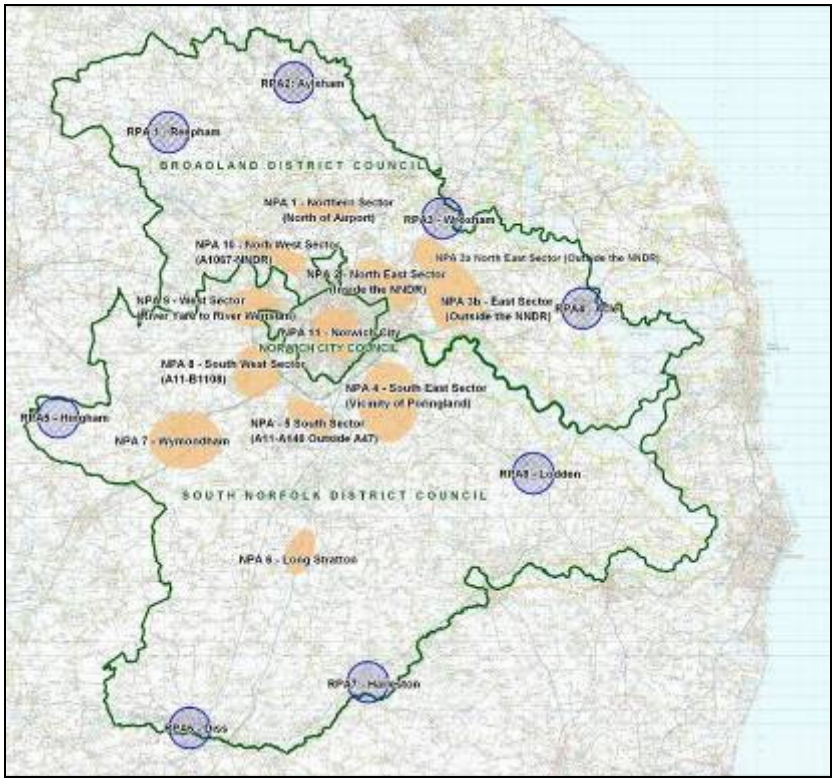
Greater Norwich Development Partnership

Stage 2b Water Cycle Study

Non Technical Planning Report - Final

February 2010



Prepared for:

Revision Schedule

Stage 2 Water Cycle Study
Non Technical Planning Report - Final
February 2010

Rev	Date	Details	Prepared by	Reviewed by	Approved by
1	January 2010	D118607 - Stage 2b – Non-Technical Planning Report - Draft Final Report	**Carl Pelling** Principal Consultant	**Sarah Kelly** Assistant Consultant	**Jon Robinson** Associate Director
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Glossary

AA	Appropriate Assessment (under the Habitats Regulations)
AMP	Asset Management Plan
AWS	Anglian Water Services
BOD	Biological Oxygen Demand
CAMS	Catchment Abstraction Management Strategy
CfSH	Code for Sustainable Homes
CLG	(department for) Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
GNDP	Greater Norwich Development Partnership
GNWCS	Greater Norwich Water Cycle Study
HD	Habitats Directive
HR	Habitats Regulations
HRA	Habitats Regulations Assessment
JCS	Joint Core Strategy
L/h/d	Litres/head/day
LDD	Local Development Document
LDF	Local Development Framework
Ml/d	Megalitres per day (1000m3/day)
NE	Natural England
NPA	Norwich Policy Area
Ofwat	Water Services Regulation Authority (formerly known as the Office of Water Services)
P	Phosphorous
PE	Population Equivalent
PGA	Potential Growth Area
PPS	Planning Policy Statement
RoC	Review of Consents (under the Habitats Directive)
RPA	Rural Policy Area
RSS	Regional Spatial Strategy
SAC	Special Area for Conservation
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable (urban) Drainage Systems
WCS	Water Cycle Study(ies)
WFD	Water Framework Directive

WRMP	Water Resources Management Plan
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

1 Executive Summary

1.1 Introduction

1.1.1 Significant growth in housing and employment is proposed for the Greater Norwich development Partnership (GNDP) planning area. In order to support the Joint Core Strategy (JCS) for the partner authorities (Norwich City Council, Broadlands District Council and South Norfolk Council), a Water Cycle Study (WCS) has been undertaken to demonstrate that water supply, water quality, sewerage and flood risk management issues can be addressed in the three Local Authorities and appropriate water services infrastructure can be provided for to enable the growth planned to 2026 and beyond. It is a key part of the evidence base for the Joint Core Strategy (JCS) and is required by the East of England Plan.

