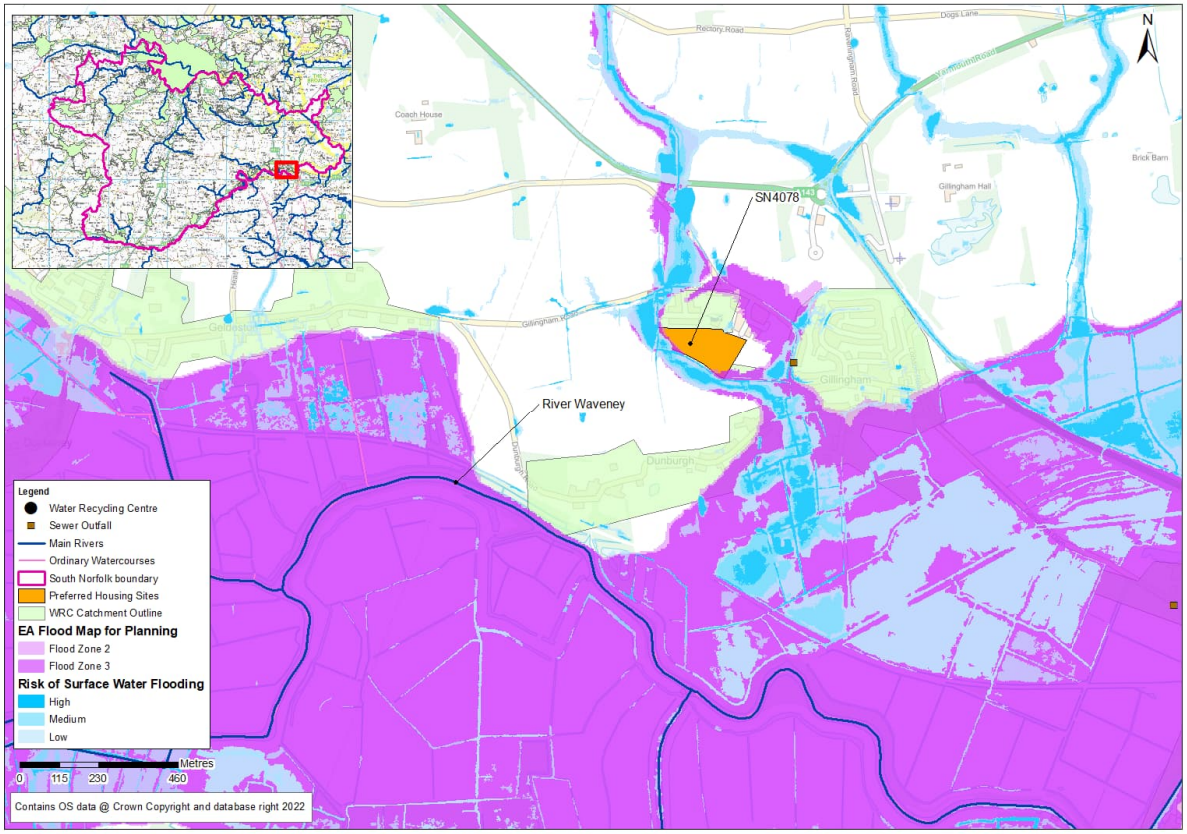


Figure 8: Beccles WRC catchment, allocated site and hydrological context

Table 7-1. Allocated site relevant to the Beccles WRC catchment

Site Reference	Site Address	Dwelling No.
SN4078	Land south of GIL1 site	35

7.2 WRC headroom capacity

7.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 91 new dwellings within the Beccles-Marsh Lane WRC catchment, of which 40 were assumed to come from the Village Cluster. The VCHAP has subsequently allocated only 35 dwellings within the Village Cluster; 5 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional wastewater treatment assessment has been completed for this WCS addendum. Only the site assessment has been completed for this Village Cluster.

7.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for the site in the Village Cluster is shown in Table 7-2.

Table 7-2: Site capacity assessment and flood risk for the allocated site

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4078	35	None identified	None	14% - The western edge and south-eastern tip of the site infringe upon FZ2.	11% - The western edge and south-eastern tip of the site infringe upon FZ3.	2% - A very small area on the western edge of the site is at high risk of flooding from surface waters.	5% - A very small area on the western edge of the site is at medium risk of surface water flooding.	10% - A small area on the western edge of the site is at low risk of surface water flooding.

7.4 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment, local infrastructure and surface water flood risk constraints for the proposed site within the Village Cluster of Gillingham, Geldeston and Stockton. However, fluvial flood risk to the single allocated site will require consideration of the sequential approach to avoid vulnerable development within Food Zones 3 and 2; the site may also need to consider specific fluvial flood risk mitigation to manage flood flow conveyance and loss of floodplain storage.

8. Burston Station Road catchment

8.1 Village Clusters and sites

There are no VCHAP allocated sites in the Burston Station Road WRC catchment, however the Diss and District Neighbourhood Plan has considered a site in the catchment as shown in Figure 9 and Table 8-1; the site would deliver a maximum of 25 dwellings in the WRC's catchment.

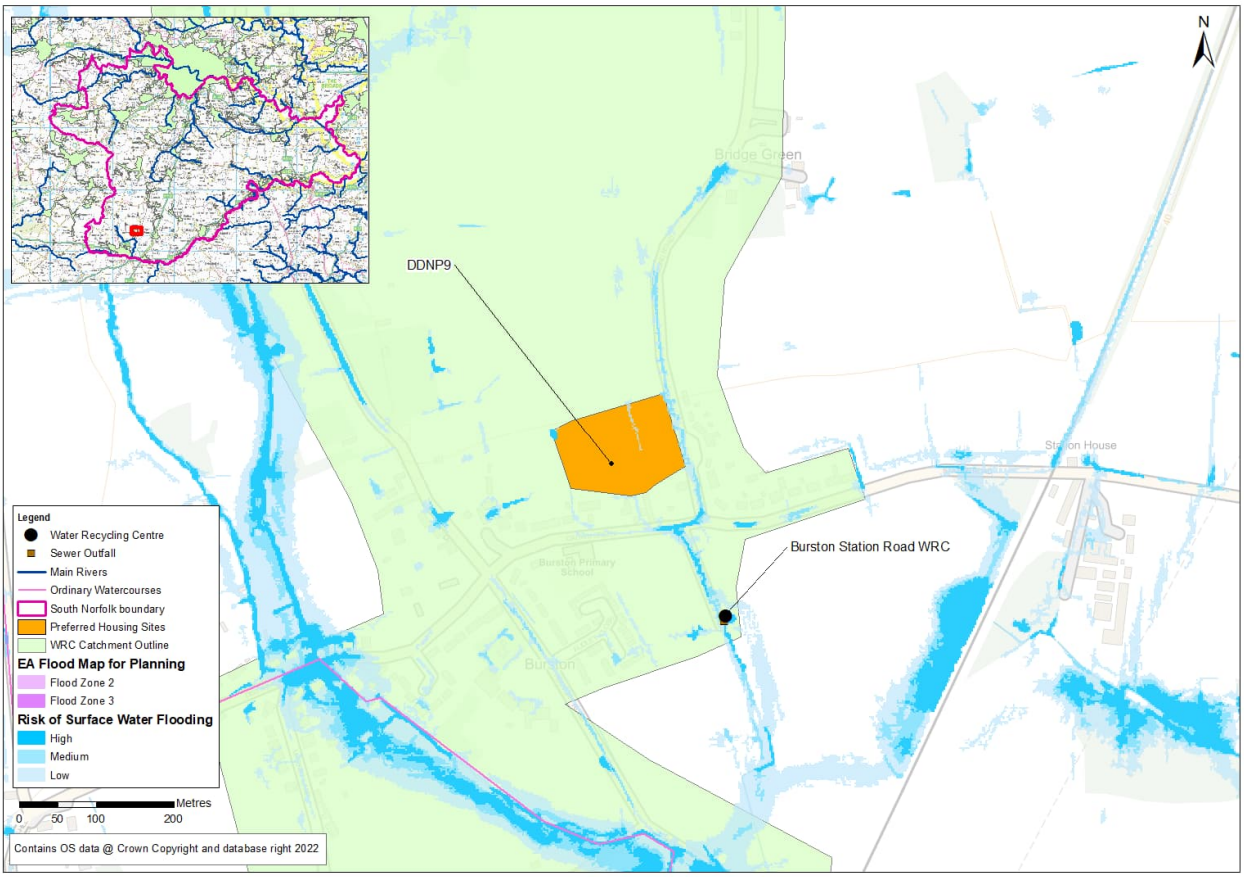


Figure 9: Burston Station Road WRC catchment, Neighbourhood Plan site and hydrological context

Table 8-1. Neighbourhood Plan site relevant to the Burston Station Road WRC catchment

Neighbourhood Plan Site Reference	Site Address	Dwelling No.
DDNP9	Land to the west of Gissing Road, Burston	25

8.2 WRC headroom capacity

Burston Station Road WRC is a small WRC which has a descriptive permit serving a population equivalent (PE) of 55.

8.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 3 new dwellings within the Burston Station Road WRC catchment of which, none were assumed to come forward from any Village Cluster. The Diss and District Neighbourhood Plan has subsequently allocated 25 dwellings in Burston and as a result, the impact of an additional 25 dwellings on capacity has been considered in this WCS addendum.

8.2.2 Capacity re-assessment

28 dwellings would add a further PE of approximately 58, giving a post-plan PE total of 137.This is within the 250 PE limit which would trigger the need for a water quality assessment and permit review. Therefore, a water quality assessment has not been undertaken and it is assumed the site proposed in Burston can be taken forward without affecting water quality targets.

8.3 Site assessments

Assessment of flood risk only has been completed for the Neighbourhood Plan site as it is not an allocation within the VCHAP and has not been considered by AWS within the remit of the SNVC WCS. The assessment outcome is shown in Table 8-2.

Table 8-2: Site capacity assessment and flood risk

Site information		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	FZ2	FZ3	High	Medium	Low
DDNP9	25	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0.5% - very small area in the north-west corner of the site	0.5% - very small area in the north-west corner of the site	2% - very small area of flooding down the centre of the site

8.4 Location summary

No significant wastewater treatment or flood risk constraints were identified for Burston. However, as Burston Station Road WRC is a small WRC, any additional growth may have a disproportionate impact on the WRC, and it is likely that WRC improvements would need to be delivered through the AWS business planning process. Further assessment would be undertaken by AWS to confirm exactly what the infrastructure impact would be.

Developers should engage with AWS at an early stage to enable the company to understand the potential impact new development may have and also consider alternative wastewater treatment and disposal via the provision of a package treatment plant.

9. Diss catchment

9.1 Village Clusters and sites

The Diss WRC catchment serves the Village Clusters of:

- **Bressingham**
- **Roydon**
- **Scole**

There is one allocated site in the Diss WRC catchment and three sites allocated by the Diss and District Neighbourhood Plan as shown in Figure 10 and Table 9-1; the sites would deliver a maximum of 125 dwellings in the WRC catchment.

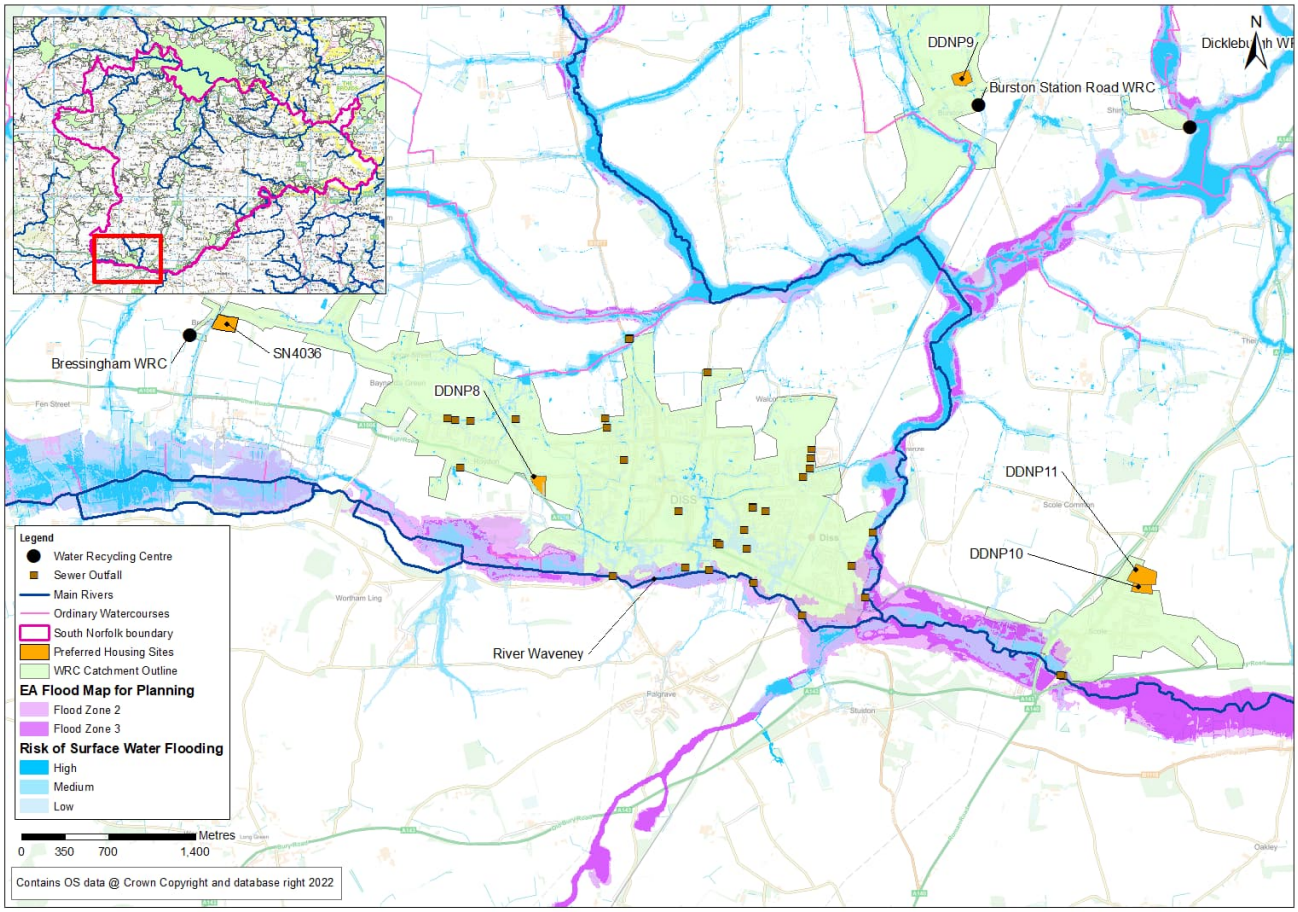


Figure 10: Diss WRC catchment, allocated site, Neighbourhood Plan sites and hydrological context

Table 9-1. Site assessment summary for Diss

Site Reference	Site Address	Dwelling No.
SN4036	Land east of School Road	40
DDNP8	*Neighbourhood Plan Site*	25
DDNP11	*Neighbourhood Plan Site*	50
DDNP10	*Neighbourhood Plan Site*	10

9.2 WRC headroom capacity

9.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 836 new dwellings within the Diss WRC catchment, of which, 75 were from the Village Clusters. The VCHAP and Diss and District Neighbourhood Plan has collectively allocated 125 dwellings within (or close to) the Diss WRC catchment. As a result, the impact of an additional 50 dwellings on capacity has been considered in this WCS addendum.

9.2.2 GNLP WCS conclusions

The GNLP WCS determined that the development of the 836 new dwellings by 2038 would not cause treatment headroom to be exceeded.

9.2.3 Capacity re-assessment

The addition of a further 50 dwellings allocated by the VCHAP does not alter the conclusions of the GNLP WCS on overall treatment headroom capacity. The Diss WRC would remain well within its headroom capacity (36% capacity remaining); however, reassessment of the environment capacity assessment was undertaken due to the increase in dwellings compared to the GNLP WCS assumptions.

9.3 Environmental capacity assessment

As there would be greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that only small (less than 12%) changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are well within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to the River Waveney catchment from this WRC would also ensure no impact on the designated sites linked to the River Waveney which form component parts of the Broads SAC and Broadlands SPA.

9.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the allocated site in the Village Cluster are shown in Table 9-2. Assessment of flood risk only has been completed for the Neighbourhood Plan sites as they are not allocations within the VCHAP and hence were not assessed by AWS for this study.

Table 9-2: Site capacity assessments and flood risk for sites in the Diss WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4036	40	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0.5% - very small area of flooding in south-west corner of site
DDNP8	25	Not assessed		0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	10% - area of flooding in the east of the site
DDNP11	50			0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no evidence of flooding on site	0% - no evidence of flooding on site
DDNP10	10			0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped	0% - no mapped flood	0% - no mapped flood

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
						flood extent on site	extent on site	extent on site

9.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the town of Diss, nor the Village Clusters of Bressingham, Roydon and Scole. Developers for the Neighbourhood Plan site should seek pre-application advice from AWS with respect to wastewater network capacity and infrastructure upgrade requirements.

10. Ditchingham catchment

10.1 Village Clusters and sites

The Ditchingham WRC catchment serves the Village Cluster of **Ditchingham, Broome, Hedenham** and **Thwaite.** There are two allocated sites in the Ditchingham catchment as shown in Figure 11 and Table 10-1; the sites would deliver a maximum of 45 dwellings in the WRC's catchment.

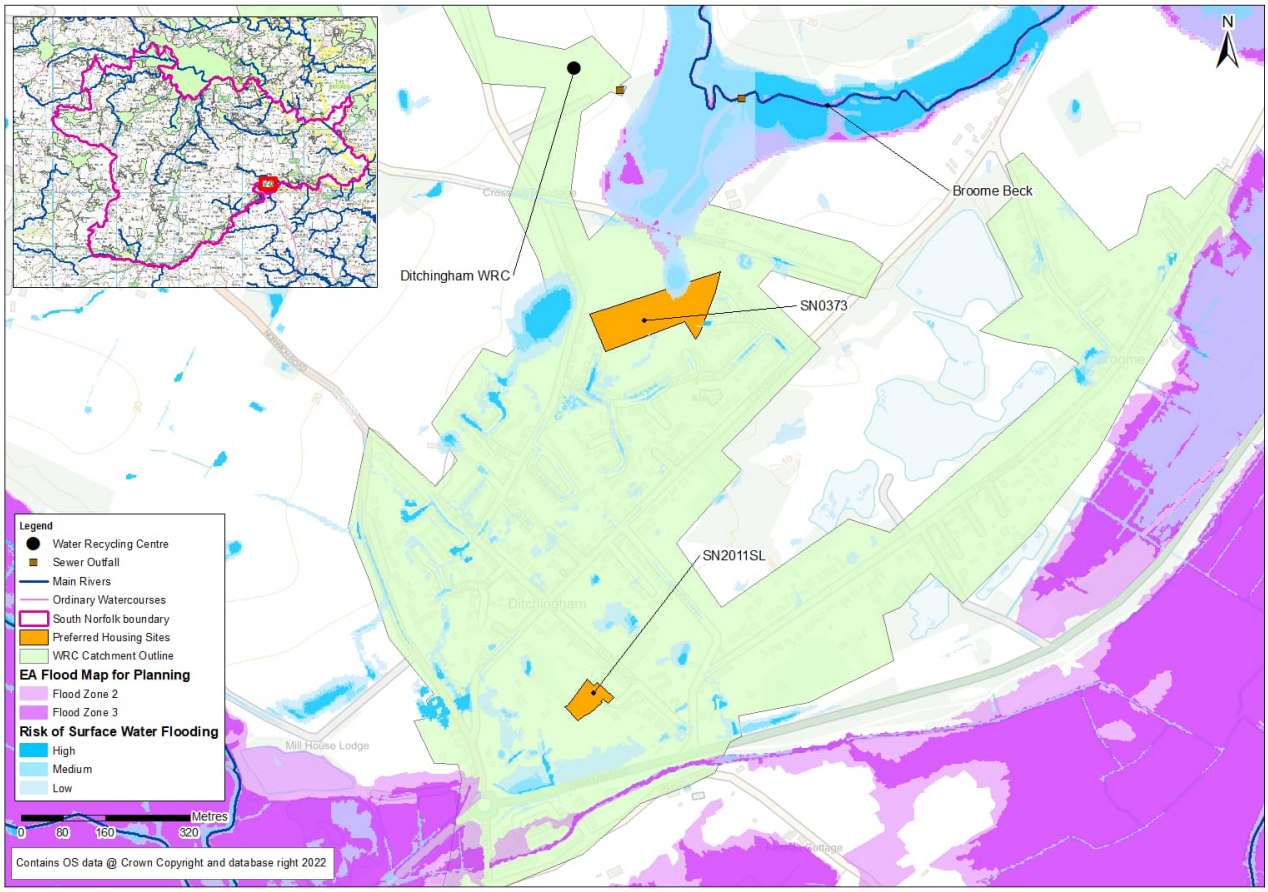


Figure 11: Ditchingham WRC catchment, allocated sites and hydrological context

Table 10-1. Allocated sites relevant to the Ditchingham WRC catchment

Site Reference	Site Address	Dwelling No.
SN0373	Thwaite Rd/Tunneys Lane	35
SN2011SL	Land at Lambert's Way	10

10.2 WRC headroom capacity

10.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 56 new dwellings within the Ditchingham WRC catchment, none of which were in the Village Cluster. The VCHAP has subsequently allocated 45 dwellings within the Village Cluster. As a result, the impact of an additional 45 dwellings on capacity has been considered in this WCS addendum.

10.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would cause the flow permit for the WRC to be exceeded. A further 45 dwellings allocated in the VCHAP (a total of 101 including GNLP growth) would exacerbate this situation. Therefore, additional environmental capacity assessment was required. This assessment considered impacts of additional treated flow on the receiving watercourse (Broome Beck).

10.3 Environmental capacity assessment

Because the headroom capacity of Ditchingham WRC would be exceeded due to growth (new permit required), this assessment used modelling (RQP) and considered impacts of additional treated flow on the receiving watercourse - the Broome Beck WFD waterbody[8].

Full results of the water quality modelling for Ditchingham WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality (for ammonia and phosphate) of the Broome Beck at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be achievable within the limits of conventionally applied treatment processes.
- Little or no change would be required to the permit quality conditions for current WFD status and future target WFD status of the Broome Beck to be maintained for all discharge parameters.
- A permit value for BOD would need to be set beyond the limits of conventionally applied treatment in order to maintain current quality. Analysis of measured BOD data in the WRC discharge demonstrates this is because the WRC currently treats well below the limits that are considered conventionally achievable. However, modelling has shown that a permit value at the limit of conventional treatment would be sufficient to prevent WFD deterioration and would not result in a waterbody level deterioration compared to the current discharge.
- It would therefore be possible to set a new permit that ensures no deterioration in the current quality of the Broome Beck as a result of future WRC discharges.

Managing the pollutant load through a new discharge permit and implementation of improvements to the discharge quality from Ditchingham WRC would also ensure no impact on the designated sites linked to the River Waveney which form component parts of the Broads SAC and Broadlands SPA. Implementing these improvements would ensure no deterioration from the current quality in the Broome Beck catchment as a result of growth associated with this WRC catchment.

10.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 10-2.

Table 10-2: Site capacity assessments and flood risk for sites in Ditchingham WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0373	35	There may be capacity limitations based on cumulative development in the catchment – there may be phasing implications whilst upgrades are made	None	1% - very small area to the north of the site	0%	2% - very small area to the north of the site.	3% - very small area to the north of the site	7% - small area to the north of the site
SN2011SL	10		None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

[8] WFD Waterbody ID GB105034045930

10.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed sites within the Village Cluster of Ditchingham, Broome, Hedenham and Thwaite.

However, a new discharge permit will be required for Ditchingham WRC because growth from the Village Cluster combined with allocations within the GNLP would result in the current WRC headroom capacity being exceeded. The environmental capacity analysis has demonstrated that new permit conditions on quality can be applied within limits of conventionally applied treatment to protect water quality and linked ecological sites, and that these permit conditions may need to be close to the current quality of discharge achieved by the WRC which is of a high standard. Given the potential scale of treatment improvement, this may require AWS to undertake process upgrades at the WRC to be able to continue to achieve these standards with higher inflows of wastewater from growth and this may have phasing implications for some sites within the catchment.

Additionally, the two sites allocated by the VCHAP may have phasing implications linked to the potential need to upgrade the sewerage system in order to allow all development proposed within the Ditchingham WRC catchment to connect.

It is recommended that development in the Village Cluster of Ditchingham, Broome, Hedenham and Thwaite is required to evidence to the Local Planning Authority that consultation with AWS has been undertaken which demonstrates that there is sufficient treatment and network capacity to serve the level of development proposed.