1.1.2 The Greater Norwich WCS (GNWCS) has been undertaken in several key stages to inform the different stages of the JCS and in keeping with current guidance on undertaking WCSs. This report represents the finings of Stage 2b which has assessed each of the Potential Growth Areas (PGAs) chosen as the Favoured Option, providing detail on the specific infrastructure required for to take the favoured growth options forward.

1.1.3 The favoured option includes for growth in all of the Norwich Policy Areas (NPAs) and Rural Policy Areas (RPAs), and with the inclusion of completed housing within the existing baseline, includes approximately for a further 40,000 homes to be delivered over the remaining plan period. These homes, plus requirements for employment have been assessed in the Stage 2b WCS.

1.1.4 This Stage 2b final findings report should be read in conjunction with the Stage 1 and Stage 2a reports of the GNWCS.

1.2 Wastewater Strategy

1.2.1 The additional 40,000 homes and proposed jobs that still need to be delivered in the GNDP area will generate additional wastewater, which will need to be collected, transmitted to a treatment facility and treated prior to discharge to a water body.

1.2.2 A wastewater strategy was developed which was required to:

- minimise the requirement for new infrastructure thereby maximising opportunity for early phasing and minimising cost (in keeping with Policy WAT2 of the Easy of England Plan);
- minimise distance required for transfer of wastewater flows to treatment facilities to minimise energy requirements and costs associated with operational pumping for the lifetime of development;
- ensure that increases in treated discharges will not cause watercourses to fail water quality targets under the Water Framework Directive (WFD) and Habitats Directive (HD); and
- determine what additional treatment and sewer infrastructure is required to deliver growth that exceeds existing capacity and meets with WFD and HD standards.

1.2.3 In order to do this, the Stage 2b study undertook the following assessments:

- calculated the treatment capacity at each of the Wastewater Treatment Works (WwTW);
- modelled the likely quality standards required for consenting the additional discharges in order to meet WFD and HD standards;
- reviewed capacity in the existing sewer network in terms of receiving more wastewater discharge; and
- determined requirements for upgrades to WwTW, and upgrades to existing sewer or provision of new strategic sewers to allow the wastewater to be transferred to the appropriate WwTW.

1.2.4 In undertaking the assessments, an optimal strategy was developed which utilised capacity at each WwTW local to the PGA first and then used spare capacity at Whitlingham WwTW to the east of Norwich which has a very large treatment capacity for further growth.

Wastewater Transmission

1.2.5 The wastewater strategy developed shows that, with some upgrades, all of the increases in wastewater flow generated as a result of new housing and employment can be transferred and treated at existing WwTW without the need for further treatment facilities.

1.2.6 A key element of the strategy is that a near circular strategic sized interceptor sewer is required around the northern and southern boundary of Norwich which intercepts flow from several of the bordering PGAs and transfers flows to Whitlingham WwTWs. This is required to prevent exacerbation of sewer flooding within Norwich and to prevent increases in discharges of polluting Combined Sewer Overflows (CSO) into the River Wensum including the Special Area of Conservation (SAC). In most cases the RPAs can make use of existing sewer network, although growth in the majority of NPAs will also need to consider a variety of sewer upgrade options in addition to the proposed interceptor sewer before they can be built and connected for wastewater treatment. In some cases, there will be a limit on growth until 2019 when the new interceptor main is likely to be operational.

Wastewater Treatment

1.2.7 The assessment has shown that, in general there is sufficient capacity within the existing permitted flows of most WwTW to accept wastewater from growth without the need to alter the consent to discharge to meet compliance with the WFD and HD and hence protect downstream sites of European importance. The exceptions to this are the WwTW of Stoke Holy Cross, Reepham, Acle and Long Stratton.

1.2.8 These WwTW would exceed their current permitted flows as a result of growth and water quality modelling has shown that, in order to meet WFD and HD requirements downstream, three of the WwTWs would have to introduce treatment solutions considered to be beyond that which is currently feasible or sustainable with current available technology. As a result proposed growth at the following PGAs will either be difficult or not possible to achieve:

- RPA1 – Reepham (241 dwellings): WFD compliance not possible immediately downstream as a result of growth. HD likely to be achievable;
- RPA4 – Acle (241 dwellings): WFD compliance not possible immediately downstream as a result of growth. HD is achievable; and

- NPA6 – Long Stratton (1,927 dwellings): Neither WFD nor HD compliance is possible as a result of growth (at maximum proposed allocations).

1.2.9 Neither Reepham nor Acle have any current dwelling capacity; however, Long Stratton has capacity for approximately 1,400 homes (see Table 4-1). This means that whilst the full proposed housing number could not be delivered under the planned consented scenarios, up to 1,400 new dwellings could be accommodated before the current flow consent is exceeded and under the planned scenario, would not require a change in quality consents.

1.2.10 Therefore in total, 1,009 dwellings (241 at Reepham, 241 at Acle and 527 at Long Stratton) out of the proposed 40,000 cannot be delivered and meet with WFD and HD compliance.

1.2.11 Water quality modelling has shown that for Stoke Holy Cross WwTW (NPA4), downstream appliance could be achieved within available technology and hence growth can go ahead in NPA4 with significant improvements to the WwTW to be carried out by AWS over the next five years,

1.2.12 For the 1,009 dwellings, either the growth needs to be allocated to other PGAs where WwTWs do have capacity, or an agreement needs to be reached at policy making level that these potential non-compliance issues with the WFD and HD are acceptable in order to achieve the growth agenda, or further more detailed analysis is required for innovative solutions that would allow growth to take place and still meet the legislative and policy requirements. The level of study that would be required to determine individual solutions would require a site specific assessment once it is known where development is likely to take place in each PGA; but some of the options that could be considered as solutions include:

- Consideration of the discharge to ground for treated wastewater, either from existing WwTW, or via new package treatment plants built specifically for new development;
- Construction of a wetland system downstream of treated effluent discharge to increase uptake of P and reduction of BOD and Ammonia in final discharge from a WwTW; or
- Re-use of treated effluent within buildings for non potable use, thereby reducing the volume of discharge from new development; this would also have the benefit of reducing demand for water in these developments.

1.2.13 Whilst the WCS has demonstrated that there is sufficient capacity to accept wastewater from most of the growth proposed in the JCS, further more detailed modelling has shown that further tightening of treatment process may be required at the next review of water company prices in 2014 in order to ensure continued compliance with the WFD. The Environment Agency will be review this position over the next five years and hence it should be considered that the growth proposed in the JCS may need to be altered to ensure continued compliance with the WFD.

1.3 Water Supply Strategy

1.3.1 AWS are yet to finalise the statutory Water Resources Management Plan (WRMP) which sets out how water demand in its operational area will be met for the next 35 year period. At the time of completing the Stage 2b WCS, the Department for the Environment, Food and Rural Affairs (Defra) have asked that AWS submit further information on its plan before it can be published.

1.3.2 Despite this position, the Stage 2b WCS has utilised information provided by AWS in its draft WRMP and in their Statement of Response to the consultation on the draft WRMP. The

Environment Agency's response to the draft WRMP (EA, 2008) has also been considered and a proposed water supply strategy put forward which shows that sufficient water resources will be available to meet the proposed increase in water demand.

1.3.3 As a result of growth in housing and employment, demand for water in the GNDP over the next 35 years has been calculated by the WCS to increase over a range from 10 million litres a day (Ml/d) up to 17 Ml/d. The lowest estimate could result if all new homes were as water efficient as possible thereby meeting levels 5 or 6 in the Code for Sustainable Homes (CfSH). The highest estimate is based on water consumption remaining as it is for current average use.

1.3.4 AWS aims to meet this demand through a 'twin-track' approach whereby existing demand for water is reduced (e.g. by installing more water meters), combined with providing new strategic sources of raw water supply to treat for potable consumption.