11. Earsham-Bungay Rd catchment

11.1 Village Clusters and sites

The Earsham-Bungay Rd WRC catchment serves the Village Cluster of **Earsham.** There is one preferred site in the Earsham-Bungay Rd WRC catchment as shown in Figure 12 and Table 11-1; the site would deliver a maximum of 24 dwellings in the WRC catchment.

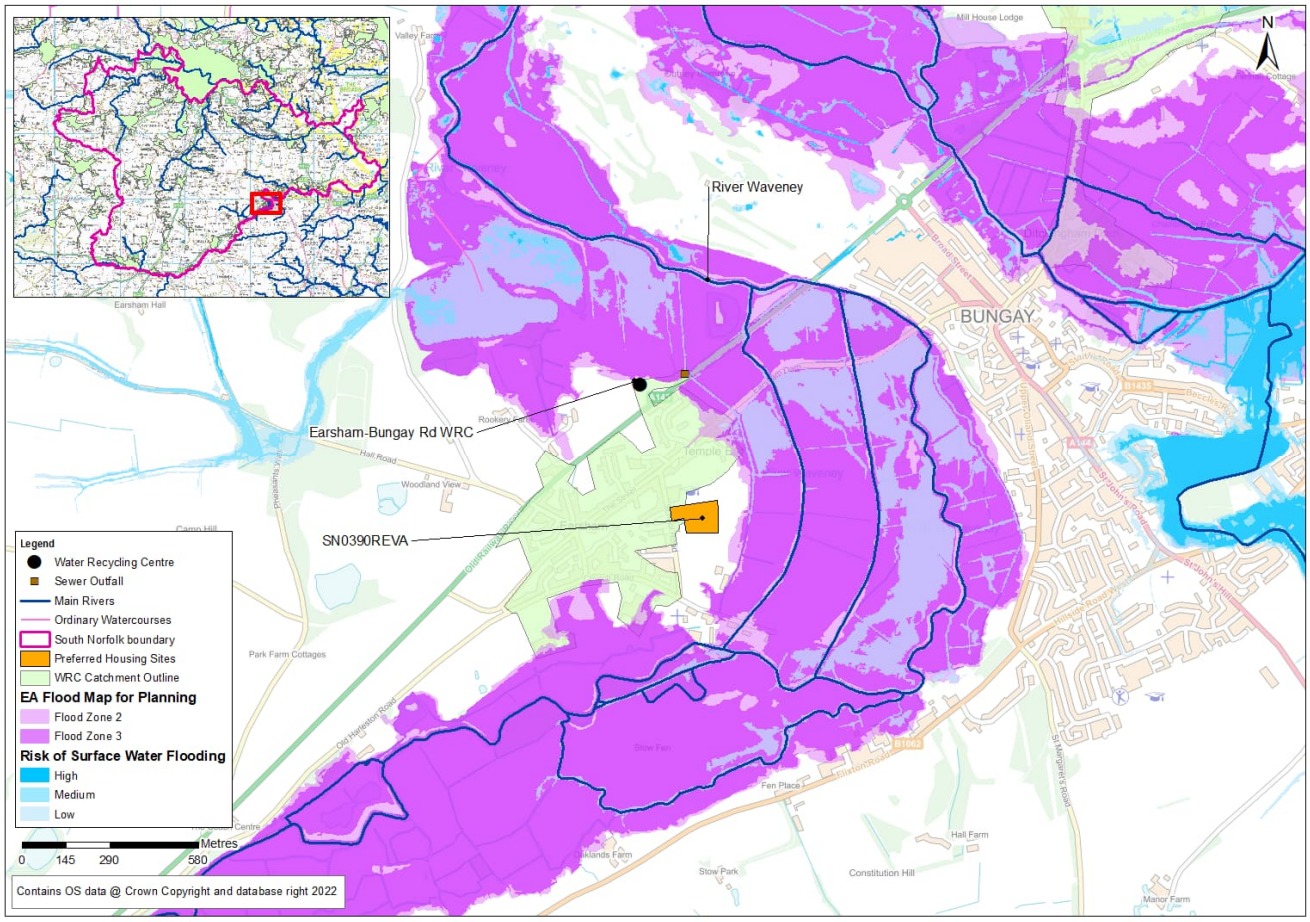


Figure 12: Earsham-Bungay Rd WRC catchment, allocated site and hydrological context

Table 11-1. Allocated site relevant to the Earsham-Bungay Rd WRC catchment

Site Reference	Site Address	Dwelling No.
SN0390REVA	Land East of School Road, Earsham	24

11.2 WRC headroom capacity

11.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 42 new dwellings within the Earsham-Bungay Rd WRC catchment, of which 25 were assumed to come from the Village Cluster. The VCHAP has subsequently allocated 24 dwellings within the Village Cluster; 1 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional wastewater assessment has been completed for this WCS addendum. Only the site assessment has been completed for this Village Cluster.

11.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for the site in the Village Cluster is shown in Table 11-2.

Table 11-2: Site capacity assessments and flood risk for the allocated site

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0390REVA	24	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

11.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Earsham.

12. Ellingham Braces Lane catchment

12.1 Village Clusters and sites

The Ellingham Braces Lane WRC catchment serves the Village Clusters of:

- **Gillingham, Geldeston and Stockton**
- **Kirby Cane and Ellingham**

There are three preferred sites in the Ellingham Braces Lane WRC catchment as shown in Figure 13 and Table 12-1; the sites would deliver a maximum of 57 dwellings in the WRC catchment.

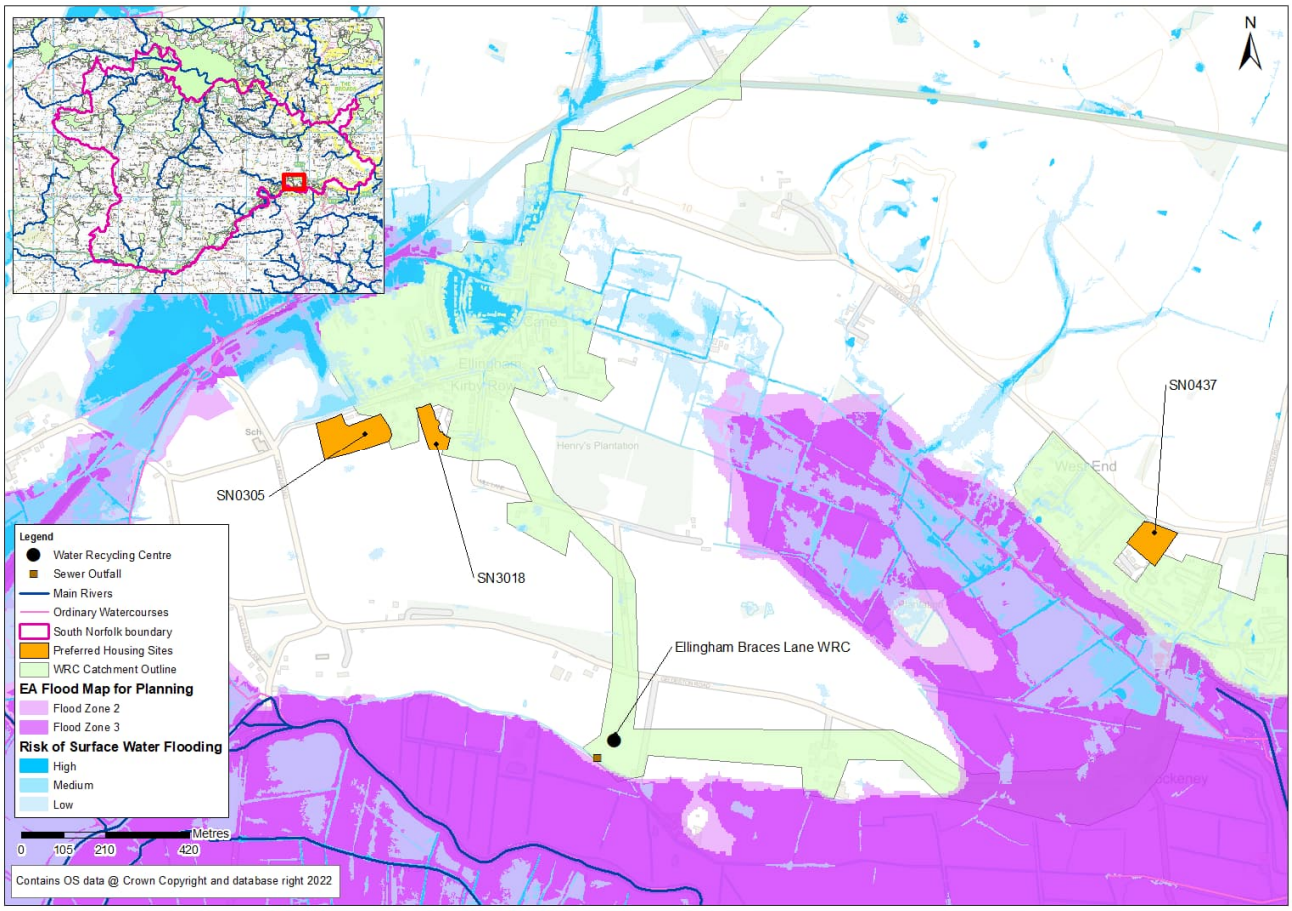


Figure 13: Ellingham Braces Lane WRC catchment, allocated sites and hydrological context

Table 12-1. Allocated sites relevant to the Ellingham Braces Lane WRC catchment

Site Reference	Site Address	Dwelling No.
SN0437	Land off Kells Way	20
SN0305	Land south of Mill Road, Ellingham Island	25
SN3018	Florence Way	12

12.2 WRC headroom capacity

12.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 64 new dwellings within the Ellingham Braces Lane WRC catchment, of which 37 were assumed to come from the village clusters. The VCHAP has subsequently allocated 57 dwellings within the Village Cluster. As a result, the impact of an additional 20 dwellings on capacity has been considered in this WCS addendum.

12.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would be within the existing headroom capacity for the WRC. A further 20 dwellings allocated in the VCHAP (a total of 84 including GNLP growth) would not exceed the available headroom, with 20% capacity remaining at the WRC. Therefore, there is sufficient headroom capacity at the WRC to treat wastewater from the Village Clusters within the catchment.

12.3 Environmental capacity assessment

As there would be greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that relatively minor changes in the discharge quality limits for BOD would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to the River Waveney catchment from this WRC would also ensure no impact on the designated sites linked to the River Waveney which form component parts of the Broads SAC and Broadlands SPA.

12.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the sites in the Village Cluster are shown in Table 12-2.

Table 12-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0437	20	None identified, but potential infiltration issues within Geldeston	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN0305	25	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN3018	12	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

12.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed sites within the Village Clusters of: Gillingham, Geldeston and Stockton; and, Kirby Cane and Ellingham. Local network issues have been reported in Geldeston linked to potential capacity issues with the wastewater pumping station. AWS have not identified any known pumping station constraints or proposed upgrades works; however, it is recommended that developers of site SN0473 liaise early with AWS to identify the preferred connection solutions and whether this requires requisition of new sewers prior to commencement of site construction. Development here must ensure that surface water is managed on site and attenuated appropriately to limit ingress of surface water from the development into the sewerage network.

13. Forncett End catchment

13.1 Village Clusters and sites

The Forncett-Forncett End WRC catchment serves the Village Clusters of:

- **Bunwell**
- **Tacolneston** and **Forncett End**

There are three preferred sites in the Forncett End WRC catchment as shown in Figure 14 and Table 13-1; the sites would deliver a maximum of 60 dwellings in the WRC catchment.

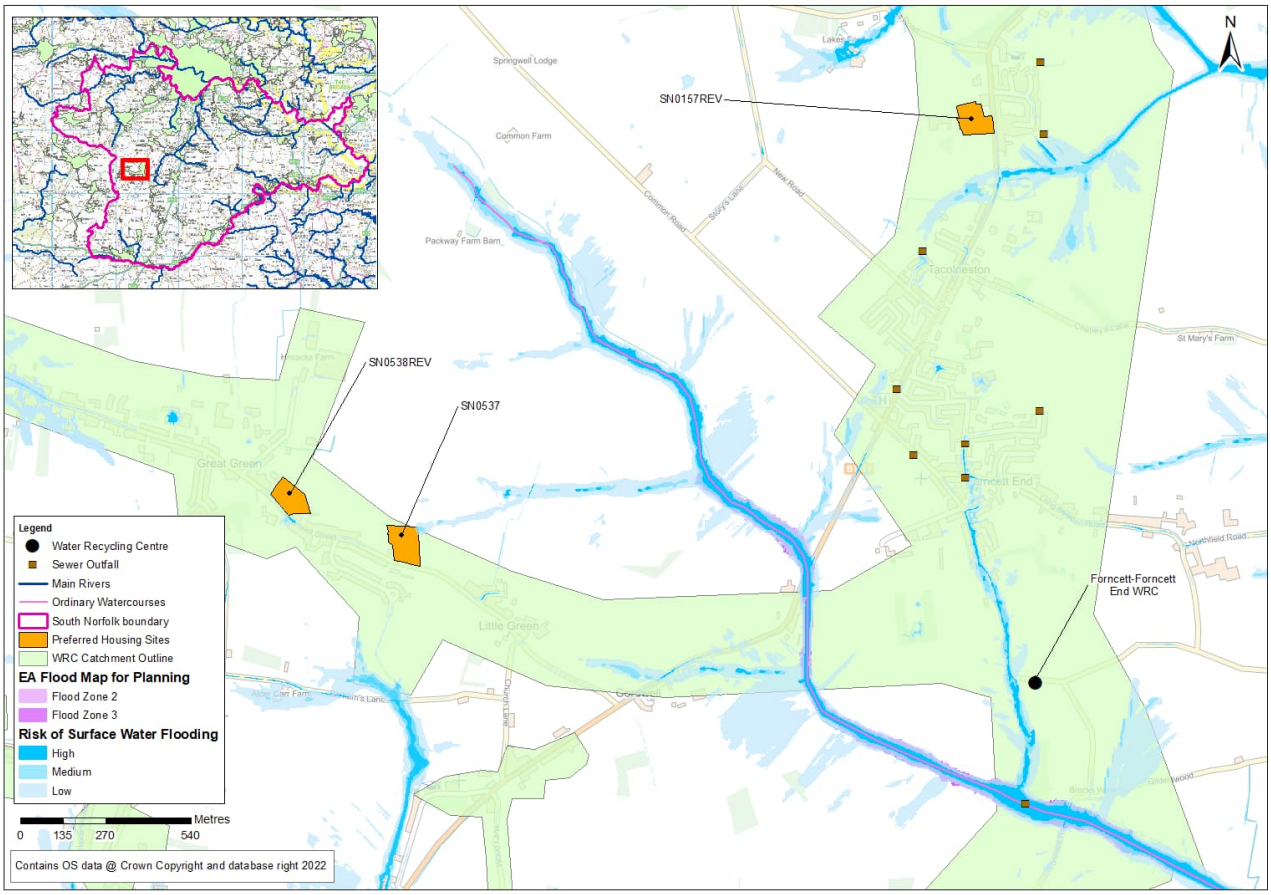


Figure 14: Forncett End WRC catchment, allocated sites and hydrological context

Table 13-1. Allocated sites of relevance to the Forncett End WRC catchment

Site Reference	Site Address	Dwelling No.
SN0537	Land to the north of Bunwell Street	15
SN0538REV	Land opposite Lilac Farm, Bunwell Street	20
SN1057REV	Land to the west of Norwich Road	25

13.2 WRC headroom capacity

13.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 70 new dwellings within the Forncett End WRC catchment, of which 25 were assumed to come from the Village Clusters. The VCHAP has subsequently allocated 60 dwellings within the Village Clusters. As a result, the impact of an additional 35 dwellings on capacity has been considered in this WCS addendum.

13.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of an additional 70 dwellings to 2038 would not cause the flow permit for the WRC to be exceeded. However, updated measured flow data (since the GNLP WCS was completed) from the WRC discharge, and the additional 35 dwellings within the catchment allocated by the VCHAP would lead to the current WRC capacity being exceeded and hence, additional environmental capacity assessment was required. This assessment considered impacts of additional treated flow on the receiving WFD water body – the Tas (Head to Tasburgh).

13.3 Environmental Capacity assessment

A quantification of the impact on the River Waveney was undertaken using the RQP modelling tool. Because the headroom capacity of Forncett End WRC would be exceeded due to growth (new permit required), this assessment used modelling and considered impacts of additional treated flow on the receiving watercourse - the Tas (Head to Tasburgh)[9].

Full results of the water quality modelling for Forncett End WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality of the Tas water body at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be achievable within the limits of conventionally applied treatment processes.
- Achieving WFD status at the point of discharge would not be possible either for current or future discharge volumes for ammonia or phosphate, although, if improvements are made to maintain current quality at the point of discharge, the status of overall Tas (head to Tasburgh) WFD water body should not be impacted compared to the current overall water body condition once growth is considered.
- It would therefore be possible to set a new permit that ensures no impact in the current quality of Tas water body as a result of future WRC discharges.

Managing the pollutant load through a new discharge permit and implementation of improvements to the discharge quality from Forncett End WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA. Implementing these improvements would ensure no deterioration from the current quality in the Broome Beck catchment as a result of growth associated with this WRC catchment.

13.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 13-2.

Table 13-2: Site capacity assessments and flood risk for allocated sites in the Forncett End WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0537	15	Vacuum system – limited capacity.	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood risk on site	0.5% - very small area of flooding in the north-east	2% - very small area of flooding in the north-east corner of the site

[9] WFD Waterbody ID GB105034045430

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
							corner of the site	
SN0538REV	20	Vacuum system – limited capacity	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood risk on site	0% - no mapped flood risk on site	0% - no mapped flood risk on site; some flooding on border
SN1057REV	25	Limited capacity in the sewerage network depending on cumulative development within the GNLP – may have phasing implications	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood risk on site	0% - no mapped flood risk on site	0% - no mapped flood risk on site

13.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Clusters of: Bunwell and Tacloneston and Forncett End.

However, a new discharge permit will be required for Forncett End WRC because the WRC already exceeds its headroom capacity with current discharge volumes, and growth from the Village Cluster combined with allocations within the GNLP would exacerbate this issue. The environmental capacity analysis has demonstrated that new permit conditions on quality can be applied within limits of conventionally applied treatment to protect water quality and linked ecological sites, and that these permit conditions may need to be close to the current quality of discharge achieved by the WRC. Given the scale of improvement required, this may require AWS to undertake process upgrades at the WRC to be able to continue to achieve these standards with higher inflows of wastewater from growth which may have phasing implications for some sites within the catchment. Plans for increased capacity at the WRC have been identified for the catchment within the draft DWMP.

In addition, allocated sites within the village of Bunwell are part of a vacuum sewer system which has limited connection capacity and new sewer upgrades may be required to service these developments and connect them to the sewerage system. Existing capacity in the conventional gravity system for site SN1057REV is also limited. It is recommended that development in the Village Clusters of Bunwell and Tacloneston/Forncett End is required to evidence to the Local Planning Authority that consultation with AWS has been undertaken which demonstrates that there is sufficient treatment and network capacity to serve the level of development proposed.

14. Haddiscoe Mock Mile Terr catchment

14.1 Village Clusters and sites

The Haddiscoe WRC catchment serves a small proportion of the Village Cluster of **Toft Monks, Aldeby, Haddiscoe, Wheatacre** and **Burgh St Peter.** Further sites within the Village Cluster would be connected to Wheatacre WRC; therefore, reference should also be made to the assessment for the Wheatacre WRC.

There is one allocated site in close proximity to the Haddiscoe Mock Mile Terr WRC catchment as shown in Figure 15 and Table 14-1; the site would deliver a maximum of 25 dwellings close to the WRC's catchment.

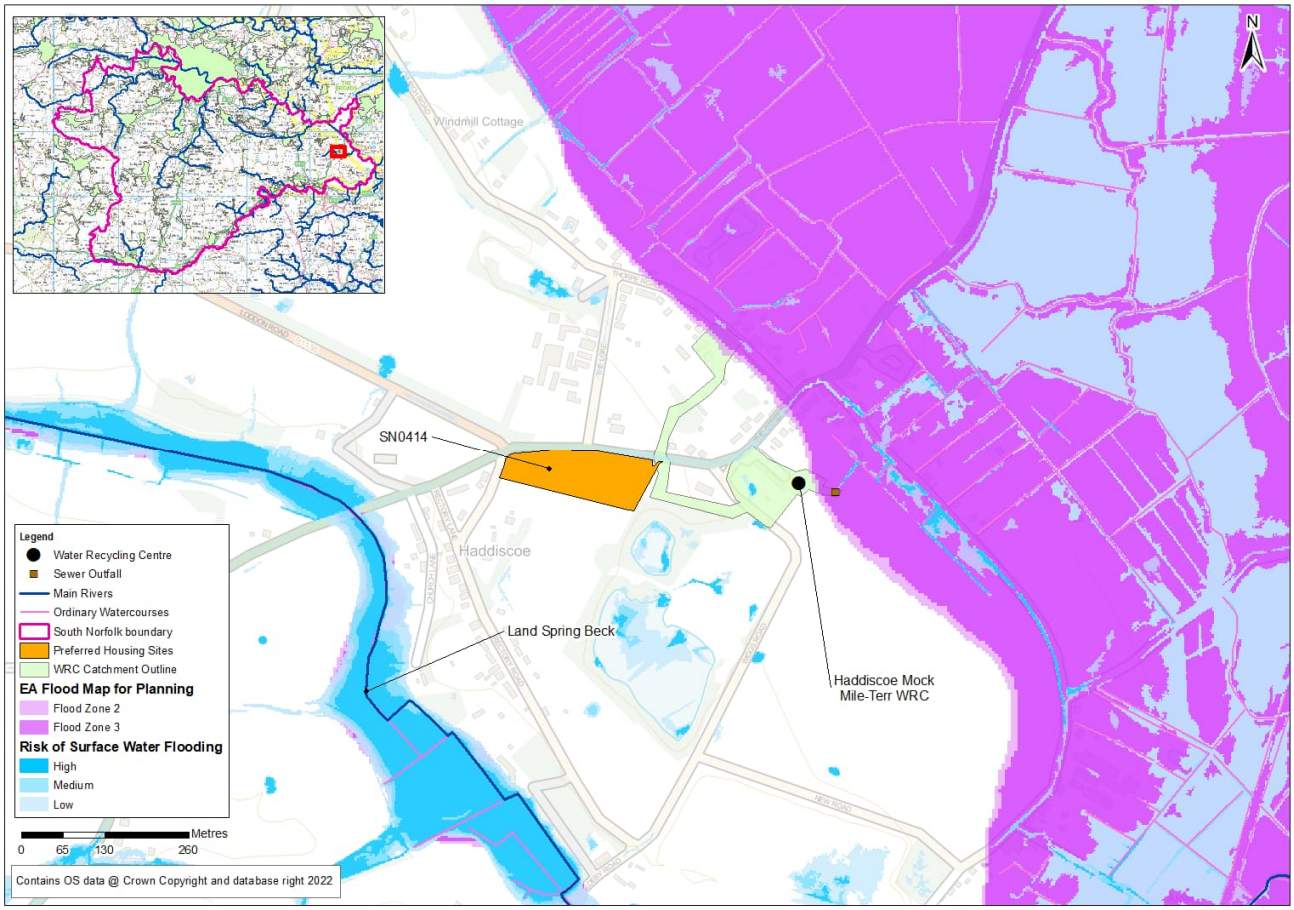


Figure 15: Haddiscoe WRC catchment, allocated site and hydrological context

Table 14-1. Allocated site of relevance to the Haddiscoe WRC

Site Reference	Site Address	Dwelling No.
SN0414	Haddiscoe Manor Farm	25

14.2 WRC headroom capacity

Haddiscoe Mock Mile Terr WRC is a small WRC which has a descriptive permit. AWS estimate it serves a PE of less than 50.

14.2.1 GNLP WCS assumptions

The GNLP WCS did not assess any new dwellings within the Haddiscoe Mock Mile Terr WRC catchment. The VCHAP has allocated 25 dwellings within the Village Cluster of Toft Monks, Aldeby, Haddiscoe, Wheatacre and Burgh St Peter and which

would be close to the Haddiscoe WRC. As a result, the impact of 25 dwellings on capacity has been considered in this WCS addendum for the Haddiscoe WRC.

14.2.2 Capacity re-assessment

The 25 dwellings would add a further PE of approximately 52, giving a post-plan PE total of 102. This is within the 250 PE limit which would trigger the need for a water quality assessment and permit review. Therefore, a water quality assessment has not been undertaken and it is assumed the site proposed in the Village Cluster can be taken forward without affecting water quality targets.

14.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for the site in the Village Cluster are shown in Table 14-2.