1.3.5 The current proposed strategy for water supply is to provide 4Ml/d additional supply through capacity in existing abstraction licences for groundwater in the area. A further 4Ml/d will be provided from a new groundwater source and in excess of 12Ml/d will be provided longer term from a flow transfer scheme which will transfer treated effluent flow from Whitlingham WwTW up catchment to 'compensate' for any water lost at the main Costessey abstraction point west of Norwich city Centre. The Costessey abstraction licence is currently being considered for a change in permitted maximum volumes that can be abstracted as part of a review process of all abstractions licences and consents that could impact ecological sites listed under the HD (SACs, SPAs and Ramsar sites). It is considered that the Costessey abstraction is impacting on the integrity of the Wensum SAC and the level of change is currently being considered to mitigate the impact. For reasons of statutory consultation, at the time of completing the Stage 2b WCS, the exact size of the sustainability change is not known; however, the implications of this have been assessed in the Stage 2b WCS and it is proposed that the effluent transfer scheme could be considered as a potential replacement to the potential loss of abstraction. The Environment Agency have also advised that if there is a loss of abstraction, that this will be compensated for and will not affect availability of water resources to provide for growth.

1.3.6 The East of England (with the exception of coastal districts on north Essex and South Suffolk) is classified by the Environment Agency as being under 'severe' water stress, meaning demand for water is high compared to available raw resources. Water supply is therefore reliant on strategic transfers within Anglian Water's supply region and development of strategic water resource schemes. It is therefore imperative that water efficiency is maximised in both existing and new homes and non residential building as part of the growth plan proposed to minimise future demand and minimise additional 'stress' on resources. A Water Efficiency Plan is proposed which has the potential to allow a position of 'water neutrality' to be achieved in the GNDP area as a whole. This would mean that by reducing demand in existing housing and non-residential buildings and by making all new homes as water efficient as possible, there could be no net increase in water demand (compared to 2009) after development has been completed at the end of the plan period.

1.3.7 Several of the NPAs will be required to provide water quality protection to any surface water infiltrated to ground and to restrict certain types of development in order to protect the quality of groundwater abstracted for supply in the study area.

1.3.8 Assessment of water supply mains has concluded that in the majority of cases, each of the PGAs can be largely serviced through existing mains using Heigham Water Treatment Works (WTW) as the focal point for distributing new resources. Local connections (along with pumping stations)

will be required in several PGAs depending on which sites are taken forward within each of the broad scale areas assessed.

1.4 Infrastructure Phasing and Funding

1.4.1 Advice has been provided on both phasing and funding of development. Significant upgrades are required to WwTW, strategic sewers and water resource development. Water Resource development will have sufficient phasing allowance to meet proposed growth; however some limitations on phasing for some PGAs will be required between 2009 and 2019 (end of AMP6) as funding for wastewater treatment and sewer infrastructure is sought by AWS and construction time is allowed for. This detail has been provided for each PGA in turn (see section 7) via a series of infrastructure timelines.

1.4.2 Significant infrastructure upgrades are required to deliver several of the required treatment upgrades (complete in 2015) and the proposed interceptor sewers (2019 at the earliest).

1.4.3 Mechanisms for developer contributions and funding to the strategic infrastructure have been identified. Although there are limits on the provision of developer funding for wastewater treatment and water resources, mechanisms for securing funding to strategic water supply mains and sewers have been identified where it is clear that the infrastructure is required solely to service specific development. Estimated costs to be contributed to by developers are provided.

1.4.4 Significant funding will be required to deliver management of surface water from the proposed developments. The cost for this will vary according to each PGA as the variability of ground conditions and abstractions means that effectiveness of preferred Sustainable Drainage Systems (SuDS) which naturally infiltrate water to the ground is also variable. Advice is provided on which SuDS systems are most suitable for each PGA.

1.5 Recommendations

1.5.1 Several Key Water Cycle policies have been put forward to include within the JCS or for other Development Plan documents (DPDs) and Supplementary Planning Documents (SPD) - see section 10. These polices are proposed to both aid the delivery of water services infrastructure required, but also to help meet the key requirements of the water strategy developed in the WCS. This includes policy recommendations on water efficiency for new homes and policy on drainage management.