Table 14-2: Site capacity assessments and flood risk for the allocated site

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0414	25	Not connected to the network – developer will need to requisition new sewers or consider package treatment plant	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no flood risk extent on site	0% - no flood risk extent on site	0% - no flood risk extent on site

14.4 Cluster summary

No significant wastewater treatment or flood risk constraints were identified for allocated site SN0414 within the Village Cluster of Toft Monks, Aldeby, Haddiscoe, Wheatacre and Burgh St Peter. However, as Haddiscoe Mike Mile Terr is a small WRC, any additional growth may have a disproportionate impact on the WRC, and it is likely that WRC improvements would need to be delivered through the AWS business planning process. Further assessment would be undertaken by AWS to confirm exactly what the infrastructure impact would be. In addition, the allocated site is also not directly connected to the WRC sewerage network and hence, the developer will need to consider requisitioning new connecting sewers. Because the site is close to the WRC, this should not adversely affect site phasing as long as early discussions are held with AWS prior to commencement.

Developers should engage with AWS at an early stage to enable the company to understand the potential impact a new development may have and also consider alternative wastewater treatment and disposal via the provision of a package treatment plant.

15. Harleston catchment

15.1 Village Clusters and sites

The Harleston WRC catchment serves the Village Cluster of **Needham, Brockdish, Starson** and **Wortwell.** There are three allocated sites in the Harleston WRC catchment as shown in Figure 16 and Table 15-1; the sites would deliver a maximum of 35 dwellings in the WRC's catchment.

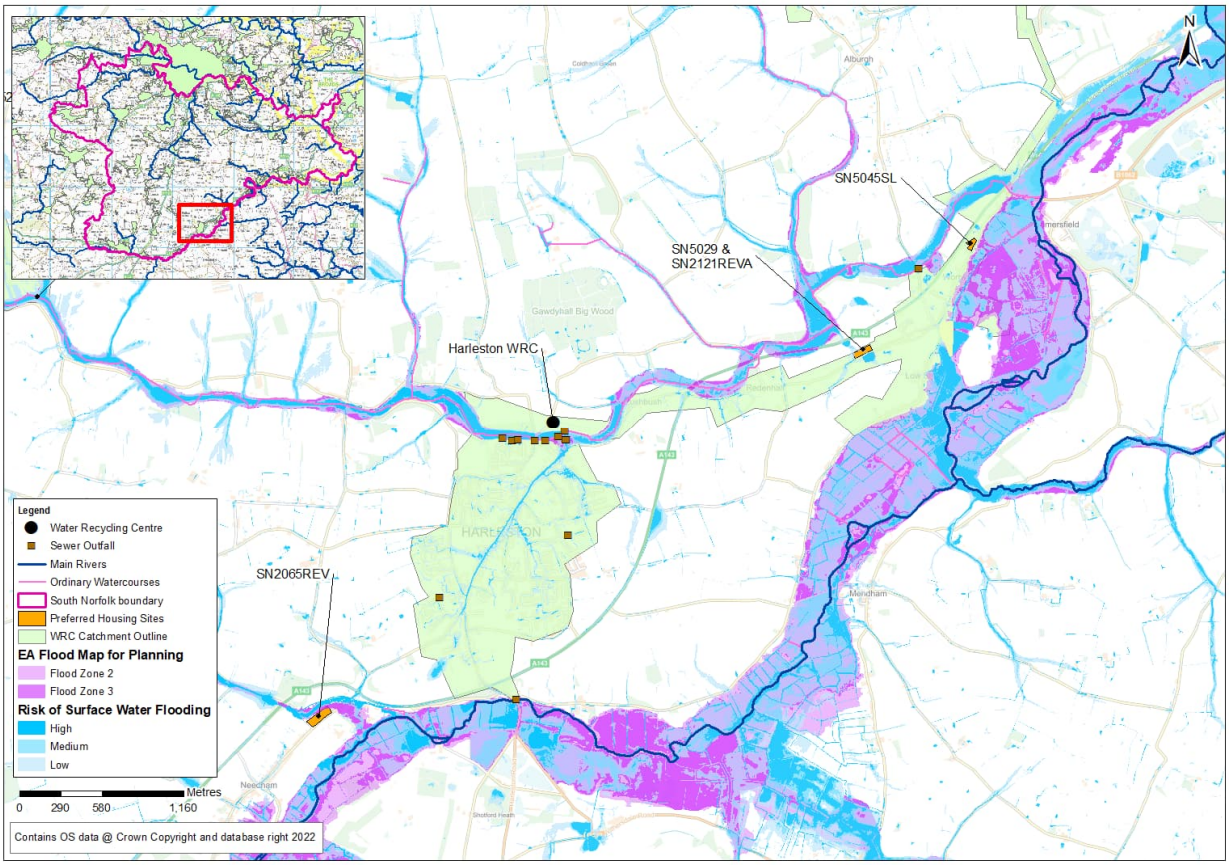


Figure 16: Harleston WRC catchment, allocated sites and hydrological context

Table 15-1. Allocated sites of relevance in the Harleston WRC catchment

Site Reference	Site Address	Dwelling No.
SN5045SL	Land north-east of High Road, Wortwell	8
SN2065REV	Land north of High Road and Harman's Lane	15
SN5029 & SN2121REVA	Land at Mill Hill, High Road, Wortwell	12

15.2 WRC headroom capacity

15.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 735 new dwellings within the Harleston WRC catchment, of which none were assumed to come from the Village Clusters. The VCHAP has subsequently allocated 35 dwellings within the Village Cluster. As a result, the impact of the additional 35 dwellings on capacity has been considered in this WCS addendum.

15.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would be within the existing headroom capacity for the WRC. A further 35 dwellings allocated in the VCHAP (a total of 770 including GNLP growth) would not exceed the available headroom, with 11% capacity remaining at the WRC. Therefore, there is sufficient headroom capacity at the WRC to treat wastewater from the Village Cluster.

15.3 Environmental capacity assessment

As there would be greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. However, the calculation has shown a 20% change in permit condition for some discharge parameters may be required and hence at some point in the plan period (for VCHAP and GNLP), some improvements to discharge quality would be required. Ensuring no increase in pollutant load to the Starston Brook catchment from this WRC would also ensure no impact on the designated sites linked to the River Waveney which form component parts of the Broads SAC and Broadlands SPA.

15.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 15-2.

Table 15-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN5045SL	8	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN2065REV	15	No existing network connectivity – may need package treatment plant or developer sewer requisition	None	10% - small area of flood risk in northern most area of the site	8% - small area of flood risk in northern most area of the site	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN5029 & SN2121REVA	12	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	40% - entire site to the south of High Road is at high risk	40% - entire site to the south of High Road is at medium risk	45% - entire site to the south of High Road is at low risk. Small area of north site in the centre is at low risk of flooding

15.5 Cluster summary

No significant wastewater treatment constraints have been identified for the Village Cluster of Needham, Brockdish, Starson and Wortwell. However, there are local infrastructure and some significant flood risk issues for some of the allocated sites which need consideration by the developer:

- Site SN2065REV is located outside of the Harleston WRC catchment and would require either a new foul sewer to be requisitioned, or the developed to consider an on-site package treatment plant.

- Flood risk is a concern for site SN5029/SN212REVA where surface water flood risk affects a significant percentage of the site area. The sites are likely to need to consider specific mitigation in the form of flood compensation, surface water storage, conveyance solutions or raised floor levels. In addition, they will need to consider the sequential approach in site layout considerations to ensure only low vulnerability land uses is located in the site areas at highest risk of flooding.

16. Hempnall Fritton Rd catchment

16.1 Village Clusters and sites

The Hempnall Fritton Rd WRC catchment serves the Village Clusters of:

- **Hempnall, Topcroft St, Morningthorpe, Fritton, Shelton** and **Hardwick**
- **Tasburgh**

There are two allocated sites in the Hempnall Fritton Rd WRC catchment as shown in Figure 17 and Table 16-1; the sites would deliver a maximum of 20 dwellings in the WRC catchment.

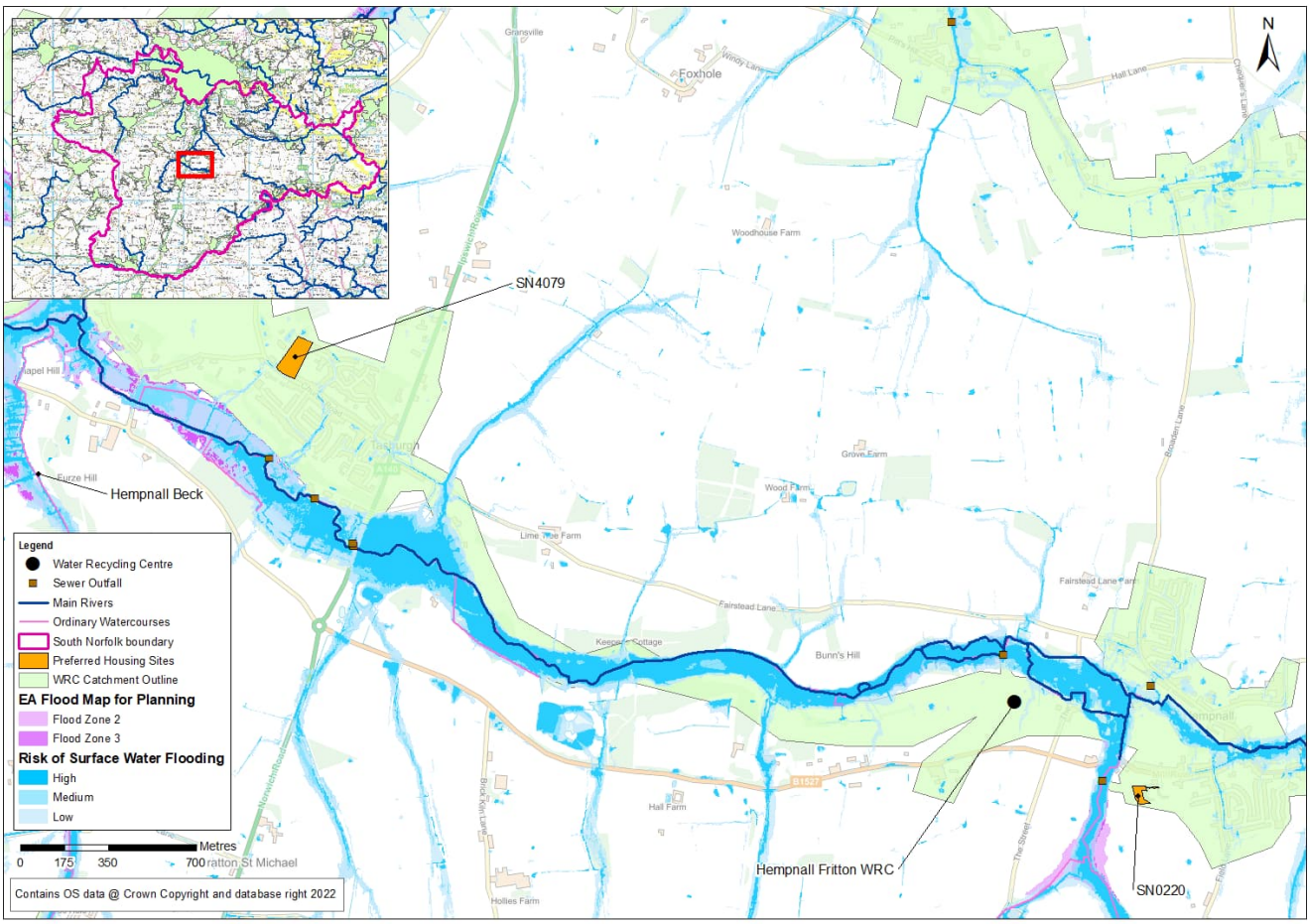


Figure 17: Hempnall Fritton Rd WRC catchment, allocated sites and hydrological context

Table 16-1: Allocated sites relevant to the Hempnall Fritton Rd WRC catchment

Site Reference	Site Address	Dwelling No.
SN0220	Land at Millfields	15
SN4079	Land north of Church Road & west of Tasburgh school	5

16.2 WRC headroom capacity

16.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 153 new dwellings within the Hempnall Fritton Rd WRC catchment, of which 40 were assumed to come from the Village Clusters. The VCHAP has subsequently allocated only 20 dwellings within the Village Clusters; 20 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum. Only the site assessment has been completed for these Village Clusters.

16.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 16-2.

Table 16-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0220	15	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	3% - very small area on area of site that protrudes to the east
SN4079	5	No capacity issues, but surface water sewer crosses the site.	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0.5% - very small areas on northern and southern boundary

16.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Clusters of Hempnall, Topcroft St, Morningthorpe, Fritton, Shelton and Hardwick, and Tasburgh; however, Site SN4079 should pay due cognisance to the surface water sewer which runs through the site.

17. Long Stratton catchment

17.1 Village Clusters and sites

The Long Stratton WRC catchment serves the Village Cluster of **Aslacton, Great Moulton** and **Tibenham.** There are two allocated sites in the Long Stratton WRC catchment as shown in Figure 18 and Table 17-1; the sites would deliver a maximum of 47 dwellings in the WRC catchment.

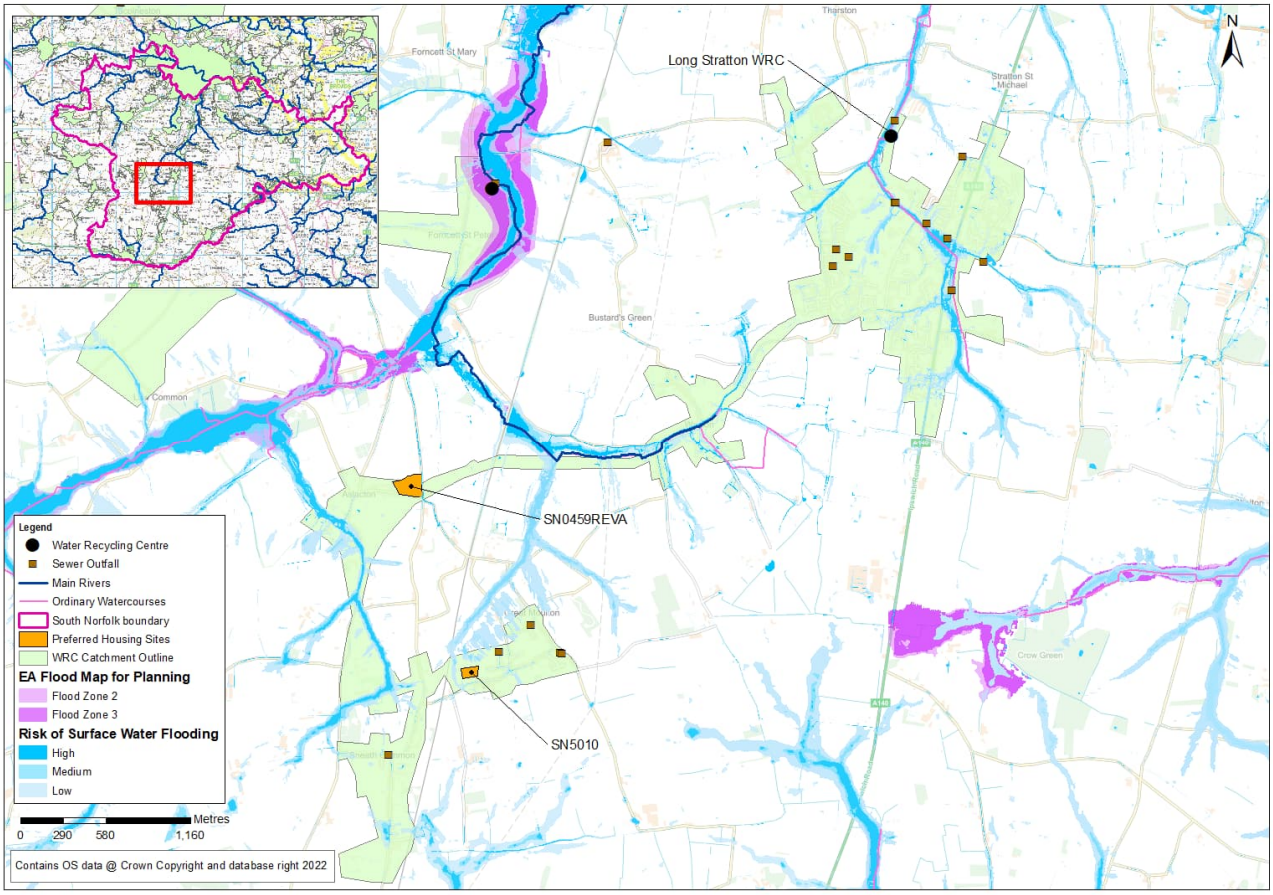


Figure 18: Long Stratton WRC catchment, allocated sites and hydrological context

Table 17-1. Allocated sites of relevance to the Long Stratton WRC catchment

Site Reference	Site Address	Dwelling No.
SN5010	Land west of Heather Way, Great Moulton.	12
SN0459REVA	Land off Church Road	35

17.2 WRC headroom capacity

17.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 1,913 new dwellings within the Long Stratton WRC catchment, of which none were assumed to come from the Village Cluster. The VCHAP has subsequently allocated 47 dwellings within the Village Cluster. As a result, the impact of the additional 47 dwellings on capacity has been considered in this WCS addendum.

17.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of the 1,913 additional dwellings to 2038 would cause the flow permit for the WRC to be exceeded. A further 47 dwellings allocated in the VCHAP (a total of 1,960 including GNLP growth) would exacerbate this situation. Therefore, additional environmental capacity assessment was required. This assessment considered impacts of additional treated flow on the receiving watercourse (Hempnall Beck).

17.3 Environmental capacity assessment

Because the headroom capacity of Long Stratton WRC would be exceeded due to growth (new permit required), this assessment used modelling (RQP) and considered impacts of additional treated flow on the receiving watercourse - the Hempnall Beck WFD waterbody[10].

Full results of the water quality modelling for Long Stratton WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality of Hempnall Beck at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be very minor for phosphate and require no changes for ammonia. All required changes would be achievable within the limits of conventionally applied treatment processes.
- Achieving WFD status at the point of discharge would not be possible for current discharge volumes or once growth is considered, although, if improvements are made to maintain current quality at the point of discharge, the status of overall Hempnall Beck WFD water body should not be impacted compared to the current overall water body condition.
- Testing for future moderate status for phosphate shows this would not be achievable at the mixing point either with, or without the impact of future discharges from growth – growth would not be the factor preventing target status from being achieved.
- It would therefore be possible to set a new permit that ensures no impact in the current quality of Hempnall Beck as a result of future WRC discharges.

Managing the pollutant load through a new discharge permit and implementation of improvements to the discharge quality from Long Stratton WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA. Implementing these improvements would ensure no deterioration from the current quality in the Broome Beck catchment as a result of growth associated with this WRC catchment.

17.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the sites in the Village Cluster are shown in Table 17-2.

Table 17-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN5010	12	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent. Flooding on Muir Lane on the eastern boundary	0% - no mapped flood extent. Flooding on Muir Lane on the eastern boundary	0% - no mapped flood extent. Flooding on Muir Lane on the eastern boundary
SN0459REVA	35	Capacity issues linked to surface water ingress and pumping station capacity	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent.	0% - no mapped flood extent.	0% - no mapped flood extent.

[10] WFD Waterbody ID GB105034045720

17.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Aslacton, Great Moulton and Tibenham.

However, a new discharge permit will be required for Long Stratton WRC because growth from the Village Cluster combined with allocations within the GNLP would result in the current WRC headroom capacity being exceeded. The environmental capacity analysis has demonstrated that new permit conditions on quality can be applied within limits of conventionally applied treatment to protect water quality and linked ecological sites, and that these permit conditions may need to be close to the current quality of discharge achieved by the WRC which is of a high standard. This is likely to require AWS to undertake process upgrades at the WRC to be able to continue to achieve these standards with higher inflows of wastewater from growth which may have phasing implications for some sites within the catchment.

There are known sewerage network capacity issues in the village of Aslacton linked to the ingress of surface water (infiltration) into the foul only network as well as capacity issues associated with a shared rising main with the village of Wacton. AWS are proposing measures to upgrade pumping stations at Aslacton and Wacton which would balance the flows and mitigate issues and AWS have also been working with the Lead Local Flood Authority (LLFA) and landowners to manage land drainage and minimise surface water ingress into the sewerage network. Developers of site SN0459REVA should ensure that surface water is managed on site through attenuation via Sustainable Drainage systems (SuDS) provision to ensure there is no exacerbation of the network issues and pump capacity.

The draft DWMP identifies that a new treatment process stream (linked to a new permit) is likely to be required in the medium term for Long Stratton WRC with a long-term strategy to remove 50% of the surface water entering the network. AWS are also committed to delivering storm tank improvements by 2024 as part of the Water Industry National Environment Programme (WINEP) of works agreed with the Environment Agency.

Despite the identified measures, it is recommended that development in the Village Cluster of Aslacton, Great Moulton and Tibenham is required to provide evidence to the Local Planning Authority that consultation with AWS has been undertaken which demonstrates that there is sufficient treatment and network capacity to serve the level of development proposed prior to commencement of development.

18. Norton Subcourse catchment

18.1 Village Clusters and sites

The Norton Subcourse WRC catchment serves the Village Cluster of **Thurlton** and **Norton Subcourse.** There are two preferred sites in the Norton Subcourse WRC catchment as shown in Figure 19 and Table 18-1; the sites would deliver a maximum of 22 dwellings in the WRC catchment.

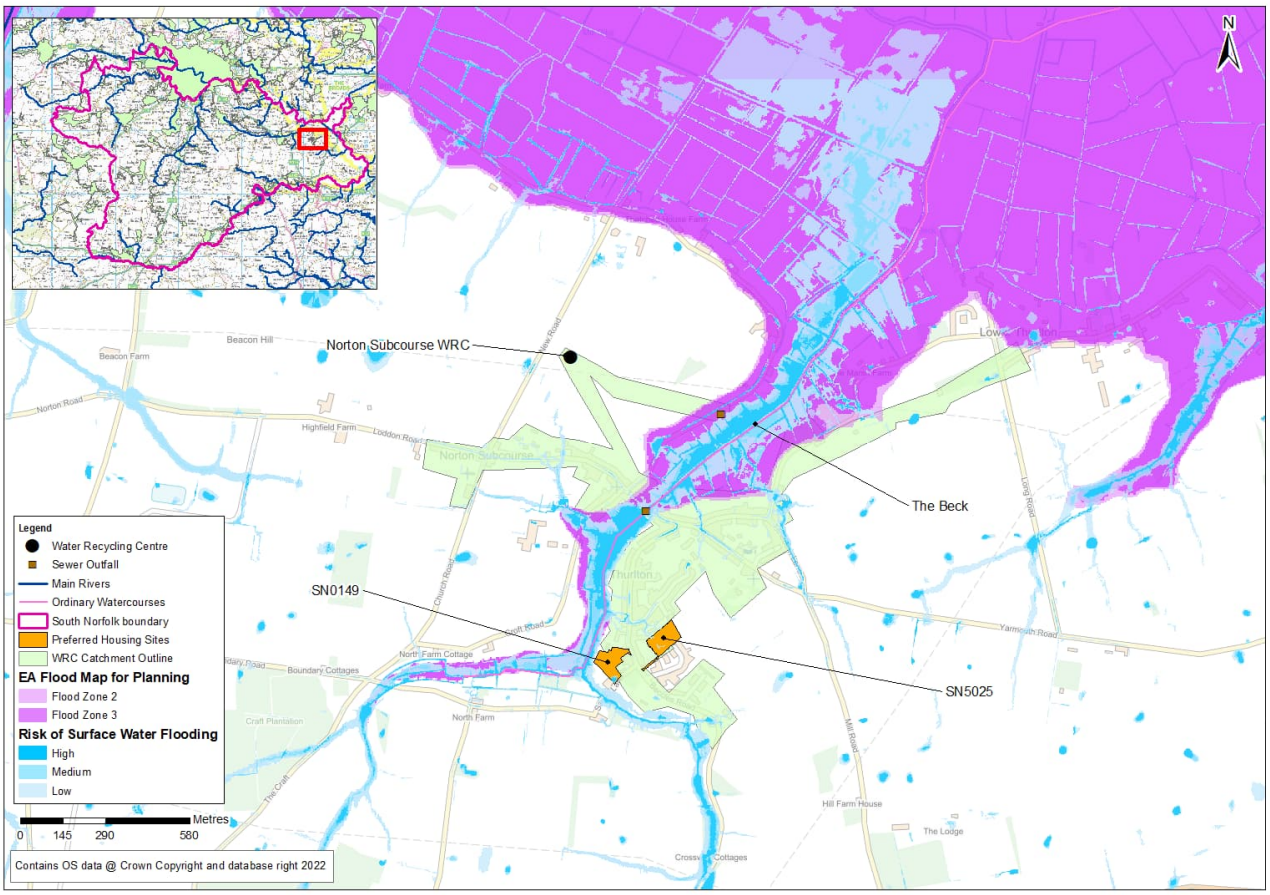


Figure 19: Norton Subcourse WRC catchment, allocated sites and hydrological context

Table 18-1. Allocated sites relevant to the Norton Subcourse WRC catchment

Site Reference	Site Address	Dwelling No.
SN5025	Land north of Blacksmiths Gardens, Thurlton	12
SN0149	Land adjacent to Holly Grange, west of Beccles Road	10

18.2 WRC headroom capacity

18.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 44 new dwellings within the Norton Subcourse WRC catchment, of which 15 were assumed to come from the Village Cluster. The VCHAP has subsequently allocated 22 dwellings within the Village Cluster. As a result, the impact of the additional 7 dwellings on capacity has been considered in this WCS addendum.

18.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would be within the existing headroom capacity for the WRC. A further 7 dwellings allocated in the VCHAP (a total of 51 including GNLP growth) would not exceed the available headroom, with 14% capacity remaining at the WRC. Therefore, there is sufficient headroom capacity at the WRC to treat wastewater from the Village Cluster.

18.3 Environmental capacity assessment

As there would be greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that only small (approximately 10%) changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are well within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to The Beck from this WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA.

18.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 18-2.

Table 18-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN5025	12	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no No mapped extent on site	0% - no No mapped extent on site	2.5% - Very small area in the north, traversing site boundary, and south, near to access route from Beccles Road
SN0149	10	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	2.5% - Very small area to the south of the site, adjacent to Sandy Lane	4% - Very small area to the south of the site, adjacent to Sandy Lane	5% - Very small area to the south of the site, adjacent to Sandy Lane

18.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Thurlton and Norton Subcourse.

19. Pulham St Mary catchment

19.1 Village Clusters and sites

The Pulham St Mary WRC catchment serves the Village Cluster of **Pulham Market** and **Pulham St Mary**. There is one preferred site in the Pulham St Mary WRC catchment as shown in Figure 20 and Table 19-1; the site would deliver a maximum of 50 dwellings in the WRC catchment.

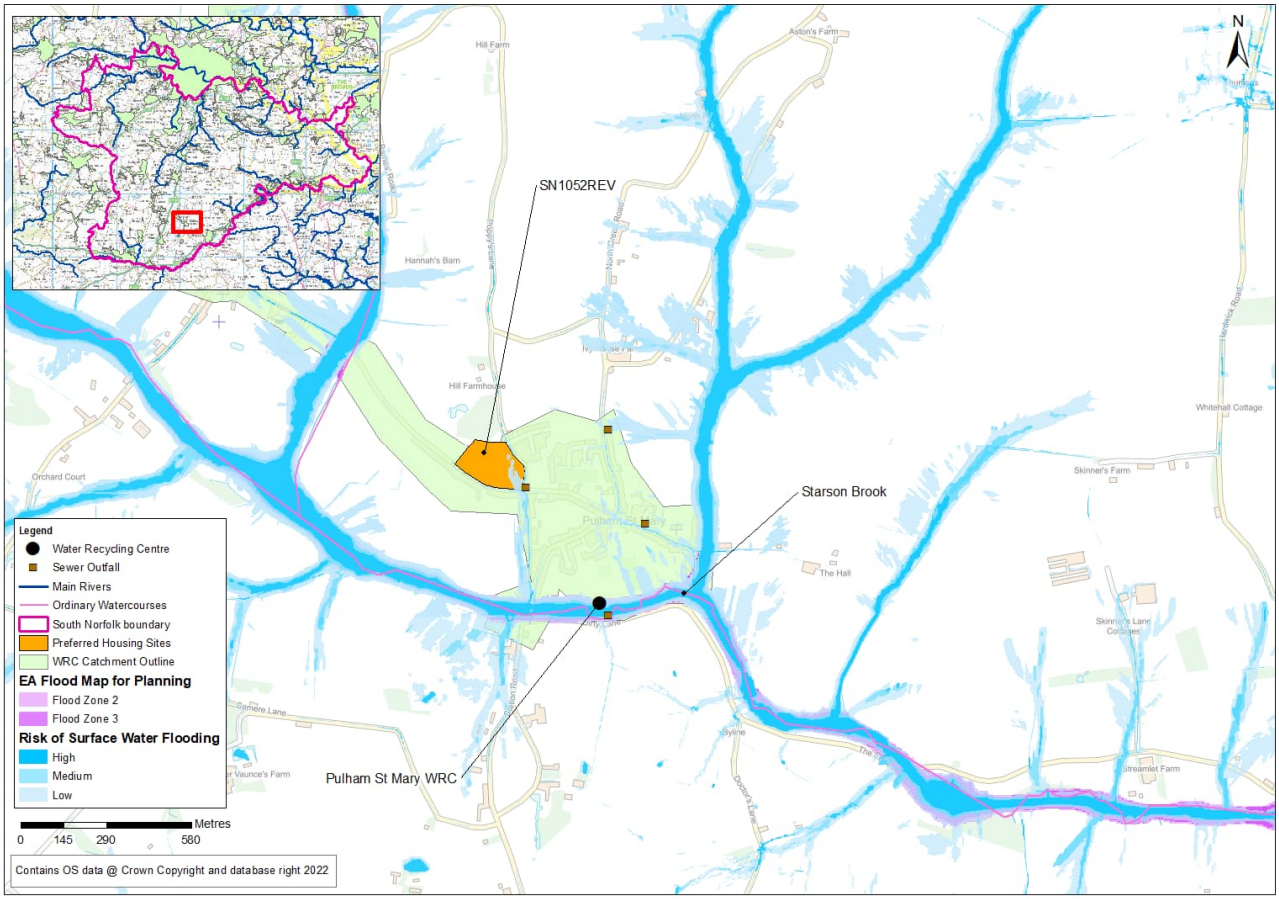


Figure 20: Pulham St Mary WRC catchment, allocated site and hydrological context

Table 19-1. Allocated site relevant to the Pulham St Mary WRC catchment

Site Reference	Site Address	Dwelling No.
SN1052REV	Land northwest of Norwich Road and Poppy's Lane	50

19.2 WRC headroom capacity

19.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 91 new dwellings within the Pulham St Mary WRC catchment, of which 50 were assumed to come from the village cluster. The VCHAP has allocated the same number of 50 dwellings. Therefore, the assessment from the GNLP WCS remains valid and no additional assessment has been completed for this WCS addendum.

19.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 19-2.

Table 19-2: Site capacity assessments and flood risk for the allocated site

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No..	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN1052REV	50	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	15% - southwest corner of the site at the intersection of Norwich Road and Poppy's Ln

19.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Pulham Market and Pulham St Mary.

20. Dickleburgh catchment

20.1 Village Clusters and sites

The Dickleburgh WRC catchment serves the Village Cluster of **Tivetshall St Mary** and **Tivetshall St Margaret**. There are two preferred sites in the Dickleburgh WRC catchment as shown in Figure 21 and Table 20-1; the sites would deliver a maximum of 25 dwellings in the WRC catchment.

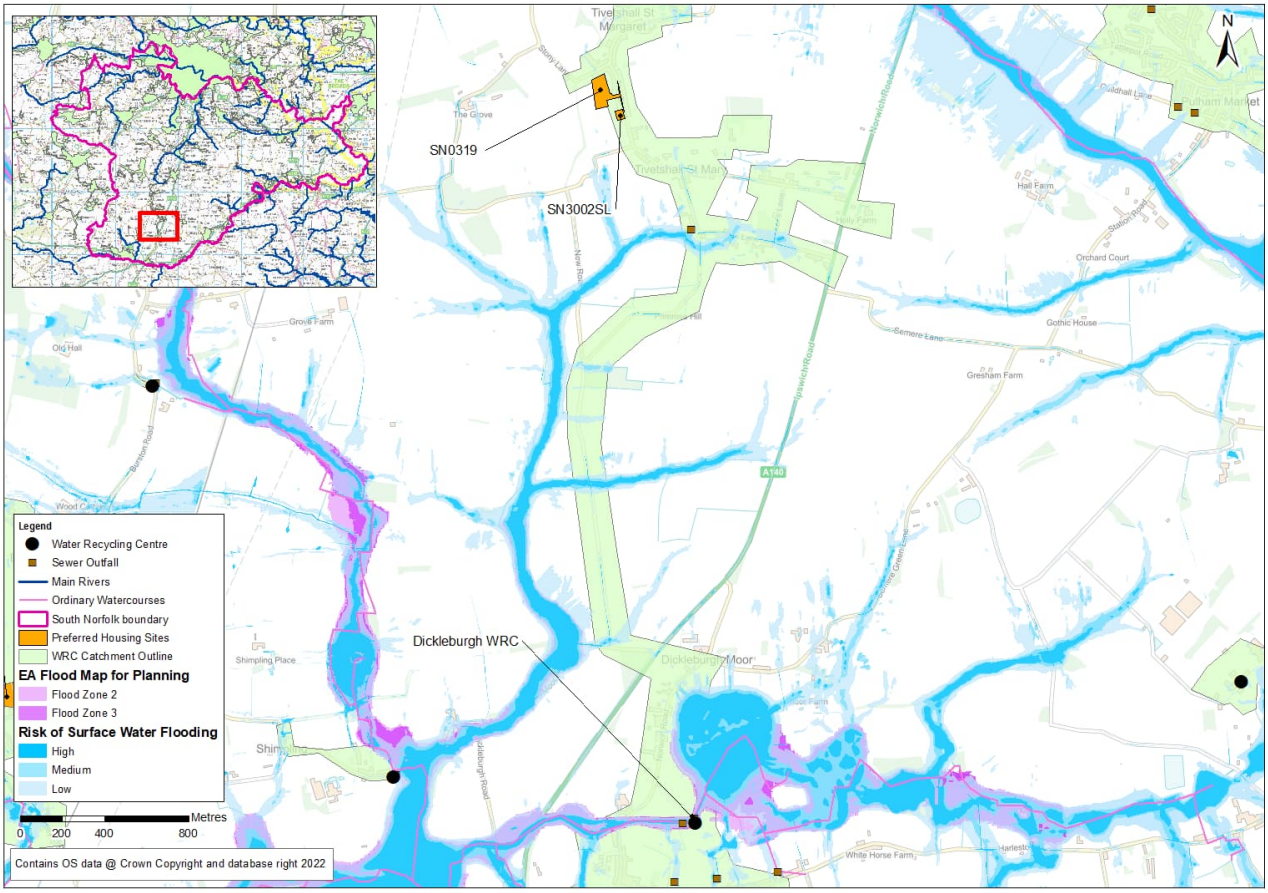


Figure 21: Dickleburgh WRC catchment, allocated sites and hydrological context

Table 20-1. Allocated sites of relevance to the Dickleburgh WRC

Site Reference	Site Address	Dwelling No.
SN0319	Pear Tree Farm, west of The Street	20
SN3002SL	Land south of Green Pastures, The Street	5

20.2 WRC capacity

20.2.1 GNLP WCS assumptions

Within the GNLP WCS, growth within the Dickleburgh WRC was assessed as going to Rushall Harleston Road WRC. Discussion with AWS as part of this WCS has identified that the catchment name was incorrectly referenced within the AWS' GIS dataset at the time of completion of the GNLP WCS and should have been named as Dickleburgh WCS. The catchment size and hence number of sites connecting from non-village cluster growth remains the same, but the catchment name has been rectified for the SNVC WCS.

The GNLP WCS assumed a total of 110 new dwellings within this WRC catchment, of which 40 were assumed to come from the Village Clusters. The VCHAP has subsequently allocated only 25 dwellings within the Village Cluster; 15 less than the GNLP assumed. However, because the WRC name and catchment has been changed for the SNVC WCS, an assessment of capacity was reconsidered as part of this WCS addendum.

20.2.2 Capacity re-assessment

The capacity assessment completed for the SNVC WCS demonstrated that the delivery of an additional 110 dwellings (including 25 within the VCHAP) within the Dickleburgh WRC catchment would not cause the flow permit for the WRC to be exceeded, with greater than 10% capacity remaining at the WRC (23% residual capacity would remain).

20.3 Environmental capacity assessment

Because there is adequate capacity to treat wastewater from the proposed growth (with more than 10% capacity remaining), only a load standstill calculation was undertaken to assess the impact of water quality on the receiving watercourse. This assessment has shown that the additional housing can be treated at the WRC with only minor changes potentially required to discharge permit quality and that these changes would be well within the limits of conventionally applied treatment technologies. There would be no barrier to growth proposed within this catchment with respect to water quality of the watercourse receiving discharge from the WRC.

20.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 5-2.

Table 20-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0319	20	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	0% - no mapped extent on site
SN3002SL	5	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	0% - no mapped extent on site

20.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment, local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Tivetshall St Mary and Tivetshall St Margaret.

21. Saxlingham catchment

21.1 Village Clusters and sites

The Saxlingham WRC catchment serves the Village Clusters of **Newton Flotman** and **Swainsthorpe.** There is one preferred site in the Saxlingham WRC catchment as shown in Figure 22 and Table 21-1; the site would deliver a maximum of 25 dwellings in the WRC catchment.

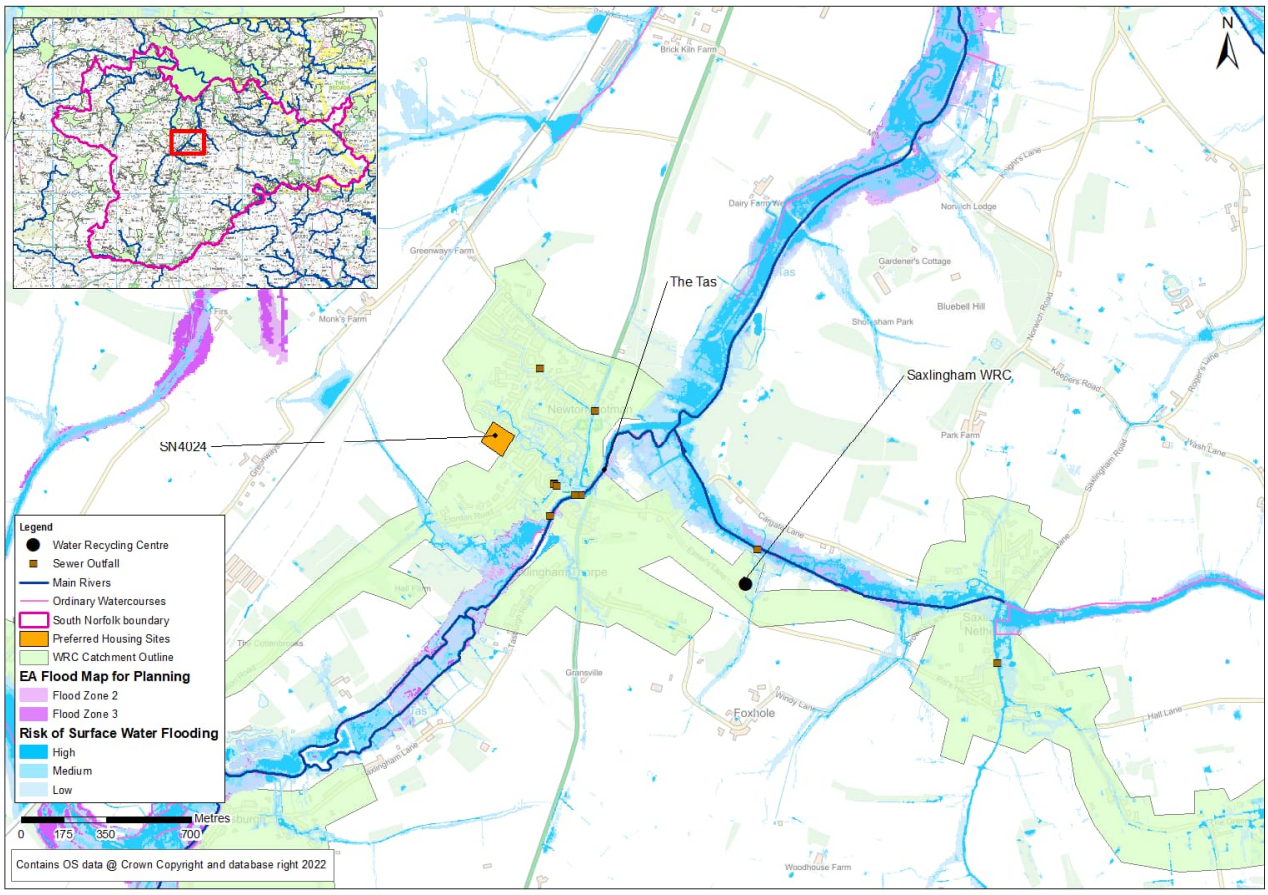


Figure 22: Saxlingham WRC catchment, allocated site and hydrological context

Table 21-1. Allocated site of relevance in the Saxlingham WRC catchment

Site Reference	Site Address	Dwelling No.
SN4024	South of Alan Avenue	25

21.2 WRC headroom capacity

21.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 206 new dwellings within the Saxlingham WRC catchment, of which 64 were assumed to come from the village cluster. The VCHAP has subsequently allocated only 25 dwellings within the Village Cluster; 39 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum.

21.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for the allocated site in the Village Cluster are shown in Table 21-2.

Table 21-2: Site capacity assessments and flood risk for the allocated site

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4024	25	Limited capacity in the sewerage network depending on cumulative development within the GNLP – may have phasing implications	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no No mapped risk on site. Flooding present on surrounding roads in Newton Flotman.	0% - no No mapped risk on site. Flooding present on surrounding roads in Newton Flotman.	0% - no No mapped risk on site. Flooding present on surrounding roads in Newton Flotman.

21.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Newton Flotman and Swainsthorpe; however, the site allocated by the VCHAP may have limited sewerage network capacity when all growth is considered in the GNLP. As a result, there may be early phasing or sewer requisition issues whilst upgrades are put in place.

22. Seething Mill Lane catchment

22.1 Village Clusters and sites

The Seething Mill Lane WRC catchment serves the Village Cluster of **Seething** and **Mundham.** There are three preferred sites in (or close to) the Seething Mill Lane WRC catchment as shown in Figure 23 and Table 22-1; the sites would deliver a maximum of 19 dwellings in the WRC's catchment.

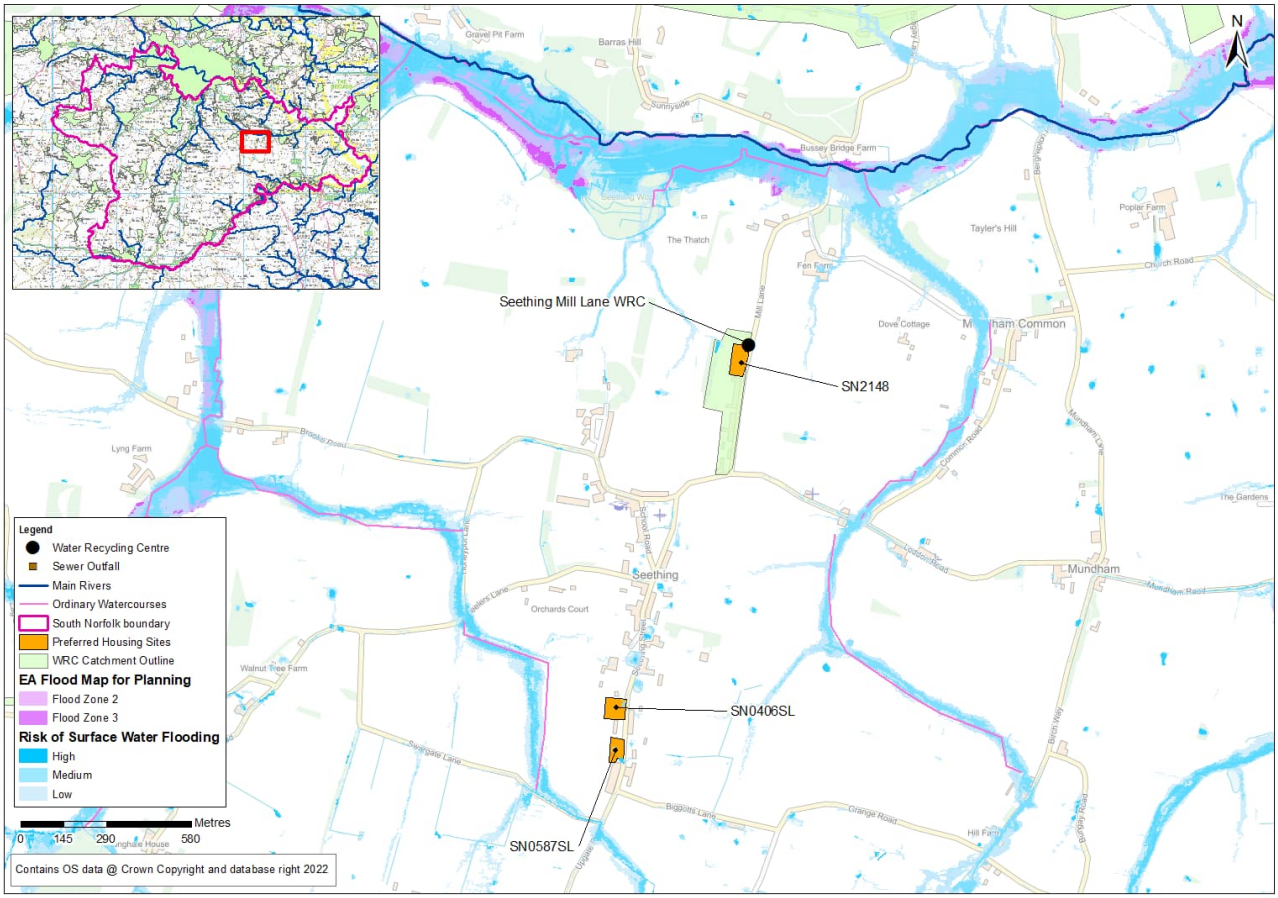


Figure 23: Seething Mill Lane WRC catchment, allocated sites and hydrological context

Table 22-1. Allocated sites of relevance to the Seething Mill Lane WRC

Site Reference	Site Address	Dwelling No.
SN0406SL	Land to the west of Seething Street	2
SN0587SL	Land to the west of Seething Street	5
SN2148	Land west of Mill Lane	12

22.2 WRC capacity

Seething Mill Lane WRC is a small WRC which has a descriptive permit serving a PE of 69.

22.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 9 new dwellings within the Seething Mill Lane catchment of which, none were assumed to come forward from the Village Cluster. The VCHAP has subsequently allocated 19 dwellings within the Village Cluster of

Seething and Mundham which would be close to, or within the Seething Mill Lane WRC catchment. As a result, the impact of an additional 19 dwellings on capacity has been considered in this WCS addendum.

22.2.2 Capacity re-assessment

The 28 dwellings would add a further PE of approximately 58, giving a post-plan PE total of 127. This is within the 250 PE limit which would trigger the need for a water quality assessment and permit review. No water quality assessment has therefore been undertaken and it is assumed the site proposed in the Village Cluster can be taken forward without affecting water quality targets.

22.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in .

Table 22-2: Site capacity assessments and flood risk for allocated sites relevant to Seething Mill Lane WRC

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0406SL	2	Significant distance from the WRC network. Developer will need to requisition new sewer connection or consider package treatment plant	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	2.5% - very small area in north-west corner adjacent to Seething Street	5% - very small area in north-west corner adjacent to Seething Street
SN0587SL	5	Significant distance from the WRC network. Developer will need to requisition new sewer connection or consider package treatment plant	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site Flooding on southern border with Seething Street.	0% - no mapped flood extent on site Flooding on southern border with Seething Street.	4.5% - very small area to the left of the centre of the site.
SN2148	12	None identified	Very close to WRC facility – may limit build type on northern perimeter of the site	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0.5% - very small area on border with Mill Lane

22.4 Cluster summary

As Seething Mill Lane is a small WRC, additional growth may have a disproportionate impact on the WRC, and it is likely that WRC improvements would need to be delivered through the AWS business planning process. Further assessment would be undertaken by AWS to confirm exactly what the infrastructure impact would be.

Developers of all three allocated sites in this Village Cluster should engage with AWS at an early stage to enable the company to understand the potential impact a new development may have and also consider alternative wastewater treatment and disposal via the provision of a package treatment plant. Two of the sites are located a significant distance from the WRC which may make requisition of sewers infeasible or expensive and would potentially affect site phasing. Site SN2148 is also located in close proximity to the WRC facility, potentially at risk of odour encroachment. The developer will need to engage early with AWS regards site layout and odour concerns as well as impacts on connecting sewers.