1.5.2 A developer checklist to ensure individual developments comply with the strategy has been provided (Appendix B: Developer Checklist).

1.5.3 Several key statutory water related outputs and plans were not finalised in time to fully inform this Stage 2b WCS. It is therefore recommended that the WCS remains a live document and is revisited at key stages of release of key information. Likely dates for review are included in Appendix C: Timeline of Likely WCS Changes.

2 Introduction

2.1 Purpose of the Water Cycle Study

2.1.1 Through Policy WAT2 (Infrastructure), the Regional Spatial Strategy (RSS) for the East of England (The East of England Plan) requires a programme of WCSs to be undertaken to:

- ensure a co-ordinated approach to the timely provision of the appropriate additional infrastructure for water supply and wastewater treatment to cater for levels of development as proposed in the RSS;
- address issues of water supply, water quality, wastewater treatment and flood risk in receiving watercourses related to development proposed in the RSS; and
- provide an evidence base for Local Development Documents (LDD) so they can demonstrate that location of new development has:
  - maximised potential of existing infrastructure; and hence
  - minimised the need for new infrastructure.

2.1.2 This study is needed to ensure that water supply, water quality, sewerage and flood risk management issues can be addressed in a sustainable way for the three Local Authorities (Norwich City Council, Broadland District Council and South Norfolk Council) to enable the growth planned to 2026[1]. It is a key part of the evidence base for the Joint Core Strategy (JCS) and is required by the East of England Plan.

2.2 Previous Water Cycle Study Stages and Findings

2.2.1 The Greater Norwich Water Cycle Study (GNWCS) has been undertaken in several key stages to inform the development of the JCS. Each stage of the WCS has been undertaken by Scott Wilson and the key findings of each are summarised here.

Stage 1 Outline GNWCS

2.2.2 Stage 1 provided a WCS for the Greater Norwich Development Partnership (GNDP) in light of their required housing and employment growth targets, as set out in the RSS. It was undertaken prior to the selection of favoured growth locations and undertook a strategic broad scale assessment of the water and wastewater issues in the region and initial testing of each of the Proposed Growth Areas (PGA). The outputs of Stage 1 were:

- The identification of water infrastructure and environmental constraints related to development of PGA locations in both the Norwich Policy Areas (NPAs) and the Rural Policy Areas (RPAs), based on existing infrastructural and environmental capacity;
- each NPA was assessed for development of up to 20,000 dwellings at each location and for up to 2,000 dwellings at RPA locations; it was concluded that within existing constraints, 33,000 new dwellings could be developed in the NPA and 2,300 in the RPAs;

[1] Further growth planned beyond 2026 required by the Joint Core Strategy is also taken account of north east of Norwich

- Whitlingham WwTW has high volumetric capacity available but there is a need for wastewater network mains improvements and technological improvements (to reduce phosphorus in the discharge) to protect The Broads SAC; and
- limited sewer capacity in central Norwich reduces the potential for development to the north and west of Norwich unless new strategic sewerage infrastructure is provided and may be an issue for future development of brownfield sites in the city centre.

Stage 2 Detailed GNWCS

2.2.3 Stage 2 has used and developed the Stage 1 findings and has been undertaken in two sub-stages. The first sub-stage (Stage 2a) was undertaken to provide the water inputs to the planning decisions on the selection of favoured options, whilst the second sub-stage (Stage 2b) was to complete the detailed assessment of the favoured options once chosen.

Stage 2a

2.2.4 Stage 2a informed the Favoured Options decisions of the JCS. It identified how the Stage 1 constraints for all the PGAs could be overcome through investment in new infrastructure which was costed and compared for each growth area assuming a maximum level of growth in each PGA. It then made recommendations on which were the most appropriate locations for growth based on a ranking system covering:

- costs of providing infrastructure to the PGA;
- impact on the environment; and
- flood risk considerations.

2.2.5 Stage 2a of the WCS identified the strategic infrastructure requirements of developing each of the PGAs for different levels of growth to give a relative comparison for each PGA in relation to water cycle issues. It identified that:

- strategic infrastructure options are available for each of the PGAs to provide sufficient wastewater and water supply infrastructure;
- the estimated costs in providing this infrastructure varied considerably dependent on water environment impacts and location, and hence several NPAs and RPAs were more preferable from a water cycle perspective than others; and
- it was identified that even with Best Available Technology for wastewater treatment, that levels of phosphorous in the WwTW discharges have a high potential to impact on in stream P targets set for both the Water Framework Directive (WFD) and the Habitats Directive (HD).