23. Sisland catchment

23.1 Village Clusters and sites

The Sisland WRC catchment serves the Village Clusters of:

- **Alpington, Yelverton** and **Bergh Apton**
- **Brooke, Kirstead** and **Howe**
- **Hales, Heckingham, Langley Street, Carleton St Peter, Raveningham** and **Sisland**

There are six allocated sites in the Sisland WRC catchment as shown in Figure 24 and Table 23-1; the sites would deliver a maximum of 147 dwellings in the WRC catchment.

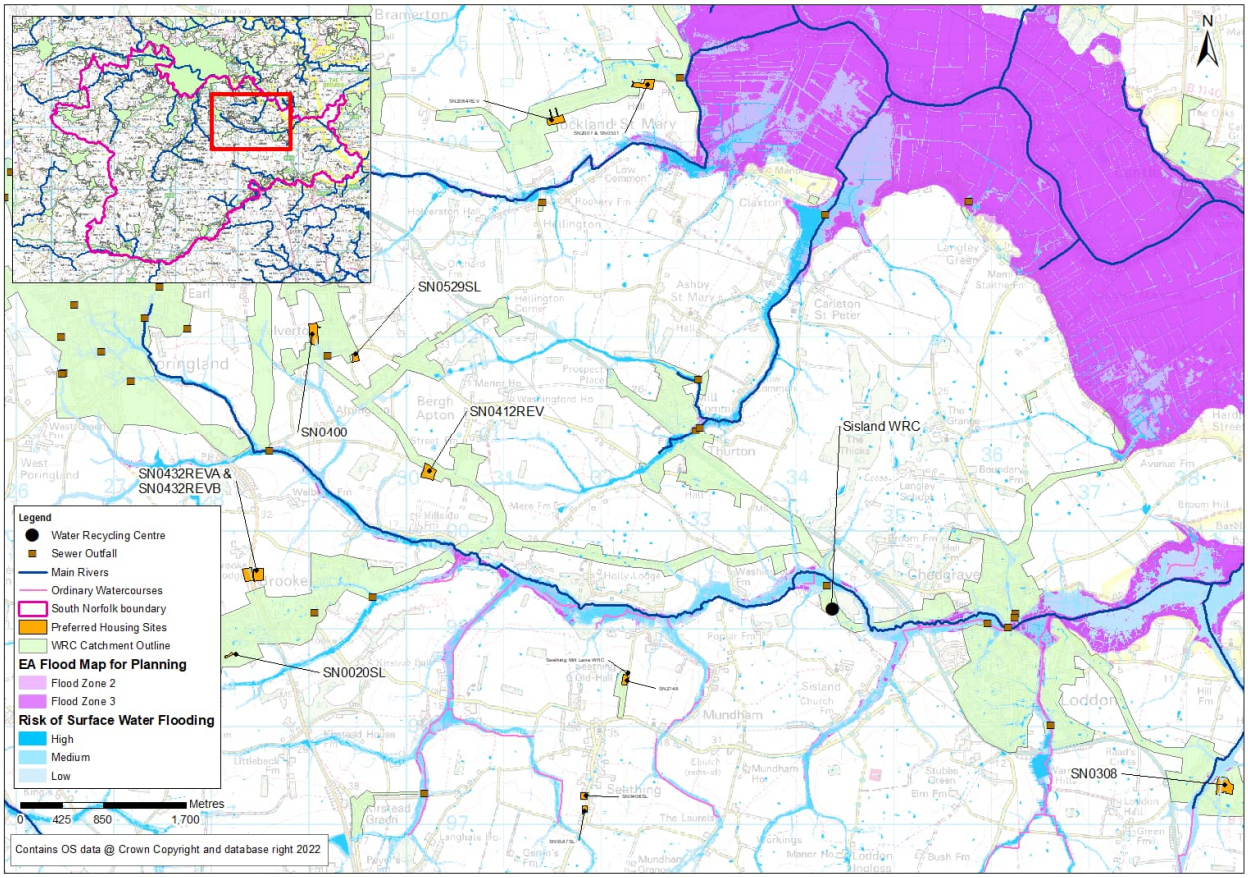


Figure 24: Sisland WRC catchment, allocated sites and hydrological context

Table 23-1. Allocated sites of relevance to the Sisland WRC catchment

Site Reference	Site Address	Dwelling No.
SN0400	Land at Church Meadow	25
SN0412REV	Former Concrete works site, Church Road	25
SN0529SL	Land east of Nichols Road	9
SN0432REVA & SN0432REVB	Land at Norwich Road	50
SN0020SL	High Green	3
SN0308	Land off Briar Lane, West Hales	35

23.2 WRC capacity

23.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 759 new dwellings within the Sisland WRC catchment, of which 165 were assumed to come from the village clusters. The VCHAP has subsequently allocated 147 dwellings within the Village Clusters; 18 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum.

23.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 23-2.

Table 23-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0400	25	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	10% - Small area of flooding to the south of the site, drains to the south
SN0412REV	25	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% no mapped extent on site	0% - no mapped extent on site	2% - very small area of flooding in centre of site.
SN0529SL	9	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	0% - no mapped extent on site
SN0432REVA & SN0432REVB	50	Not directly connected to the Sisland WRC catchment – may require sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	0% - no mapped extent on site
SN0020SL	3	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - n no mapped extent on site	0% - no mapped extent on site	0% - no mapped extent on site
SN0308	35	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped extent on site	0% - no mapped extent on site	15% - a linear area of flooding through the centre of the site

23.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Clusters of: Alpington, Yelverton and Bergh Apton; Brooke, Kirstead and Howe; and, Hales, Heckingham, Langley Street, Carleton St Peter, Raveningham and Sisland. Allocated site SN0432REVA/REVB may need to consider sewer requisition from AWS to connect to the WRC catchment.

24. Stoke Holy Cross catchment

24.1 Village Clusters and sites

The Stoke Holy Cross WRC catchment serves the Village Cluster of **Stoke Holy Cross, Shotesham** and **Caistor St Edmund.** There is one allocated site in the Stoke Holy Cross WRC catchment as shown in Figure 25 and Table 24-1; the site would deliver a maximum of 25 dwellings in the WRC catchment.

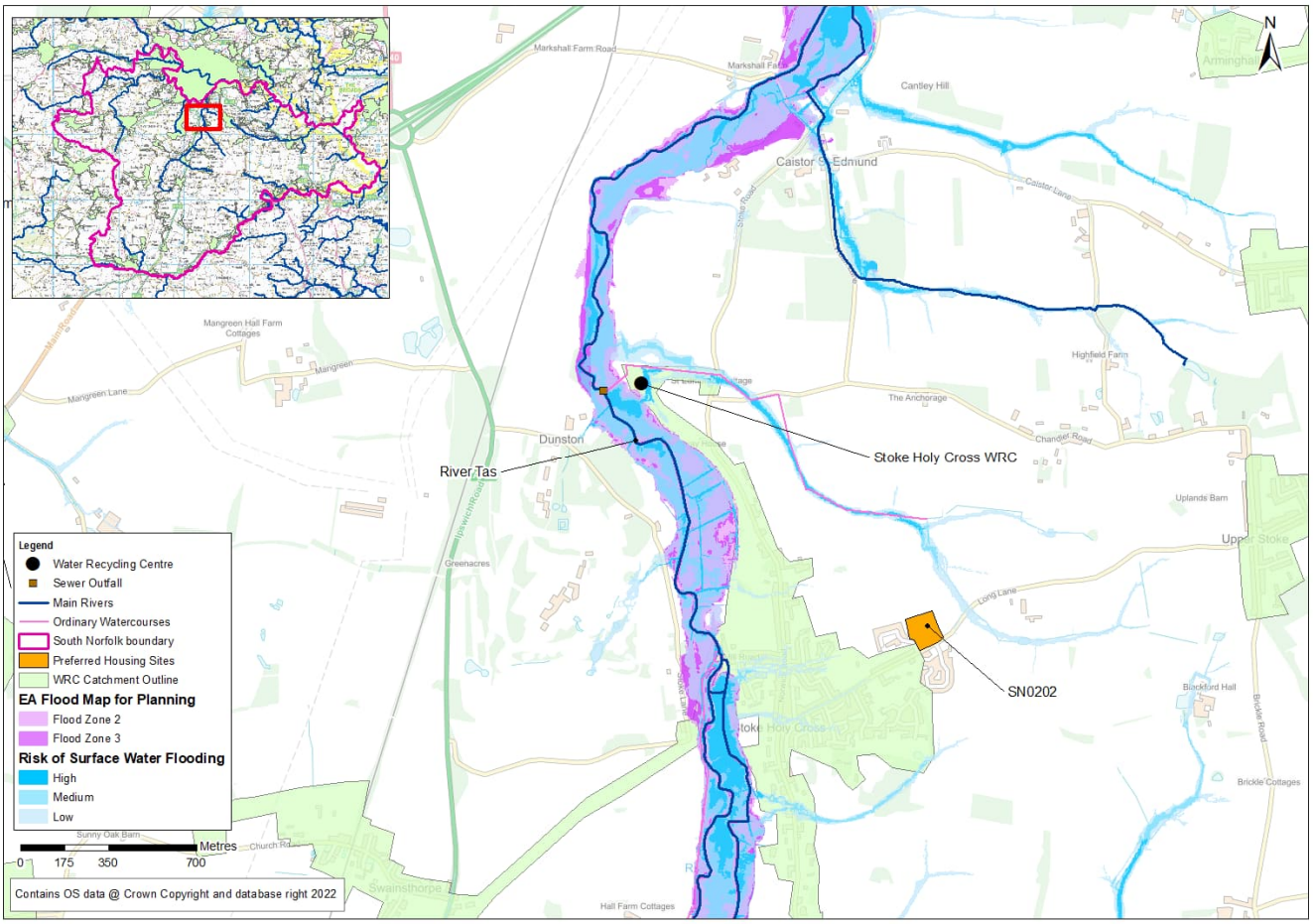


Figure 25: Stoke Holy Cross WRC catchment, allocated site and hydrological context

Table 24-1. Allocated site relevant to the Stoke Holy Cross WRC catchment

Site Reference	Site Address	Dwelling No.
SN0202	Land north of Long Lane	25

24.2 WRC headroom capacity

24.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 19 new dwellings within the Stoke Holy Cross WRC catchment, of which none were assumed to come from the Village Cluster. The VCHAP has subsequently allocated 25 dwellings within the Village Cluster. As a result, the impact of the additional 25 dwellings on capacity has been considered in this WCS addendum.

24.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of additional dwellings to 2038 would be within the existing headroom capacity for the WRC. A further 25 dwellings allocated in the VCHAP (a total of 44 including GNLP growth) would not exceed the available headroom, with 19% capacity remaining at the WRC. Therefore, there is sufficient headroom capacity at the WRC to treat wastewater from the Village Cluster.

24.3 Environmental capacity assessment

As there would be greater than 10% capacity at the WRC post growth, a simpler assessment of water quality impact was undertaken using load standstill calculations. This assessment demonstrated that only very small (less than 6%) changes in the discharge quality limits would be required in order to ensure no increase in pollutant load (see Appendix C). These changes are well within the limits of conventionally applied treatment and as such there should be no barrier to deliver the sites with respect to water quality. Ensuring no increase in pollutant load to the Tas catchment from this WRC would also ensure no impact on the designated sites linked to the River Yare which form component parts of the Broads SAC and Broadlands SPA.

24.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the allocated site in the Village Cluster are shown in Table 24-2.

Table 24-2: Site capacity assessments and flood risk for the allocated site in the Stoke Holy Cross WRC catchment

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0202	25	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

24.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Stoke Holy Cross, Shotesham and Caistor St Edmund.

25. Swardeston-Common catchment

25.1 Village Clusters and sites

The Swardeston-Common WRC catchment serves the Village Cluster of **Mulbarton, Bracon Ash, Swardeston** and **East Carleton.** There are two allocated sites in the Swardeston-Common WRC catchment as shown in Figure 26 and Table 25-1; the sites would deliver a maximum of 55 dwellings in the WRC catchment.

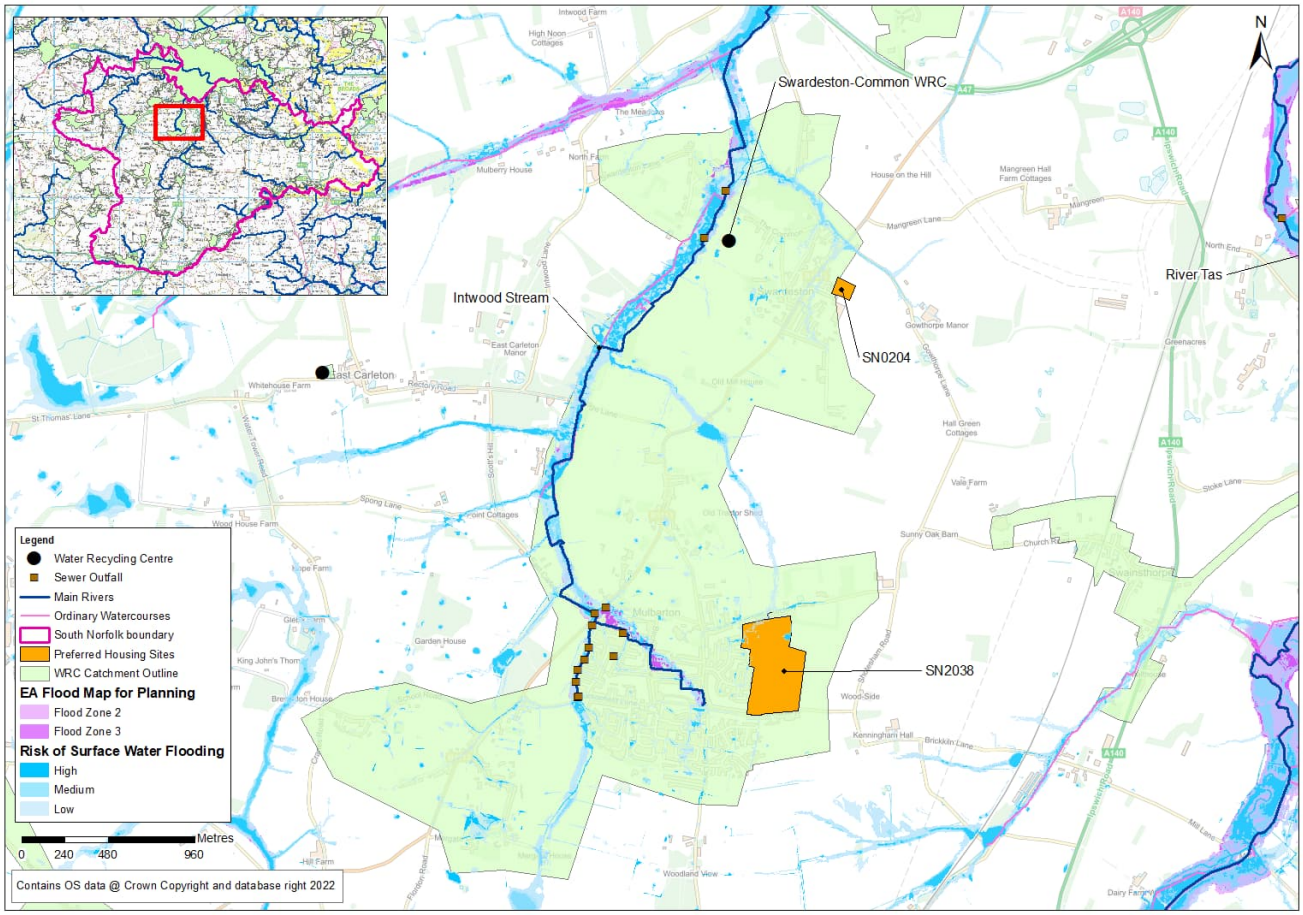


Figure 26: Swardeston-Common WRC catchment, allocated sites and hydrological context

Table 25-1. Allocated sites of relevance in the Swardeston-Common WRC catchment

Site Reference	Site Address	Dwelling No.
SN0204	Land off Bobbins Way	20
SN2038	Land south of Rectory Lane	35

25.2 WRC headroom capacity

25.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 259 new dwellings within the Swardeston-Common WRC catchment, of which 107 were assumed to come from the Village Cluster. The VCHAP has subsequently allocated only 55 dwellings within the Village Cluster; 52 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum.

25.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 25-2.

Table 25-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0204	20	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no Mapped flood extent	0% - no Mapped flood extent	00% - no Mapped flood extent
SN2038	25	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0.5% - very small area of flooding to the north-east and north-west of the site.	1.2% - very small area of flooding to the north-east and north-west of the site.	3% - very small area of flooding to the north-east and north-west of the site.

25.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed sites within the Village Cluster of Mulbarton, Bracon Ash, Swardeston and East Carleton.

26. Spooner Row catchment

26.1 Village Clusters and sites

The Spooner Row WRC catchment serves the Village Cluster of **Spooner Row** and **Suton.** There are two preferred sites close to the Spooner Row WRC as shown in Figure 27 and Table 26-1; the sites would deliver a maximum of 40 dwellings in the WRC catchment. It should be noted that a catchment boundary for Spooner Row is not available for reporting; however, AWS have confirmed these sites should be considered as part of the Spooner Row WRC capacity assessment.

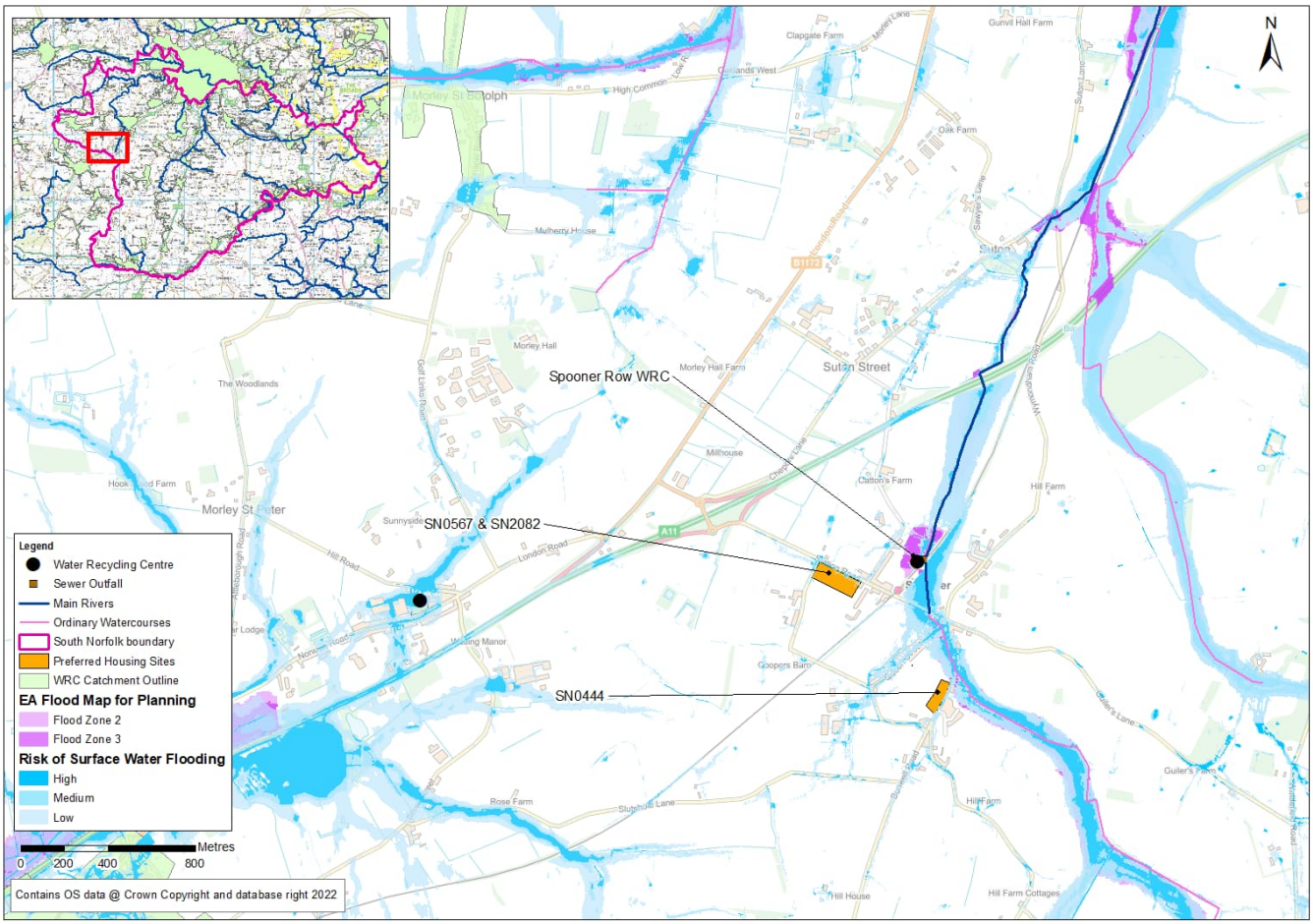


Figure 27: Spooner Row WRC, allocated sites and hydrological context

Table 26-1. Allocated sites of relevance to the Spooner Row WRC catchment

Site Reference	Site Address	Dwelling No.
SN0444	Land west of Bunwell Road	15
SN0567 & SN2082	Land south of Station Road	25

26.2 WRC capacity

Spooner Row WRC is a small WRC which has a descriptive permit serving a PE of 50.

26.2.1 GNLP WCS assumptions

The GNLP WCS did not assess any dwellings within the Spooner Row WRC catchment. The VCHAP has subsequently allocated 40 dwellings within the Village Cluster. As a result, the impact of an additional 40 dwellings on capacity has been considered in this WCS addendum.

26.2.2 Capacity re-assessment

40 dwellings would add a further PE of approximately 83, giving a post-plan PE total of 133. This is within the 250 PE limit which would trigger the need for a water quality assessment and permit review. No water quality assessment has therefore been undertaken and it is assumed the site proposed in the Village Cluster can be taken forward without affecting water quality targets.

26.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 26-2.

Table 26-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0444	15	None Identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no Mapped flood extent on site Flooding at eastern border with Bunwell Road	0% no mapped flood extent on site Flooding at eastern border with Bunwell Road
SN0567 & SN2082	25	None Identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

26.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Spooner Row and Suton. However, as Spooner Row is a small WRC, any additional growth may have a disproportionate impact on the WRC, and it is likely that WRC improvements would need to be delivered through AWS' business planning process. Further assessment would be undertaken by AWS to confirm exactly what the infrastructure impact would be.

27. Wheatacre Church Lane catchment

27.1 Village Clusters and sites

The Wheatacre Church Lane WRC catchment serves part of the Village Cluster of **Toft Monks, Haddiscoe, Wheatacre** and **Burgh St Peter.** There are two allocated sites in (or close to) the Wheatacre Church Lane WRC catchment as shown in Figure 28 and Table 27-1; the sites would deliver a maximum of 17 dwellings in the WRC catchment.

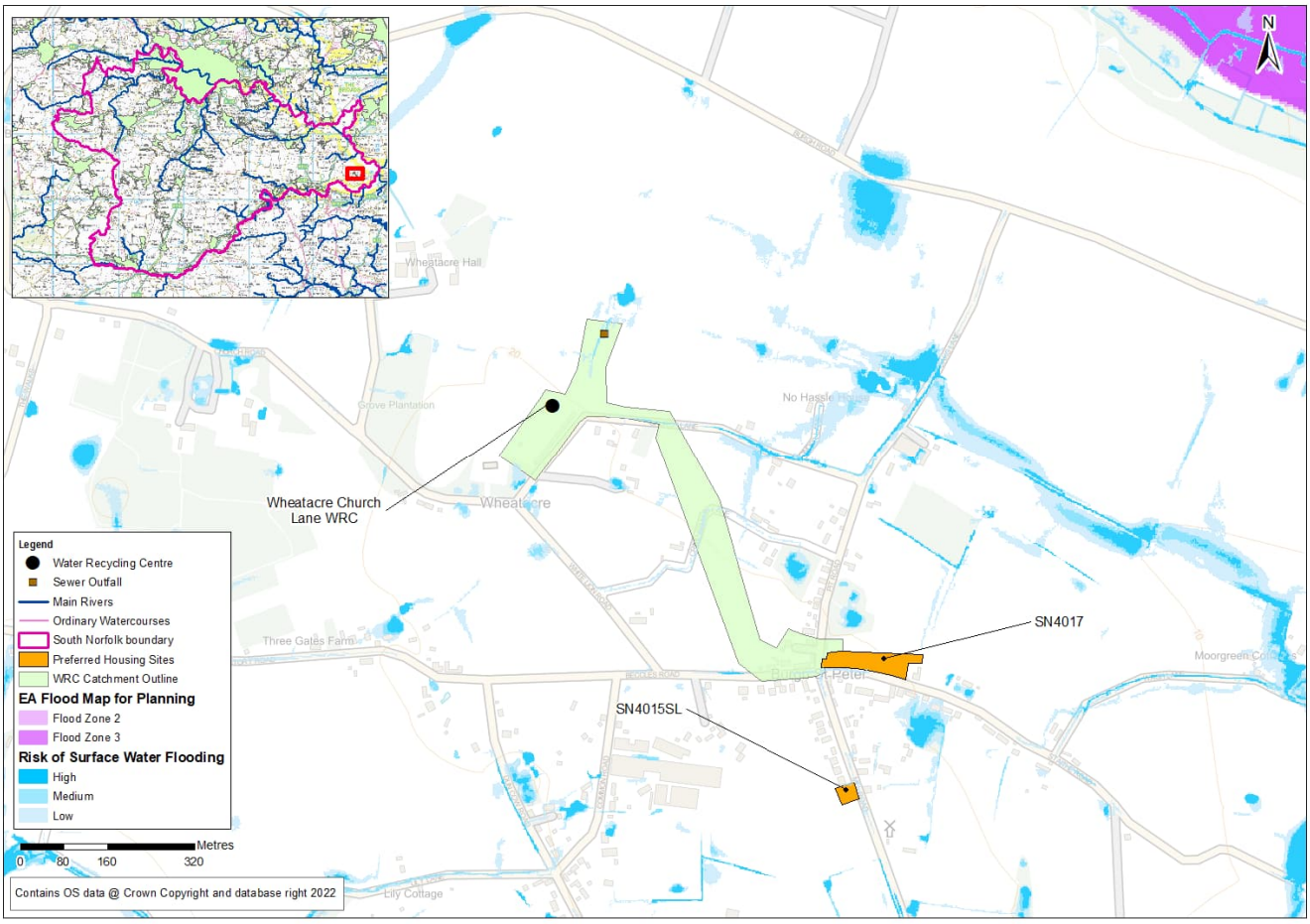


Figure 28: Wheatacre Church Lane WRC catchment, allocated sites and hydrological context

Table 27-1. Allocated sites of relevance to the Wheatacre Church Lane WRC

Site Reference	Site Address	Dwelling No.
SN4015SL	West of Mill Road	5
SN4017	North of Staithe Road	12

27.2 WRC capacity

Wheatacre Church Lane WRC is a small WRC which has a descriptive permit serving a PE of 37.

27.2.1 GNLP WCS assumptions

The GNLP WCS did not make any assessment of dwellings in the Wheatacre Church Lane catchment. The VCHAP has subsequently allocated 17 dwellings within the Village Cluster. As a result, the impact of an additional 17 dwellings on capacity has been considered in this WCS addendum.

27.2.2 Capacity re-assessment

The 17 dwellings would add a further PE of approximately 35, giving a post-plan PE total of 72. This is within the 250 PE limit which would trigger the need for a water quality assessment and permit review. No water quality assessment has therefore been undertaken and it is assumed the site proposed in the Village Cluster can be taken forward without affecting water quality targets.

27.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 27-2.

Table 27-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4015SL	5	Limited sewer capacity – sewer upgrades likely to be required which will affect early phasing	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no Mapped flood extent on site	0% - no Mapped flood extent on site	2% - very small area of flooding to the northern boundary of the site.
SN4017	12	Limited sewer capacity – sewer upgrades likely to be required which will affect early phasing	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no Mapped flood extent on site	0% - no Mapped flood extent on site	0.5% - very small area of flooding to the southern boundary of the site.

27.4 Cluster summary

No significant wastewater treatment or flood risk constraints were identified for this catchment; however, as Wheatacre Church Lane is a small WRC, any additional growth may have a disproportionate impact on the WRC, and it is likely that WRC improvements would need to be delivered through AWS' business planning process. Further assessment would be undertaken by AWS to confirm exactly what the infrastructure impact would be.

In addition, the two allocated sites would discharge upstream in the WRC catchment where there are capacity constraints and hence sewer upgrades are likely to be required which will affect early phasing of the sites and when these can be occupied.

Developers should engage with AWS at an early stage to enable the company to understand the potential impact a new development may have and also consider alternative wastewater treatment and disposal via the provision of a package treatment plant. It is recommended that developers are required to consult with AWS and to provide evidence to the Local Planning Authority that there is sufficient capacity prior to site commencement.

28. Whitlingham Trowse catchment

28.1 Village Clusters and sites

The Whitlingham Trowse WRC catchment serves the Village Clusters of:

- **Bawburgh**
- **Little Melton** and **Great Melton**
- **Rockland St Mary, Hellington** and **Holverston**

There are six allocated sites in the Whitlingham Trowse WRC catchment as shown in Figure 29 and Table 28-1; the sites would deliver a maximum of 133 dwellings in the WRC catchment. It is important to note that the VCHAP contribution to growth within the Whitlingham Trowse WRC catchment is only a small component of overall growth allocated within the catchment via the GNLP.

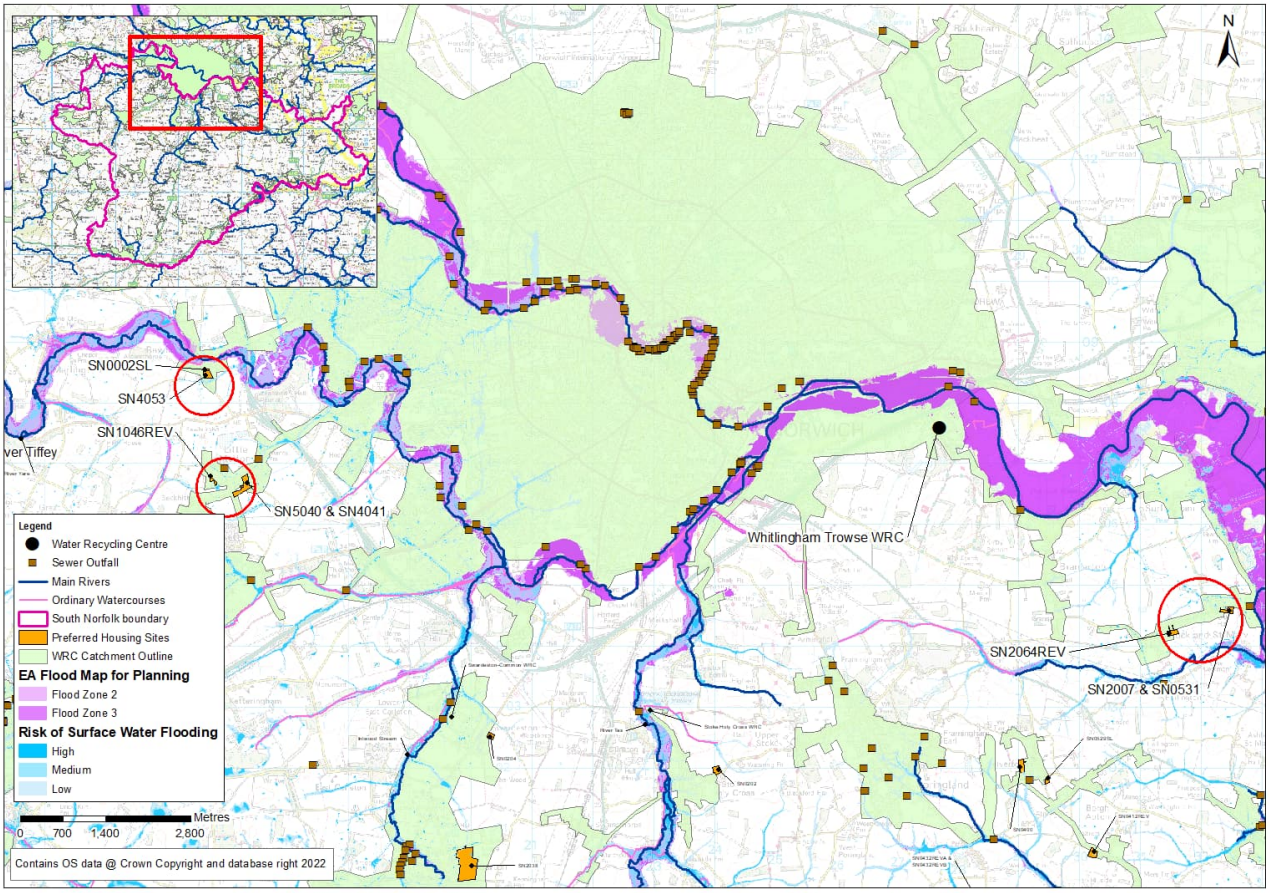


Figure 29: Whitlingham Trowse WRC catchment, allocated sites and hydrological context

Table 28-1. Allocated sites of relevance within the Whitlingham Trowse WRC catchment

Site Reference	Site Address	Dwelling No.
SN4053	Land east of Stocks Hill	35
SN0002SL	Land east of Stocks Hill	5
SN5040 & SN4041	Land at School Lane & Burnthouse Lane, Little Melton	35
SN1046REV	Land north of Great Melton Rd, south of Ringwood Close	8

Site Reference	Site Address	Dwelling No.
SN2007 & SN0531	Land west of Lower Rd, south of New Inn Hill	25
SN2064REV	Land south of The Street	25

28.2 WRC headroom capacity

28.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 33,517 new dwellings within the Whitlingham Trowse WRC catchment, of which 86 were assumed to come from the village cluster. The VCHAP has subsequently allocated 133 dwellings within the Village Cluster. As a result, the impact of the additional 47 dwellings on capacity has been considered in this WCS addendum.

28.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of the 33,517 additional dwellings to 2038 would cause the flow permit for the WRC to be exceeded. A further 47 dwellings allocated in the VCHAP (a total of 33,650 including GNLP growth) would exacerbate this situation. Therefore, additional environmental capacity assessment was required. This assessment considered impacts of additional treated flow on the receiving WFD water body - The Yare (Wensum to tidal)[11].

28.3 Environmental capacity assessment

Updated measured discharge flow data for Whitlingham Trowse WRC compared to the GNLP assumptions has shown that the headroom capacity for the WRC is already (current flows) exceeded prior to an evaluation of the impact of growth (exceeded by 3%). Growth would result in the current headroom capacity being exceeded by 20% by the end of the plan period. Therefore, a new discharge permit is required.

Full results of the water quality modelling for Whitlingham Trowse WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality of the Yare water body at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be achievable within the limits of conventionally applied treatment processes.
- Changes in permit quality conditions could also be applied within the limits of conventionally applied treatment technologies to ensure no deterioration in WFD status of the Yare water body at the discharge point to the river.
- It would therefore be possible to set a new permit that ensures no deterioration in the current quality of the Yare as a result of future WRC discharges.

Managing the pollutant load through a new discharge permit and implementation of improvements to the discharge quality from Whitlingham Trowse WRC would also ensure no impact on the designated sites linked to the River yare which form component parts of the Broads SAC and Broadlands SPA. Implementing these improvements would ensure no deterioration from the current quality in the Yare as a result of growth associated with this WRC catchment.

28.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 28-2.

Table 28-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4053	35	Capacity may be limited depending on cumulative impact – may	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

[11] WFD Waterbody ID GB105034051370

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
		require new sewer requisition						
SN0002SL	5	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN5040 & SN4041	35	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0.3% - very small area to the south of the site.	1% - three very small areas, one to the south of the site and two in the middle of the site.	2% - five very small areas. Two to the south, two to the central eastern site, one in the north central area of the site.
SN1046REV	8	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	1% - very small area in southwestern region of site	1% - very small area in southwestern region of site	0.5% - very small area in southwestern region of site
SN2007 & SN0531	25	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN2064REV	25	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

28.5 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of: Bawburgh; Little Melton and Great Melton; Rockland St Mary; and Hellington and Holverston.

However, a new discharge permit will be required for Whitlingham Trowse WRC, due the headroom capacity of the WRC already being exceeded and because future growth as set out in the GNLP (and a small additional number from the Village Clusters) will exacerbate the current issue.

AWS's medium to longer term strategy for WRC catchment includes:

- the slowing of flow in the sewers (attenuation);
- removal of surface water volumes from the sewerage system;
- reduction in water ingress into the sewers from the ground (infiltration); and,
- the potential for a new WRC to be delivered.

Aside from these additional measures, an environmental capacity assessment was completed as part of the SNVC WCS to determine whether the future discharge volumes could be managed at the current discharge point. The analysis has demonstrated that new permit conditions on quality can be applied within limits of conventionally applied treatment to protect

water quality and linked ecological sites; however, this will require AWS to undertake process upgrades at the WRC to be able to continue to achieve tighter permit limits on quality with higher inflows of wastewater from growth.

This will have phasing implications for sites within the catchment, including the Village Clusters, whilst AWS implement measures to reduce sewer flows and a new permit is put in place. Additionally, the sites allocated by the VCHAP may have phasing implications linked to the potential need to upgrade the sewerage system in order to allow all development proposed within the large WRC catchment to connect.

It is recommended that development in the Village Clusters of Bawburgh; Little Melton and Great Melton; Rockland St Mary; and Hellington and Holverston is required to provide evidence to the Local Planning Authority that consultation with AWS has been undertaken which demonstrates that there is sufficient treatment and network capacity to serve the level of development proposed, prior to site commencement.

29. Winfarthing Chapel Close catchment

29.1 Village Clusters and sites

The Winfarthing Chapel Close WRC catchment serves the Village Cluster of **Winfarthing** and **Shelfanger.** There are two allocated sites in (or close to) the Winfarthing Chapel Close WRC catchment as shown in Figure 30 and Table 29-1; the sites would deliver a maximum of 40 dwellings in the WRC catchment.

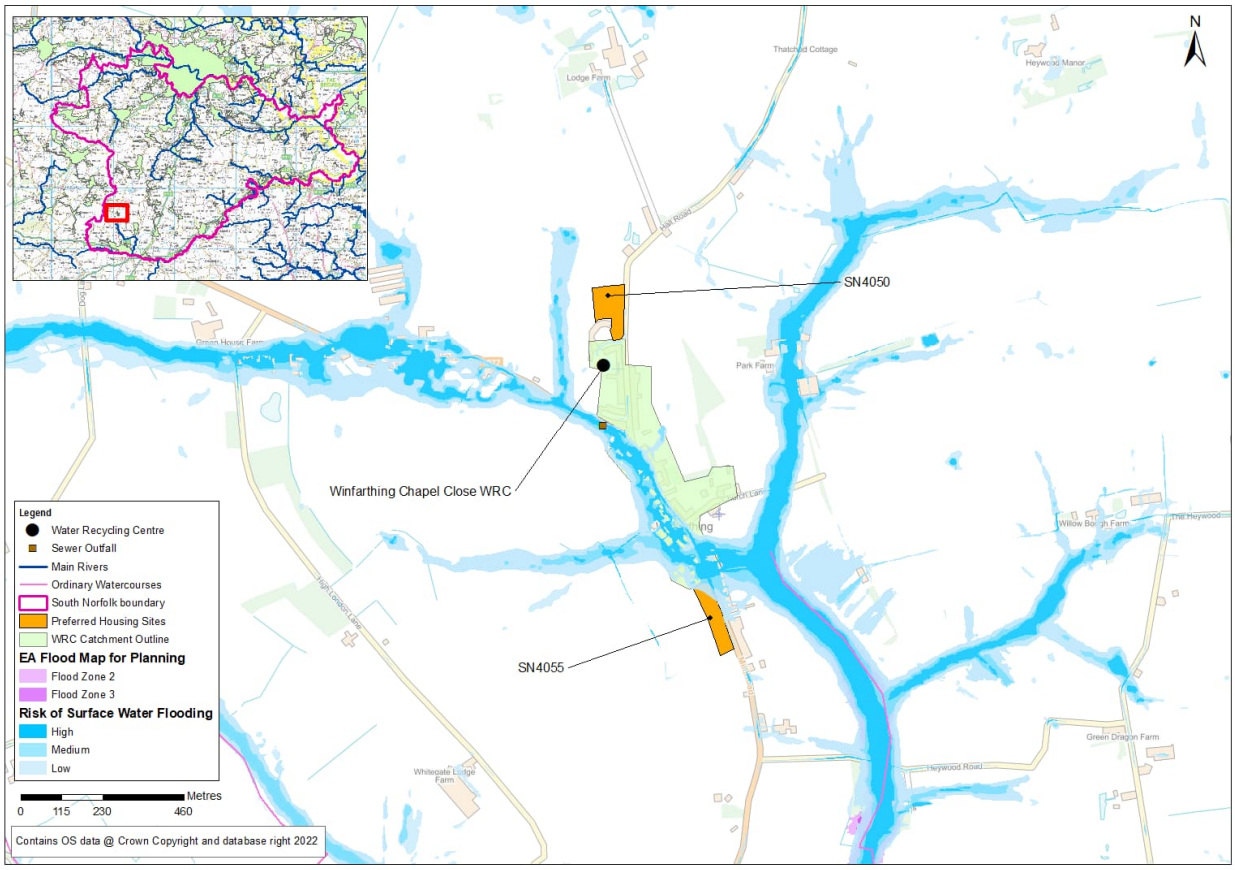


Figure 30: Winfarthing WRC catchment, allocated sites and hydrological context

Table 29-1. Allocated sites of relevance within the Winfarthing WRC catchment

Site Reference	Site Address	Dwelling No.
SN4050	Land to the west of Hall Road	20
SN4055	Land off The Street	20

29.2 WRC headroom capacity

29.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 71 new dwellings within the Winfarthing Chapel Close WRC catchment, of which 49 were assumed to come from the village cluster. The VCHAP has subsequently allocated 40 dwellings within the Village Cluster; 9 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum.

29.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 29-2.

Table 29-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN4050	20	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent	0% - no mapped flood extent	0% - no mapped flood extent
SN4055	20	None identified	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent	1% - very small area of flooding in north-east corner.	15% - area of flooding in north-west corner of site, extends along Mill Road

29.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Winfarthing and Shelfanger. However, Winfarthing WRC is a small treatment facility with a descriptive permit; therefore, developers should engage with AWS at an early stage to enable the company to understand the potential impact the allocated sites may have and also consider alternative wastewater treatment and disposal via the provision of a package treatment plant.

30. Woodton catchment

30.1 Village Clusters and sites

The Woodton WRC catchment serves the Village Cluster of **Woodton** and **Bedingham.** There is one allocated site in the Woodton WRC catchment as shown in Figure 31 and Table 30-1; the site would deliver a maximum of 50 dwellings in the WRC's catchment.

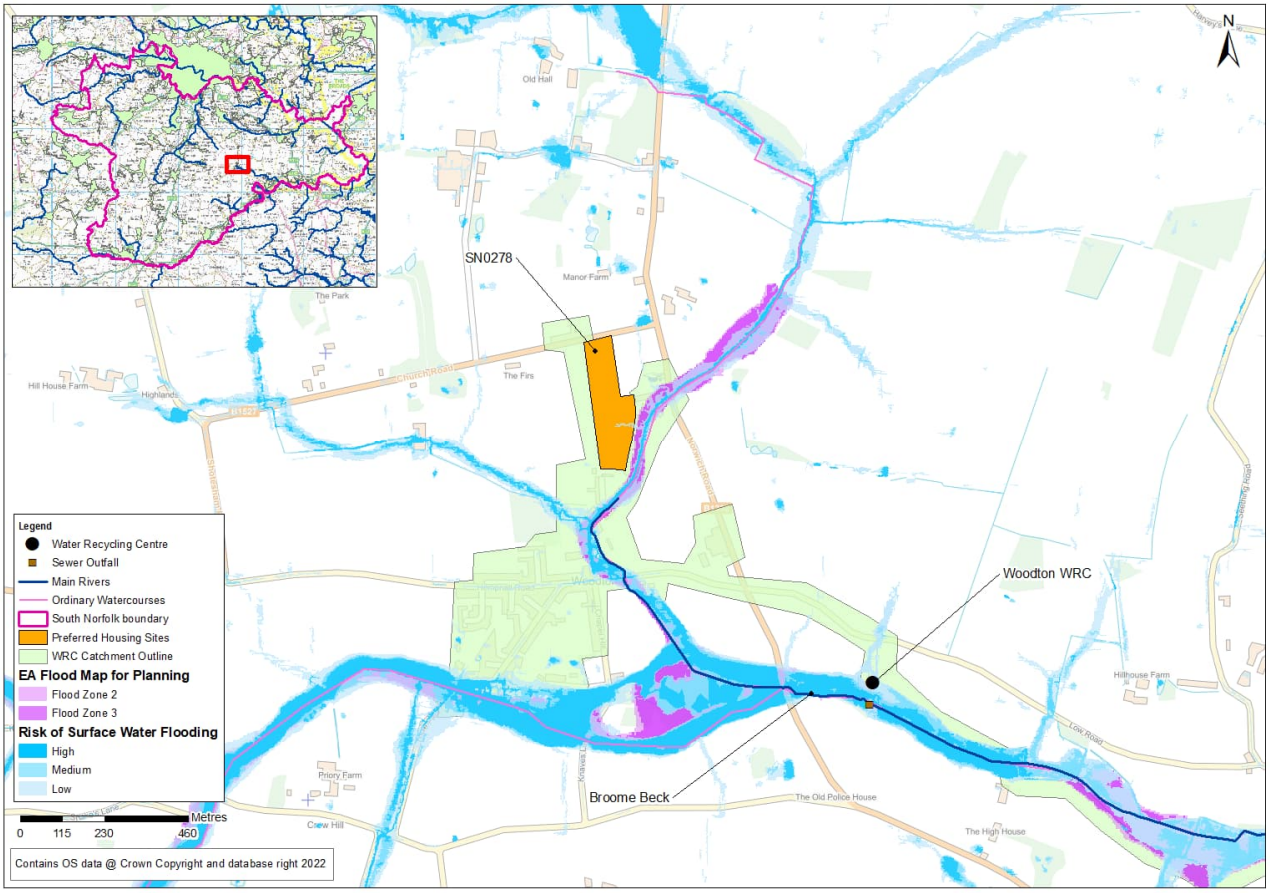


Figure 31: Woodton WRC catchment, allocated site and hydrological context

Table 30-1. Allocated site of relevance within the Woodton WRC catchment

Site Reference	Site Address	Dwelling No.
SN0278	Land south of Church Road	50

30.2 WRC capacity

30.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 68 new dwellings within the Woodton WRC catchment, of which 25 were assumed to come from the Village Cluster. The VCHAP has subsequently allocated 50 dwellings within the Village Cluster. As a result, the impact of the additional 25 dwellings on capacity has been considered in this WCS addendum.

30.2.2 Capacity re-assessment

The GNLP WCS identified that delivery of the 68 additional dwellings to 2038 would not cause the flow permit for the WRC to be exceeded but would result in less than 10% of the headroom capacity at the WRC to be remaining. Updates to

measured discharge flow and the increase in allocation from VCHAP has meant that headroom would likely be exceeded by the end of the plan period. Therefore, additional environmental capacity assessment was required. This assessment considered impacts of additional treated flow on the receiving watercourse (Broome Beck).

30.3 Environmental capacity assessment

Because the headroom capacity of Woodton WRC would be exceeded due to growth (new permit required), this assessment used modelling (RQP) and considered impacts of additional treated flow on the receiving watercourse - the Broome Beck WFD waterbody[12].

Full results of the water quality modelling for Woodton WRC are provided in section 0 of Appendix D. In summary, the modelling demonstrates that:

- The current quality (for ammonia and phosphate) of the Broome Beck at the point of discharge can be maintained after growth as long as changes to the permitted quality limits are applied to the new permit to discharge. This would be achievable within the limits of conventionally applied treatment processes.
- Some (or no) change would be required to the permit quality conditions for current WFD status and future target WFD status of the Broom Beck to be maintained.
- A permit value for BOD would need to be set beyond the limits of conventionally applied treatment in order to maintain current quality. Analysis of measured BOD data in the WRC discharge demonstrates this is because the WRC currently treats slightly better than the limits which are considered conventionally achievable. However, modelling has shown that a permit value at the limit of conventional treatment would be sufficient to prevent WFD deterioration and would not result in a waterbody level deterioration compared to the current discharge.
- It would therefore be possible to set a new permit that ensures no deterioration in the current quality of the Broome Beck as a result of future WRC discharges.

Managing the pollutant load through a new discharge permit and implementation of improvements to the discharge quality from Woodton WRC would also ensure no impact on the designated sites linked to the River Waveney which form component parts of the Broads SAC and Broadlands SPA. Implementing these improvements would ensure no deterioration from the current quality in the Broome Beck catchment as a result of growth associated with this WRC catchment.

30.4 Site assessments

Assessment of flood risk and wastewater network capacity issues for the allocated site in the Village Cluster are shown in Table 30-2.

Table 30-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0278	50	Limited sewer capacity – sewer upgrades likely to be required which will affect early phasing	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no Mapped flood extent on site	0% - no Mapped flood extent on site	0% - no Mapped flood extent on site

30.5 Cluster summary

No significant WCS constraints have been identified with respect to wastewater treatment capacity or local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Woodton and Bedingham.