Stage 2b

2.2.6 This sub-stage has assessed each of the PGAs chosen as the Favoured Options in greater detail, providing detail on the specific infrastructure required for the favoured growth options taken forward. Its final output is the development of a Water Cycle Strategy for the preferred growth option setting out the requirement for new infrastructure, mitigation, policy and guidance to support sustainable levels of growth within the Greater Norwich study area.

2.2.7 The key outputs of the Stage 2b study are to:

- complete any assessments required to define capacity and the water supply and wastewater strategy;
- develop the preferred wastewater and water supply strategies for the favoured options;
- provide advice on the timing of infrastructure upgrades required to deliver the strategies for the favoured growth sites;
- provide advice on policy required to deliver the overall water strategy, including a developer checklist; and
- provide guidance on developer contributions to the strategic infrastructure identified as required.

2.3 Document Structure

2.3.1 The undertaking of a Phase 2 detailed Water Cycle Study involves a significant amount of technical data collection, analysis and interpretation. However, it is acknowledged that the WCS key purpose is to act as a planning evidence base and hence, the GNWCS has been reported via two distinct documents.

2.3.2 This document is the Non-technical version of the Stage 2b GNWCS, and its purpose is to act as the principal planning reference for the WCS which sets out the strategy, the key findings of the study in relation to the LDFs and the various LDDs which it informs and sets out planning implications of the solutions proposed from the study. It presents:

- the development proposals, including new housing numbers, locations and jobs;
- a non technical summary of the wastewater and water supply strategy that make up the overall *Water Cycle Strategy* required to service the development proposals;
- the phasing and cost implications of delivering these key infrastructure solutions at each PGA, including potential mechanisms for funding;
- suggested planning policy that needs to be included as part of the LDF to ensure the strategy can be met; and
- guidance to the various stakeholders and developers as to how to ensure future development meets with the requirements of the strategy.

2.3.3 The various assessments undertaken to define the water cycle strategy have been detailed in the accompanying document, the 'Norwich WCS Stage 2b – Technical Report'. The technical Report also includes the data used in the assessments, the methodologies used, further discussion around the policy and legislative drivers affecting the assessments and the results and conclusions of the assessments. Its aim is to act as the technical reference for the evidence base to satisfy the requirements of technical stakeholders (such as the Environment Agency and Natural England), showing how the strategy has been developed in more detail.

2.3.4 The accompanying Technical Report sets out the key starting assumptions for the Stage 2b assessment work; however, a key issue most pertinent to this non-technical report is the acknowledgement that whilst the favoured growth locations (PGAs) have been assessed, specific sites within the growth areas have not been identified. This has therefore necessitated a high level strategic assessment of the infrastructure required to service the PGAs and hence it has not been possible to determine site specific infrastructure requirements such as

household connections, local pumping stations or site specific Sustainable Drainage Systems (SUDS).

3 Planning Considerations

3.1 Favoured Housing Option

3.1.1 Following submission of the Stage 2a WCS report, the information provided on PGA rankings was utilised by the GNDP along with other planning considerations, to determine where the growth in the study area would be located with respect to the PGAs identified.

3.1.2 In total, a target of approximately 51,000 new homes are to be provided in the GNDP study area up to 2026 and beyond to meet with the new housing requirement for the areas as set out in the East of England Plan. The favoured location for these target dwellings includes for some level of growth within each of the NPA and RPA areas assessed in previous stages of the GNWCS. The targets for each PGA are shown in Table 3-1 and detailed geographically in Figure 1 (Appendix A); these figures have been provided by the GNDP.

3.1.3 Of the approximate target of 51,000 new dwellings, approximately 11,000 have already been completed up to the point of undertaking this study, leaving a residual target of approximately 40,000 new homes to be built.