However, a new discharge permit will be required for Woodton WRC because growth from the Village Cluster combined with allocations within the GNLP would result in the current WRC headroom capacity being exceeded towards the end of the plan period. The environmental capacity analysis has demonstrated that new permit conditions on quality can be applied within limits of conventionally applied treatment to protect water quality and linked ecological sites, and that these permit conditions

[12] WFD Waterbody ID GB105034045930

may need to be close to the current quality of discharge achieved by the WRC which is of a high standard. This is likely to require AWS to undertake process upgrades at the WRC to be able to continue to achieve these standards with higher inflows of wastewater from growth. This is unlikely to have any phasing implications for sites within the catchment because upgrades are only likely to be required toward the end of the plan period.

The site allocated by the VCHAP may have phasing implications linked to the potential need to upgrade the sewerage system in order to allow all development proposed within the Woodton WRC catchment to connect.

31. Wymondham catchment

31.1 Village Clusters and sites

The Wymondham WRC catchment serves the Village Cluster of **Wicklewood.** There are two allocated sites in the Wymondham WRC catchment as shown in Figure 32 and Table 31-1; the sites would deliver a maximum of 42 dwellings in the WRC catchment.

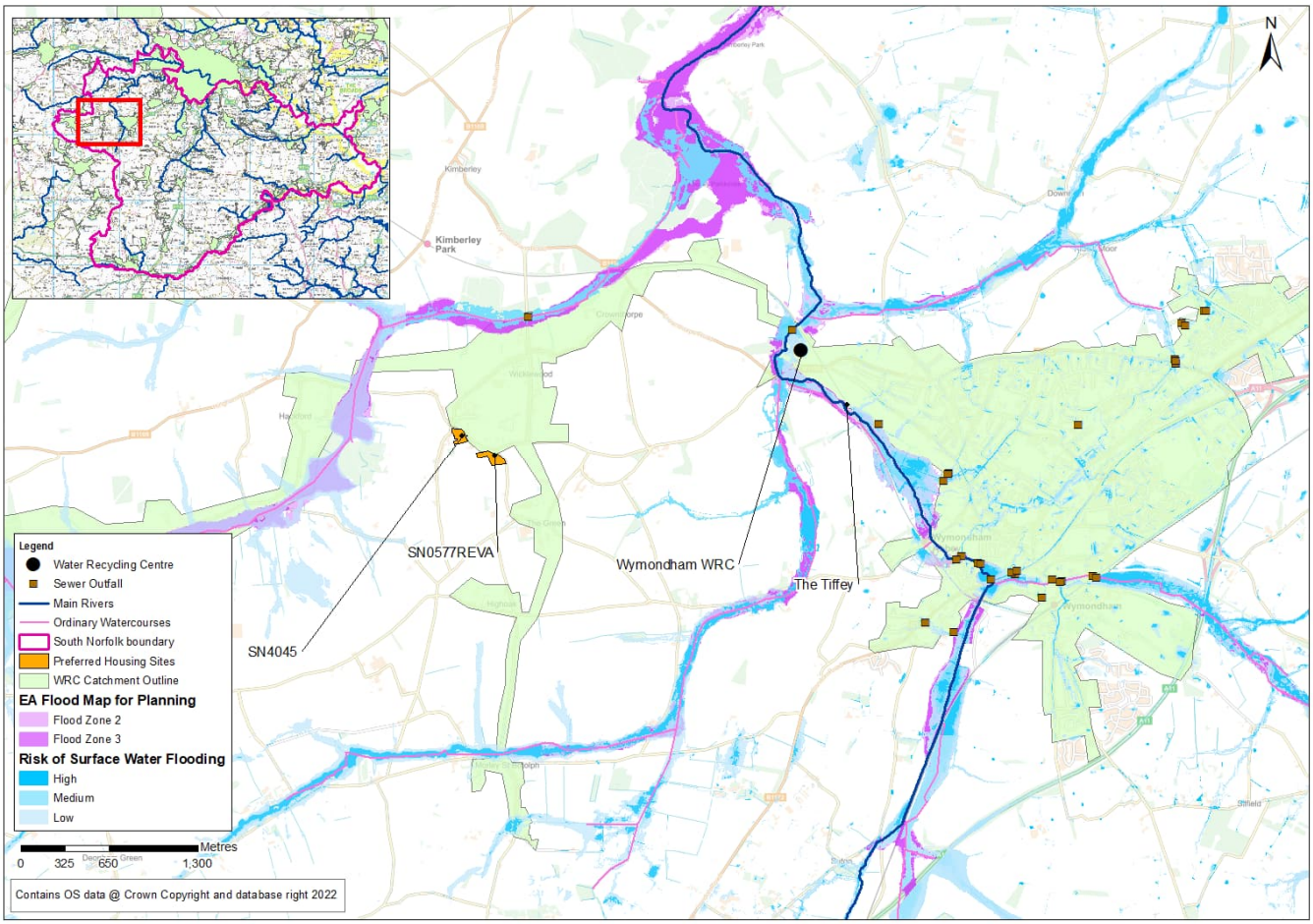


Figure 32: Wymondham WRC catchment, allocated sites and hydrological context

Table 31-1. Allocated sites of relevance to the Wymondham WRC catchment

Site Reference	Site Address	Dwelling No.
SN0577REVA	Land to the south of Wicklewood Primary School (Option 1)	30
SN4045	Land off Hackford Road	12

31.2 WRC capacity

31.2.1 GNLP WCS assumptions

The GNLP WCS assessed a total of 2,356 new dwellings within the Wymondham WRC catchment, of which 82 were assumed to come from the Village Clusters. The VCHAP has subsequently allocated only 42 dwellings within the Village Cluster; 40 less than the GNLP assumed. Therefore, the assessment from the GNLP WCS remains valid as a conservative assessment and no additional assessment has been completed for this WCS addendum.

31.3 Site assessments

Assessment of flood risk and wastewater network capacity issues for each site in the Village Cluster are shown in Table 31-2.

Table 31-2: Site capacity assessments and flood risk for allocated sites

Site information		Wastewater issues		Fluvial flood risk		Risk of surface water flooding		
Site Reference	Dwelling No.	Wastewater network capacity	WRC encroachment issues	FZ2	FZ3	High	Medium	Low
SN0577REVA	30	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no mapped flood extent on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site
SN4045	12	Capacity may be limited depending on cumulative impact – may require new sewer requisition	None	0% - Site is beyond FZ2 extent	0% - Site is beyond FZ3 extent	0% - no evidence of flooding on site	0% - no mapped flood extent on site	0% - no mapped flood extent on site

31.4 Cluster summary

No significant WCS constraints have been identified with respect to local infrastructure and flood risk constraints for the proposed site within the Village Cluster of Wicklewood. The allocated sites may need to consider sewer requisition from AWS to connect to the WRC catchment. It is recommended that developers in Wicklewood consult with AWS and provide evidence to the Local Planning Authority that there is sufficient wastewater network capacity prior to site commencement.

Appendix A – Details of wastewater assessment methodology

This appendix presents details on the wastewater assessment approach and methodologies used in the SNVC WCS.

A.1 Legislative drivers

This section sets out how the key legislative drivers has been considered as part of the wastewater assessment and capacity of receiving water bodies.

Water Framework Directive

Introduction

The environmental objectives of the WFD relevant to this WCS are:

- to prevent deterioration of the status of surface waters and groundwater (the no deterioration principle);
- to achieve objectives and standards for protected areas; and
- to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status.

These environmental objectives are legally binding, and all public bodies should have regard to these objectives when making decisions that could affect the quality of the water environment. The Environment Agency publishes the status and objectives of each surface waterbody on the Catchment Data Explorer[13], and describes the status of each waterbody as detailed in Table A1.

Table A1: Description of status in the WFD

Status	Description
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

Source: Environment Agency RBMPs 2019

WFD Compliance

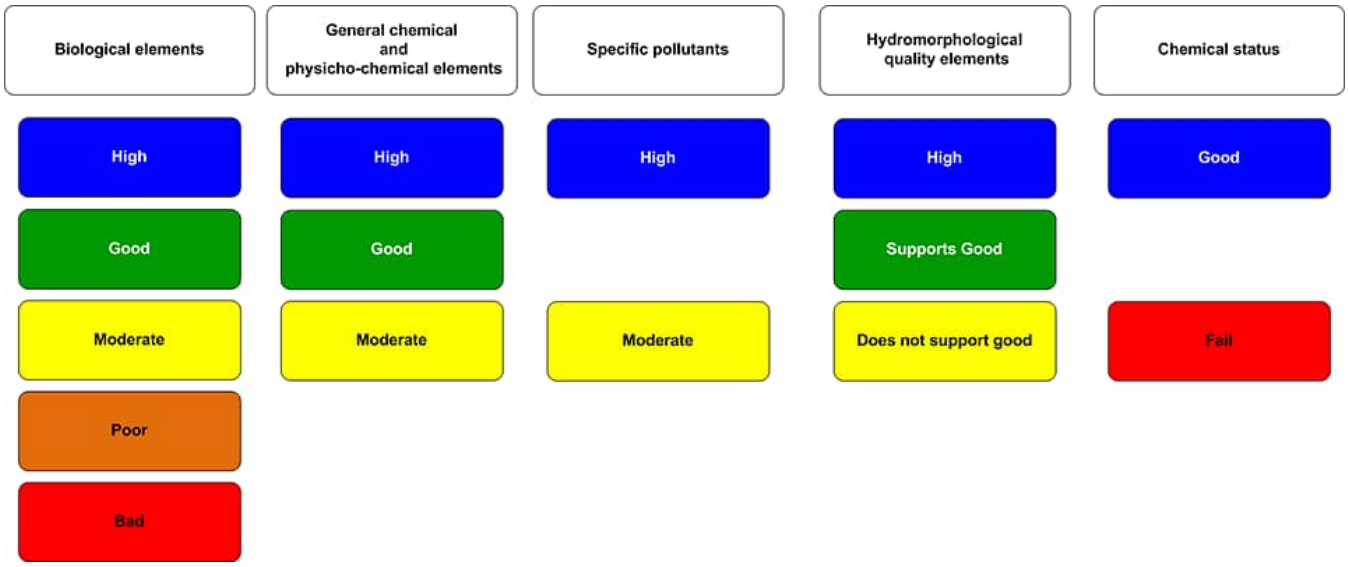
The definition of a waterbody's overall WFD 'status' is a complex assessment that combines standards for chemical quality and hydromorphology (habitat and flow conditions), with the ecological requirements of an individual waterbody catchment. A waterbody's 'overall status' is derived from the classification hierarchy made up of 'elements', and the type of waterbody will dictate what types of elements are assessed within it. The following is an example of the classification hierarchy and Figure A1 illustrates the classifications applied within the hierarchy:

Overall water body status or potential

- Ecological or Chemical status (e.g. ecological)
  - Component (e.g. biological quality elements)
    - Element (e.g. fish)

[13] Environment Agency (2022) Catchment Data Explorer: http://environment.data.gov.uk/catchment-planning/, accessed November 2022.

Figure A1: WFD classifications used for surface water elements



The two key aspects of the WFD relevant to the wastewater assessment in this WCS addendum are the policy requirements that:

- Development must not cause a deterioration in WFD status of a waterbody; and
- Development must not prevent a waterbody from achieving its Future Target Status (usually at least good status).

It is important to note that, if a waterbody's overall status is less than good as a result of another element, it is not acceptable to justify a deterioration in another element because the status of a waterbody is already less than good. It is also important to note that for a waterbody at bad status for any quality element, no deterioration is acceptable according to the Wesser Ruling[14] made by the Court of Justice of the European Union.

Where permitted headroom at a WRC would be exceeded by proposed growth, or there is a WRC that would have less than 10% capacity remaining, a water quality modelling assessment was undertaken to determine the quality conditions that would need to be applied to a new or revised discharge permit to ensure the two policy requirements of the WFD are met.

It is important to note that the modelling exercise specifically considered key physico-chemical elements which form a component part of the WFD Ecological Status of waterbodies but which relate to wastewater and sanitary contamination affecting dissolved oxygen, Biochemical Oxygen Demand (BOD), ammonia and phosphate. The Wesser Ruling also made clear that deterioration in any single element (in this case, phsyico-chemical elements) would constitute deterioration as defined by the Directive, even if the overall status of the waterbody is not changed.

Habitats Regulations and other ecological site protection

Some ecological sites are designated as areas that require protection in order to maintain or enhance the rare ecological species or habitat associated with them under the remit of the UK Habitats Regulations.

Although the Habitats Regulations do not directly stipulate conditions on discharge for WRC, the Regulations can, by the requirement to ensure no detrimental impact on designated sites, require restrictions on discharges to water dependent habitats that could be impacted by anthropogenic manipulation of the water environment. The Broads SAC has been identified as a site with relevance to the study area which is potentially affected by future WRC discharges. The total load discharging to the Broads SAC downstream has been considered by modelling the potential to maintain current quality as well as ensuring load standstill.

In addition to the SAC sites specifically, where future discharge from a WRC is likely to be significant due to proposed levels of growth, a screening exercise was undertaken to identify whether internationally or nationally important sites which are hydrologically linked to watercourses receiving treated wastewater flows from growth could be adversely affected. The scope

[14] https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-07/cp150074en.pdf

of this assessment included non-Habitats Regulations sites such as nationally designated Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNRs).

When a new or revised discharge permit was deemed as likely to be required, an assessment needed to be undertaken to determine what new quality conditions would need to be applied to the discharge. If the quality conditions remain unchanged, the increased flow of wastewater received at the WRC would result in an increase in the pollutant load of some substances being discharged to the receiving waterbody. This may have the effect of deteriorating water quality and hence in most cases, an increase in permitted discharge flow results in more stringent (or tighter) conditions on the quality of the discharge.

The requirement to provide a higher standard of treatment may result in an increase in the intensity of treatment processes at a WRC, which may also require improvements or upgrades to be made to the WRC to allow the new conditions to be met. In some cases, it may be possible that the quality conditions required to protect water quality and ecology are not achievable with conventional treatment processes and as a result, this WCS assumed that a new solution would be required in this situation to allow growth to proceed.

A.2 Assessment approach

An increase in residential and employment growth will have a corresponding increase in the volume and flow of wastewater generated within the study area, therefore it was essential to consider physical WRC headroom capacity and environmental capacity.

WRC headroom capacity

The treatment headroom capacity of a WRC is defined as the volume of additional flow that a WRC can treat before it would exceed the volume of discharge it is allowed to discharge within the conditions of its discharge permit. The following questions were answered through the assessment:

- Is there sufficient treatment capacity (headroom) within existing WRCs?
- What new infrastructure is required to provide for the additional wastewater treatment?

Environmental Capacity

Environmental capacity is defined in this WCS as the water quality needed in the receiving waterbodies to maintain the aquatic environments. The following objectives are answered in the results section:

- Could development cause deterioration in water quality?
- Could development cause deterioration in WFD status of any element? It is a requirement of the WFD to prevent status deterioration.
- Could development alone prevent the receiving water from achieving its Future Target Status or Potential? This is also a requirement of the WFD, which can be separated into the following two objectives:
  - Is the Future Target Status possible now assuming adoption of best available technology? To determine if it is limits in conventional treatment that would prevent the Future Target Status being achieved.
  - Is the Future Target Status technically possible after development and adoption of best available technology? To determine if it is growth that would prevent the Future Target Status being achieved.
- Will development cause deterioration in Broads SAC or prevent the designation meeting their targets?

Assumptions and input data

Several key assumptions were used in the assessments as follows:

- The wastewater generation per new household was based on an assumed Occupancy Rate (OR) of 2.07 people per house and an average consumption of 125 l/h/d).
- For WRCs with numerical permits, the WRC current discharge flows were taken as the current measured dry weather flow (DWF) (Q80) as provided by AWS in 2022 (using the last 3 years of data). Future discharge flows were calculated by adding the volume of additional wastewater generated by new dwellings (using an OR of 2.07 and a consumption value of 125l/h/d) to the current permitted DWF value.

- WRC current discharge quality was taken as the current permitted limits for each water quality element. Figures for the mean and standard deviation of each element were calculated based on these permit levels using RQP 2.5 software.
- Raw water quality data for modelling was provided by Environment Agency water quality planners as part of the GNLP WCS. The WFD 'no deterioration' target for each WRC are the downstream status for each water quality element, based on river monitoring data for the most recent three years of sampling data. The mean value and standard deviation was calculated, using this raw data for BOD, ammonia and phosphate where available for both the upstream (of the WRC) and downstream (the discharge) inputs.
- For the purposes of this study, the limits of conventionally applied treatment processes are considered to be:
  - 5mg/l for BOD;
  - 1mg/l for Ammoniacal-N; and
  - 0.25mg/l for Phosphate.

A.3 Assessment methodology

WRC Headroom Assessment

This assessment was the first step to determine which WRC required water quality assessment as a result of housing and employment growth based on how much treatment headroom a WRC has after growth has been considered. It also informed the type and complexity of water quality assessment required.

A WRC flow headroom calculator was developed and used to inform this assessment. The calculator identified which WRC within the study area will receive future growth and what the quantity of growth is in order to determine the additional wastewater flow generated at each WRC; an allowance of 25% for infiltration was applied to all the WRC as advised by AWS and allocated and committed housing from outside the study area which drains to a WRC receiving growth from the South Norfolk area was also accounted for.

The permitted flow headroom capacity within an existing permit is assumed to be usable; therefore the following steps were applied to calculate approximately how much available headroom each WRC has:

1. Determine the quantity of growth within a WRC catchment to determine the additional flow expected at each WRC (housing and employment land);
2. Calculate the additional wastewater flow generated at each WRC;
3. For WRC with numerical consents, calculate the remaining permitted flow headroom at each WRC and for WRC with descriptive consents, calculate remaining PE capacity before PE would exceed 250;
4. Determine whether the growth can be accommodated within existing headroom (or PE allowance).

Results are presented in Appendix B.

Environmental capacity – water quality assessment

Water quality assessment was then required whenever levels of growth (and hence wastewater generation) were defined as significant in relation to the available headroom at a WRC or the sensitivity of the watercourse receiving the treated flows; this defined the environmental capacity.

The water quality assessment determines whether significant growth served by a WRC has the potential to result in water quality impacts on receiving watercourse and is a key tool to determine where WRC treatment upgrades, or new treatment solutions may be required. In the context of the WCS aims, significant growth is defined as being when the future wastewater flows would result in:

- a WRC exceeding its permitted headroom and require a new discharge permit; or,
- a WRC having less than 10% remaining headroom when compared to the DWF permit limit.

WRC which would receive significant growth were identified for water quality modelling using the River Quality Planning tool (RQP). WRC which would receive growth but where the growth is considered not to be significant (greater than 10% residual headroom after growth) had a simpler load standstill calculation undertaken to consider water quality implications. WRC which would receive no growth were scoped out of the assessment.

RQP Modelling

Modelling of the quality permits required to meet the two WFD requirements was undertaken, using RQP 2.5 (River Quality Planning), the Environment Agency's software for calculating permit conditions.

The software is a monte-carlo based statistical tool that determines what statistical quality is required from discharges in order to meet defined downstream targets, or to determine the impact of a discharge on downstream water quality compliance statistics. Modelling was completed for four tests under two main banners of 'no deterioration' and 'meeting future WFD Status':

- Step 1: No deterioration – modelling to determine:
  - *Test C1*: the permit required after growth but which would maintain the same river quality at the discharge mixing point as modelled for the current discharge volume. This would ensure no deterioration from the current river condition;
  - *Test C2:* the permit required after growth but which would limit deterioration in the river at the mixing point to less than 10% of the current modelled quality; and,
  - *Test C3:* the permit required after growth that would ensure no deterioration in WFD status of the waterbody at the mixing point.
- Step 2: whether growth would prevent future objective WFD status from being attained.

Step 1 – 'No Deterioration' – Tests C1 to C3

Table C-2 provides detail on each of the modelling steps related to no deterioration and the sequence in which these are performed.

Table C2: Step 1, no deterioration tests, C1, C2 and C3.

Test Ref	Calculation Name	Calculation Detail	Reason for Calculation
C1	Maintain mixing point quality	No change in current modelled discharge quality at mixing point	To determine if it is technically feasible to ensure no change in current quality as a result of growth
C2	Limit deterioration to 10%	No deterioration from current downstream quality + 10% with future effluent flow	To determine if it is technically feasible to limit deterioration to no more than 10% of the current downstream water quality
C3	No deterioration (Current)	No deterioration from current status with current effluent flow	To calculate what quality condition is currently needed to avoid deterioration in the current status downstream with the current flow

If 'No Deterioration' could be achieved, then a proposed discharge permit standard was calculated which will be needed as soon as the growth causes the WRC flow permit to be exceeded.

Step 2 – Meeting Future 'Good' Status – C4 and C5

For all WRC meeting the requirement for RQP modelling and where the current downstream quality of the receiving watercourse is less than good, a calculation was undertaken to determine if the receiving watercourse could achieve its future objective status as set out in the online Catchment Data Explorer, with the proposed growth within limits of conventional treatment technology and what permit limits would be required to achieve this.

The assessment of attainment of future status assumed that other measures will be put in place to ensure the target status upstream, so that the modelling assumed upstream water quality is at the midpoint of the target status for each element and set the downstream target as the lower boundary of the target status for each element.

If the target status could be achieved with growth with permits achievable within the limits of conventional treatment, then a proposed discharge permit standard which may be needed in the future has been given in Table C-3

If the modelling showed that the watercourse could not meet future target status with the proposed growth within limits of conventional treatment technology, then the scenario is rerun with current WRC flows. If the additional run shows that future

targets could be met without growth, then it is concluded that growth would be a limiting factor in achieving the future target status and a detailed study is required to find suitable mitigation. If the modelling shows the future target status could not be achieved either with, or without growth, then the planned growth is concluded not to be a limiting factor in future target status requirements.

Table C-3: Step 2, meeting future 'Good' status, C4 and C5

Test Ref	Calculation Name	Calculation Detail	Reason for Calculation
C4	Achieve target status (Current)	Achieving target status with current effluent flow	To test what effluent quality would be needed to achieve target status with the current flow permit
C5	Achieve target status (Future)	Achieving target status with future effluent flow	To assess whether the future quality permit limits needed to achieve target status will be significantly more onerous and difficult to achieve than those currently needed (calculation 4)

Results are presented in Appendix D.

Load standstill calculations

For WRC where growth was not significant (more than 10% capacity remaining after growth), calculations were undertaken using Microsoft Excel. This used estimates of current measured flow at each WRC (Q80) to determine load amounts based on current permitted conditions for each quality parameter. These load amounts were then compared to the load amounts that would occur with the same quality conditions applied but for the calculated WRC flow once growth had been accounted for. The goal seek took in Excel was then used to adjust the future quality conditions required for each parameter in order to reduce future load amounts back to the load amounts calculated.

Where the quality conditions would need to be less than the limits of conventionally applied treatment processes, then a new solution was deemed to be required.

Results are presented in Appendix C.

Appendix B – WRC capacity assessment

Table B1 sets out the results of the WRC headroom capacity assessment for each WRC receiving growth from allocations within the VCHAP.

Table B1: Headroom capacity assessment summary

Water Recycling Centres	SNVC plus GNLP Dwelling Numbers Assumptions	Neighbouring Authority Dwelling Assumption	DWF Permitted flow (m3/d)	Measured DWF (Q80) (m3/d)	Headroom Capacity pre-growth (m3/d)	Post growth DWF estimate (m3/d)	Headroom Capacity post-growth (m3/d)	Percentage capacity after growth
Ashwellthorpe	15		119	102	17	107	12	10%
Barford-Chapel Street	34		127	99	28	110	17	13%
Barnham Broom	97		158	150	8	181	-23	-15%
Dickleburgh	95		410	285	125	316	94	23%
Diss	886	43	4032	2290.8	1741	2591	1441	36%
Ditchingham	101		280	268	12	301	-21	-7%
Ellingham-Braces Lane	84		199	132	67	159	40	20%
Forncett-Forncett End	105		327	340.8	-14	375	-48	-15%
Harleston	770		1392	988	404	1237	155	11%
Long Stratton	1960		1200	860.8	339	1494	-294	-25%
Norton Subcourse	51		170	129.7	40	146	24	14%
Stoke Holy Cross	44		341	260.8	80	275	66	19%
Whitlingham Trowse	33564		66250	68544.4	-2294	79809	-13559	-20%
Woodton	93		199	185	14	215	-16	-8%

Appendix C – Load standstill assessments

A summary of the results from the water quality assessment using the load standstill method are included in this section.

Table C1: Load standstill results	Ashwell thorpe	Barford-Chapel Street	Diss	Dickleburgh	Ellingham-Braces Lane	Harleston	Norton Subcourse	Stoke Holy Cross
Current BOD Limit of Conventional Treatment (mg/l)	5	5	5	5	5	5	5	5
Current Ammonia Limit of Conventional Treatment (mg/l)	1	1	1	1	1	1	1	1
Current Phosphate Limit of Conventional Treatment (mg/l)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Current DWF Permit (m3/day)	119	127	4032	410	199	1392	170	341
Measured flow Q80 (m3 /day)	108	99	2291	285	132	988	130	261
Current DWF capacity (m3 /day)	17	28	1741	125	67	404	40	80
BOD Permit limits (mg/l - 95% percentile)	40	50	12	30	40	17	30	50
Ammonia Permit Limits (mg/l - 95% percentile)	15	25	5	15	-	5	20	-
Phosphate Permit Limits (mg/l - annual average)	-	-	-	-	-	-	-	-
Future DWF (m3 /day)	107	111	2591	316	159	1237	146	275
Discharge Permit required*								
Effluent Quality permit required for BOD (mg/l - 95% percentile)	**38.1**	**45**	**10.6**	**10.7**	**33.2**	**13.6**	**26.7**	**47.4**
Effluent Quality permit required for Ammonia (mg/l - 95% percentile)	**14.3**	**22.5**	**4.4**	**5.3**	**-**	**4**	**17.8**	**-**
Effluent Quality permit required for Phosphate (mg/l - annual average)	-	-	-	-	-	-	-	-

* **Colour key**: **Green – no change to permit**; **Amber – change tightening, but within limits of conventionally applied treatment processes**; **permit required not achievable within limits of conventionally applied treatment processes**.

Appendix D – RQP assessment results

The results from the water quality assessment using the RQP tool are included in this section. A summary table of results in provided first, followed by an explanation of the findings for each WRC.

D.1 Summary RQP results table

Table D1: Summary of RQP outputs for each WRC

WRC	Barnham Broom WRC			Ditchingham WRC		
Parameters considered	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)
Permit condition	30	40	N/A	8.7	20	1
Measured quality of current discharge (taken from RQP output)	11.25	7.98	5.31	3.25	4.09	0.76
Limit of Conventional Treatment (LCT)	1	5	0.25	1	5	0.25
WFD receiving waterbody and ID	**River Yare**			**Broome Beck GB105034045930**		
Parameters considered	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)
Receiving waterbody Quality Element Published Status (2019)	**High**	N/A - not assessed	**Good**	**High**	N/A - not assessed	**Moderate**
Upstream sample point	**YAR050**			**None**		
Measured quality upstream of discharge(90 percentile Ammonia & BOD, annual average Phosphate) based on data PROVIDED BY EA and calculated in RQP	0.17	2.2	0.10	0.15	2.01	0.166
Quality Element Status based on measured data	**High**	**High**	**Moderate**	**High**	**High**	**Moderate**
Test 1 - Maintain Current Quality and limit to 10% deterioration	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Mixing Point Quality with current WRC flow (90 percentile Ammonia & BOD, annual average Phosphate)	0.21	2.20	0.14	0.2	1.98	0.19
Modelled status at mixing point with current flow	**High**	**High**	**Moderate**	**High**	**High**	**Moderate**
Permit condition required to maintain mixing point quality (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	**9.67**	**9.42**	**4.79**	**3.17**	**4.09**	**0.86**
river target to limit to 10% deterioration limit (90 percentile Ammonia & BOD, annual average Phosphate)	0.23	2.42	0.15	0.22	2.178	0.21
Permit condition required to be within 10% deterioration target (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	**14.09**	**54.38**	**5.98**	**4.21**	**13.49**	**1.49**
Test 2 - WFD Status: no deterioration (waterbody status)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Threshold at which status deterioration would occur (90 percentile Ammonia & BOD, annual average Phosphate)	0.30	4.00	0.095 (from EA)	0.30	4.00	0.231
permit condition required at mixing point - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(discharge quality 95%)**	**33.45**	**366.51**	**This test cannot be carried out - EA data shows upstream measured mean water quality is already worse than the deterioration target mean (provded by EA as Good target) - Published status is good, but measured data shows river is actually moderate.**	**8.52**	**81.16**	**2.24**
permit condition required at mixing point - after growth (95 percentile Ammonia & BOD, annual average Phosphate)	**27.01**	**291.39**		**8.12**	**77.36**	**2.14**
Test 3 - Future Status	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)
Is current status less than good for the quality element	No - test not required	No - test not required	N/A - test not required	N/A - test not required	N/A - test not required	Yes
Target future status (2019)	N/A	N/A	N/A	N/A	N/A	**Moderate**
Permit condition required - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(Discharge quality - mean quality)**						No Test required - target status same as current
Permit condition required - after growth (95 percentile Ammonia & BOD, annual average Phosphate)						
Will Growth prevent future target status						N/A

WRC	Forncett Forncett-End			Long Stratton WRC		
Parameters considered	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)
Permit condition	15	20	N/A	1	20	1
Measured quality of current discharge (taken from RQP output)	4.48	6.26	7.32	2.46	6.63	0.76
Limit of Conventional Treatment (LCT)	1	5	0.25	1	5	0.25
WFD receiving waterbody and ID	**Tas (Head to Tasburgh) GB105034045430**			**Tas (Head to Tasburgh) (GB105034045730)**		
Parameters considered	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)
Receiving waterbody Quality Element Published Status (2019)	**High**	N/A Not assessed	**Good**	**High**	N/A - not assessed	**Poor**
Upstream sample point	**None**			**None**		
Measured quality upstream of discharge(90 percentile Ammonia & BOD, annual average Phosphate) based on data PROVIDED BY EA and calculated in RQP	Assumed status mid point	Assumed status mid point	Assumed status mid point	0.15	2.01	0.17
Quality Element Status based on measured data	**N/A**	**N/A**	**N/A**	**High**	**High**	**Moderate**
Test 1 - Maintain Current Quality and limit to 10% deterioration	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Mixing Point Quality with current WRC flow (90 percentile Ammonia & BOD, annual average Phosphate)	3.21	4.68	5.65	1.59	5.26	0.73
Modelled status at mixing point with current flow	**Poor**	**Good**	**Poor**	**Moderate**	**Moderate**	**Poor**
Permit condition required to maintain mixing point quality (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	4.59	6.38	5.65	2.47	6.67	0.76
river target to limit to 10% deterioration limit (90 percentile Ammonia & BOD, annual average Phosphate)	3.531	5.148	6.215	1.749	5.786	0.80
Permit condition required to be within 10% deterioration target (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	5.05	7.02	6.22	2.72	7.34	0.83
Test 2 - WFD Status: no deterioration (waterbody status)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Threshold at which status deterioration would occur (90 percentile Ammonia & BOD, annual average Phosphate)	0.30	5.00	0.092	0.30	5.00 (based on EA advice - Good)	0.223
permit condition required at mixing point - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(discharge quality 95%)**	**0.43**	6.82	**0.09**	**0.47**	6.38	**0.23**
permit condition required at mixing point - after growth (95 percentile Ammonia & BOD, annual average Phosphate)	**0.43**	6.82	**0.09**	**0.46**	6.34	**0.22**
Test 3 - Future Status	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)
Is current status less than good for the quality element				N/A - test not required	N/A - test not required	N/A - test not required
Target future status (2019)						**Moderate**
Permit condition required - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(Discharge quality - mean quality)**				N/A	N/A	N/A - test not required - moderate status was used for the no deterioration test. It is not possible to achieve current moderate status with or without growth
Permit condition required - after growth (95 percentile Ammonia & BOD, annual average Phosphate)						
Will Growth prevent future target status						

WRC	Whitlingham Trowse WRC			Woodton WRC		
Parameters considered	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)
Permit condition	7	20	1	10	33	-
Measured quality of current discharge (taken from RQP output)	1.51	6.82	0.76	2	4.93	4.13
Limit of Conventional Treatment (LCT)	1	5	0.25	1	5	0.25
WFD receiving waterbody and ID	**Yare (Wensum to tidal) (GB105034051370)**			**Broome Beck (GB105034045930)**		
Parameters considered	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)
Receiving waterbody Quality Element Published Status (2019)	**High**	**High**	**Moderate**	**High**	N/A - not assessed	**Moderate**
Upstream sample point	**YAR190**			**None**		
Measured quality upstream of discharge(90 percentile Ammonia & BOD, annual average Phosphate) based on data PROVIDED BY EA and calculated in RQP	0.19	2.71	0.11	0.15	2.01	0.078
Quality Element Status based on measured data	**High**	**High**	**Moderate**	**High**	**High**	**Moderate**
Test 1 - Maintain Current Quality and limit to 10% deterioration						
Mixing Point Quality with current WRC flow (90 percentile Ammonia & BOD, annual average Phosphate)	0.35	3.12	0.25	0.19	2.00	0.27
Modelled status at mixing point with current flow	**Good**	**High**	**Poor**	**High**	**High**	**Poor**
Permit condition required to maintain mixing point quality (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	1.37	6.48	0.67	1.71	4.32	3.56
river target to limit to 10% deterioration limit (90 percentile Ammonia & BOD, annual average Phosphate)	0.385	3.432	0.28	0.209	2.20	0.30
Permit condition required to be within 10% deterioration target (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	1.56	7.9	0.79	2.39	9.52	4.11
Test 2 - WFD Status: no deterioration (waterbody status)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Threshold at which status deterioration would occur (90 percentile Ammonia & BOD, annual average Phosphate)	0.30	4.00	0.23	0.30	4.00	0.231
permit condition required at mixing point - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(discharge quality 95%)**	1.20	11.61	0.67	6.18	55.19	3.41
permit condition required at mixing point - after growth (95 percentile Ammonia & BOD, annual average Phosphate)	1.07	10.46	0.59	5.16	47.00	2.85
Test 3 - Future Status	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)
Is current status less than good for the quality element	N/A - test not required	N/A - test not required	Yes -Test Required	N/A - test not required	N/A - test not required	Yes
Target future status (2019)	N/A	N/A	**Moderate**	N/A	N/A	**Moderate**
Permit condition required - current WRC flow (95 percentile Ammonia & BOD, annual average Phosphate) **(Discharge quality - mean quality)**			N/A - Test 2 above uses Moderate Status limit as measured data is Moderate - Test 2 shows Moderate can be reached with and without growth			N/A - Test 2 above uses Moderate Status limit as measured data is Moderate - Test 2 shows Moderate can be reached with and without growth
Permit condition required - after growth (95 percentile Ammonia & BOD, annual average Phosphate)						
Will Growth prevent future target status						

D.2 RQP outputs for WRC

Barnham Broom WRC assessment

Receiving watercourse

The Yare (u/s confluence with Tiffey - Lower) waterbody (GB105034051290) receives treated effluent from Barnham Broom WRC and currently has an overall 2019 waterbody status of Moderate. The 2019 status of the physico-chemical elements considered in this assessment are provided in Table D2. Because the current element status' are either High or Good, the objective for 2027 is to remain as High or Good for these elements.

Table D2: WFD Status summary for the Yare (u.s confluence with Tiffey – Lower) water body

Classification Element	Current Status (2019)	Future Objective
Ammonia	High	High
Phosphate	Good	Good

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D3.

Table D3: RQP modelled permit quality conditions required for Barnham Broom WCS

			Future Permit quality limit required (mg/l)			
Determinant	2019 element status	Current permit quality limit (mg/l)	Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**30**	**9.67**	**14.09**	**27.01**	N/A
BOD (mg/l 95%ile)	**N/A**	**40**	**9.42**	**54.38**	**291.39**	N/A
Phosphate (mg/l annual average)	**Good**	**N/A**	**4.79**	**5.98**	EA data shows upstream quality is worse than good	N/A

Barnham Broom WRC's flow permit would be exceeded once all the growth within its catchment is delivered by 2036 and a new permit would be required. Water quality modelling has shown that the new permit would require improvements to the quality standards for BOD and ammonia (compared to the current permit conditions) and for phosphate, a new limit may be required to ensure there was no deterioration in the Yare as a result of the additional treated discharge.

These changes are possible within the limits of conventional treatment for all parameters assessed, and it would be possible to set a new permit that ensures no deterioration in the current quality of the Yare as a result of future Barnham Brook WRC discharges. This means there is a solution to ensure that growth at the WRC would not impact on downstream water dependent designated sites. The analysis also shows that the WFD status of the river would be unlikely to be impacted, even if no changes to the permit quality conditions were implemented. This is a result of the relatively small discharge flow from the WRC compared to the large river flow in the Yare at the point of discharge.

Ditchingham WRC assessment

Receiving watercourse

The Broome Beck water body (GB105034045930) receives treated effluent from Ditchingham WRC and currently has an overall 2019 waterbody status of Moderate. The 2019 status of the physico-chemical elements considered in this assessment are provided Table D4.

Phosphate is currently not achieving the minimum requirement of good status. The reasons for not achieving Good (RNAG) Status are: poor soil and nutrient management (agriculture and rural land management), and continuous sewage discharges. The future objective status for phosphate remains as Moderate with the justification for why good status is not the objective summarised in Table D4.

Table D4: WFD Status summary and RNAG for Broome Beck water body

Classification Element	Current Status (2019)	Future Objective	Justification for objective less than good
Ammonia	High	High	N/A
Phosphate	Moderate	Moderate	No known technical solution available

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D5.

Table D5: RQP modelled permit quality conditions required for Ditchingham WCS

			Future Permit quality limit required (mg/l)			
Determinant	2019 element status	Current permit quality limit (mg/l)	Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**8.7**	**3.17**	**4.21**	**8.12**	N/A
BOD (mg/l 95%ile)	**N/A**	**20**	**4.09**	**13.49**	**77.36**	N/A
Phosphate (mg/l annual average)	**Good**	**1**	**0.86**	**1.49**	**2.14**	Target status remains as moderate

Ditchingham WRC's flow permit would be exceeded once all the growth within its catchment is delivered by 2038 and a new permit would be required. Water quality modelling has shown that the new permit would require improvements to the quality standards for all parameters to ensure there was no deterioration in the Broome Beck as a result of the additional treated discharge. These changes are possible within the limits of conventional treatment for ammonia and phosphate.

For BOD, monitoring data shows the WRC is currently discharging at a quality beyond what is theoretically achievable with conventional treatment (4.09 mg/l) and modelling confirms that a permit similar to this value and hence below the limit of

conventional treatment (5 mg/l) would be required to ensure no change in water quality at mixing point. However, modelling has shown that a permit value of 5 mg/l would be sufficient to prevent WFD deterioration and would not result in a waterbody level deterioration compared to the current discharge. It would therefore be possible to set a new permit that ensures no deterioration in the current quality of the Broome Beck as a result of future WRC discharges.

The analysis also shows that the WFD status of the river would be unlikely to be impacted, even if no changes to the permit quality conditions were implemented for BOD and phosphate and only a minor improvement for ammonia.

Forncett-Forncett End WRC assessment

Receiving watercourse

A tributary of the Tas (Head to Tasburgh) GB105034045430 receives treated effluent from Forncett-Forncett End WRC. The Tas (Head to Tasburgh) has an overall waterbody status of Moderate. The 2019 status of the physico-chemical elements considered in this assessment are provided in Table D6. Because the current element status' are either High or Good, the objective for 2027 is to remain as High or Good for these elements.

Table D6: Status summary for the Tas (Head to Tasburgh) water body

Classification Element	Current Status (2019)	Future Objective
Ammonia	High	High
Phosphate	Good	Good

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D7.

Table D7: RQP modelled permit quality conditions required for Forncett End WRC

			Future Permit quality limit required (mg/l)			
Determinant	2019 element status	Current permit quality limit (mg/l)	Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**15**	4.59	5.05	0.43	N/A
BOD (mg/l 95%ile)	**N/A**	**20**	6.38	7.02	6.82	N/A
Phosphate (mg/l annual average)	**Good**	**-**	5.65	6.22	0.09	Already at Good Status

Forncett End WRC's flow permit is currently exceeded and would be exacerbated once all the growth within its catchment is delivered by 2038; a new permit would therefore be required to ensure no deterioration in the River Tas as a result of the additional treated discharge. The changes are possible within the limits of conventional treatment, and it would be possible to set a new permit that ensures no deterioration in the current quality of the Tas as a result of future discharges.

Modelling has also been undertaken to understand if the Good phosphate WFD status of the tributary of the Tas which receives the discharged flow can be achieved at the mixing point of the discharge. This modelling shows that it would not be possible to achieve this status at this point in the watercourse once growth has been considered within the limits of conventional treatment. However, model runs demonstrate that this would also not be possible with the current volume of discharge (requiring a permit limit of 0.09 mg/l mean) which demonstrates that growth is not a factor in the waterbody not achieving Good status for phosphate at mixing point. Despite the findings of the modelling, the overall status of the Tas (Head to Tasburgh) waterbody for phosphate is Good, which suggests that the mixing point quality is not a concern for the overall waterbody classification and that maintaining the current mixing point quality after growth is sufficient to ensure no deterioration in current river WFD status for phosphate. Maintaining the current mixing point quality after growth is sufficient to ensure no deterioration in current river quality and therefore growth is achievable.

Long Stratton WRC assessment

Receiving watercourse

The Hempnall Beck (GB105034045720) receives treated effluent from Long Stratton WRC and currently has an overall 2019 waterbody status of Poor. The 2019 status of the physico-chemical elements considered in this assessment are provided Table D8.

Phosphate is currently not achieving the minimum requirement of Good status. The RNAG are: poor livestock management, poor nutrient management (agriculture and rural land management), and continuous sewage discharges. The future objective status for phosphate remains as poor with the justification for why Good status is not the objective summarised in Table D8.

Table D8: Status summary for the Hempnall Beck water body

Classification Element	Current Status (2019)	Future Objective	Justification for objective less than good
Ammonia	**High**	**High**	N/A
Phosphate	**Poor**	**Poor**	No known technical solution available

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D9.

Table D9: RQP modelled permit quality conditions required for Long Stratton WRC

Determinant	2019 element status	Current permit quality limit (mg/l)	Future Permit quality limit required (mg/l)			
			Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**1**	**2.47**	**2.72**	**0.46**	N/A
BOD (mg/l 95%ile)	**N/A**	**20**	**6.67**	**7.34**	**6.34**	N/A
Phosphate (mg/l annual average)	**Good**	**1**	**0.76**	**0.83**	**0.22**	N/A

Long Stratton WRC's flow permit would be exceeded once all the growth within its catchment is delivered by 2038 and a new permit would be required. Water quality modelling has shown that the new permit would require improvements to the permit limits for BOD and phosphate to ensure there was no deterioration in the Hempnall Beck as a result of the additional treated discharge; no changes to the ammonia limit would be required. The changes are possible within the limits of conventional treatment, and it would be possible to set a new permit that ensures no deterioration in the current quality of the Hempnall Beck as a result of future Long Stratton WRC discharges.

Modelling has also been undertaken to understand if the high WFD status of the Beck for ammonia can be achieved at the mixing point of the discharge. This modelling shows that it would not be possible to achieve this status at this point in the watercourse once growth has been considered within the limits of conventional treatment. However, model runs demonstrate that this would also not be possible with the current volume of discharge (requiring a permit limit of 0.47 mg/l 95 percentile) which demonstrates that growth is not a factor in the waterbody not achieving high for ammonia at mixing point. Despite the findings of the modelling, the overall status of the waterbody for ammonia is High, which suggests that the mixing point quality is not a concern for the overall waterbody classification and that maintaining the current mixing point quality after growth is sufficient to ensure no deterioration in current river WFD status for ammonia.

Modelling has also been undertaken to determine if moderate status can be achieved for phosphate at the mixing point of the discharge (the current 2019 status is poor). This modelling shows that it would not be possible to achieve this status at this point in the watercourse once growth has been considered within the limits of conventional treatment. However, model runs demonstrate that this would also not be possible with the current volume of discharge (requiring a permit limit of 0.23 mg/l mean) which demonstrates that growth is not a factor in the waterbody not being able to achieve moderate for phosphate at mixing point. The overall status of the waterbody for phosphate is Poor (2019) and modelling shows it is not possible to achieve Moderate with current discharge volumes and this is reflected in the current future status for phosphate remaining as Poor. Maintaining the current mixing point quality after growth is sufficient to ensure no deterioration in current river quality and therefore growth is achievable.

Whitlingham Trowse WRC assessment

Receiving watercourse

The Yare (Wensum to tidal) waterbody (GB105034051370) receives treated effluent from Whitlingham Trowse WRC and currently has an overall 2019 waterbody status of Moderate. The 2019 status of the physico-chemical elements considered in this assessment are provided Table D10.

Phosphate is currently not achieving the minimum requirement of Good status. The RNAG are: poor livestock management, poor nutrient management (agriculture and rural land management), transport drainage and, continuous sewage discharges. The future objective status for phosphate remains as Moderate with the justification for why Good status is not the objective summarised in Table D10.

Table D10: Status summary and RNAG for the Yare (Wensum to tidal) water body

Classification Element	Current Status (2019)	Future Objective	Justification for objective less than good
Ammonia	High	High	N/A
BOD	High	High	N/A
Phosphate	Moderate	Moderate	No known technical solution available

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D11.

Table D11: RQP modelled permit quality conditions required for Whitlingham Trowse WRC

			Future Permit quality limit required (mg/l)			
Determinant	2019 element status	Current permit quality limit (mg/l)	Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**7**	**1.37**	**1.56**	**1.07**	N/A
BOD (mg/l 95%ile)	**N/A**	**20**	**6.48**	**7.90**	**10.46**	N/A
Phosphate (mg/l annual average)	**Good**	**1**	**0.67**	**0.79**	**0.59**	N/A – future target is moderate

The headroom capacity at Whitlingham WRC is already exceeded and would be exacerbated by the additional growth, mostly from the GNLP, but also a small volume from the VCHAP; a new permit would be required. Water quality modelling has shown that the new permit would require improvements to the quality limits for all parameters to ensure there was no deterioration in the Yare (and WFD status maintained) as a result of the additional treated discharge.

These changes are possible within the limits of conventional treatment for all parameters assessed, and it would be possible to set a new permit that ensures no deterioration in the current quality of the Yare as a result of future Whitlingham WRC discharges. This means there is a solution to ensure that growth at the WRC would not impact on downstream water dependent designated sites.

Woodton WRC assessment

Receiving watercourse

The Broome Beck waterbody (GB105034045930) receives treated effluent from Woodton WRC and currently has an overall 2019 waterbody status of Moderate. The 2019 status of the physico-chemical elements considered in this assessment are provided in Table D12.

Phosphate is currently not achieving the minimum requirement of Good status. The RNAG are: poor soil and nutrient management (agriculture and rural land management) and continuous sewage discharges. The future objective status for phosphate remains as Moderate with the justification for why Good status is not the objective summarised in Table D12.

Table D12: status summary and RNAG for Broome Beck water body

Classification Element	Current Status (2019)	Future Objective	Justification for objective less than good
Ammonia	High	High	N/A
Phosphate	Moderate	Moderate	No known technical solution available

Revised permit conditions – modelling results

The revised discharge permit required by the end of the plan period for each determinant and for each modelled scenario are presented in Table D13.

Table D13 RQP modelled permit quality conditions required for Woodton WRC

			Future Permit quality limit required (mg/l)			
Determinant	2019 element status	Current permit quality limit (mg/l)	Maintain current mixing point quality	Limit mixing point deterioration to 10%	No deterioration in 2019 WFD element status at mixing point	Achieve future WFD target status (where 2019) status is less than good)
Ammonia (mg/l 95%ile)	**High**	**10**	**1.71**	**2.39**	**5.16**	N/A
BOD (mg/l 95%ile)	**N/A**	**33**	**4.32**	**9.52**	**47.00**	N/A
Phosphate (mg/l annual average)	**Moderate**	**-**	**3.56**	**4.11**	**2.85**	N/A – future target is moderate

Woodton WRC's flow permit would be exceeded once all the growth within its catchment is delivered by 2038 and a new permit would be required. Water quality modelling has shown that the new permit would require improvements to the quality standards for all parameters to ensure there was no deterioration in the Broome Beck as a result of the additional treated discharge.

These changes are possible within the limits of conventional treatment for ammonia and phosphate. For BOD, monitoring data shows the WRC is currently discharging at a quality beyond what is theoretically achievable with conventional treatment (4.93 mg/l) and modelling confirms that a permit similar to this value and hence below the limit of conventional treatment (5 mg/l) would be required to ensure no change in water quality at mixing point. However, modelling has shown that a permit value of 5 mg/l would be sufficient to prevent WFD deterioration and would not result in a waterbody level deterioration compared to the current discharge. Therefore, it would be possible to set a new permit that ensures no deterioration in the current quality of the Broome Beck as a result of future Woodton WRC discharges. This means there is a solution to ensure that growth at the WRC would not impact on downstream water dependent designated sites.

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