3.1.4 For the purposes of assessing capacity for new infrastructure and determining the type and phasing of this new infrastructure, only the 40,000 new dwellings to be built have been assessed. It has been assumed that the 11,000 dwellings already completed have formed part of the baseline and have already been taken into account in the baseline data provided.

3.1.5 Growth to be delivered in the proposed Eco-Town near Rackheath has been included in this assessment (approximately 4,100 houses considered as part of the NPA3a total); however, it is not intended to act as a full WCS assessment of the proposed Eco-Town which would need to be undertaken as part of the supplementary planning policy statement to PPS1. The total of 4,100 is higher than the original assumptions, following the precautionary principle. As a result, the totals for PGAs NPA2 and 3a in table 3-1 are slightly higher than the scale of allocation in the Joint Core Strategy.

Table 3-1: Favoured Option Detail (remaining 40,000 houses to be built)[2]

PGA	PGA Description	Parishes included	Granted Permissions & Allocations	Total Growth numbers in "Favoured" Option[1]	Total assessed in WCS
NPA1	North Sector (North of Airport)	Horsham and Newton St Faiths, Horsford and Spixworth.	50	90	140
NPA2	North East Sector (inside NNDR)	Thorpe St Andrew, Sprowston, Rackheath, Gt & Lt Plumstead, Old Catton, Beeston and Postwick with Witton.	1,646	7,454	9100
NPA3a[3]	North East Sector (outside NNDR, vicinity of Rackheath)	Rackheath, Salhouse	36	4,145	4181
NPA3b	East Sector (outside of NNDR)	Gt & Lt Plumstead, Postwick with Witton	220	200	420
NPA4	South East Sector (vicinity of Poringland)	Bixley, Bramerton, Caistor St. Edmund, Framingham Earl, Framingham Pigot, Kirby Bedon, Poringland, Stoke Holy Cross, Surlingham, Trowse,	686	200	886
NPA5	South Sector (A11-A140 Outside A47)	Bracon Ash, East Carleton, Flordon, Mulbarton, Newton Flotman, Swainsthorpe, Swardeston, Tasburgh	128	375	503
NPA6	Long Stratton	Long Stratton, Tharston	77	1,850	1927
NPA7	Wymondham	Wymondham	500	2,250	2750
NPA8	South West Sector (A11-B1108)	Colney, Cringleford, Great Melton, Hethersett, Keswick, Ketteringham, Little Melton, Marlingford	715	2,500	3215
NPA9	West Sector (River Yare to River Wensum)	Bawburgh, Easton, Costessey	1,581	1,525	3106
NPA10	North West Sector (A1067-NNDR)	Hellesdon, Drayton and Taverham.	280	1,200	1480
RPA1	Reepham	Reepham	41	200	241

[2] NB – where a range of new housing numbers have been put forward for a PGA, the upper limit has been presented and assessed to represent worst case
[3] NPA3a includes for the 'number' of new developments in the proposed Eco-town near Rackheath

PGA	PGA Description	Parishes included	Granted Permissions & Allocations	Total Growth numbers in "Favoured" Option[1]	Total assessed in WCS
RPA2	Aylsham	Aylsham	250	350	600
RPA3	Wroxham	Wroxham	11	200	211
RPA4	Acle	Acle	41	200	241
RPA5	Hingham	Hingham	48	100	148
RPA6	Diss	Diss	237	300	537
RPA7	Harleston	Harleston	479	300	779
RPA8	Loddon	Loddon	123	200	323
Norwich City	Norwich City area	City administrative area	5,911	3,000	8,911
	TOTALS		**13,060**	**26,639**	**39,699**

3.2 Employment Growth

3.2.1 An Employment Growth and Sites & Premises Study was completed for the Greater Norwich Area in 2008 (ARUP and Oxford Economics, 2008). This assessed the capacity and implications of planned employment growth within the Greater Norwich Area up to 2026 and identified the quantity, quality and location of employment sites and premises provision.

3.2.2 The overall aggregate employment growth planned within the Greater Norwich area is as follows:

- 35,215 jobs in the period 2001 – 2021 (directly compatible with the RSS);
- 40,212 in the period 2001 – 2026, 2026 being the end date of the plan period; and
- Overall growth of 25,000 jobs between 2007 and 2026 (the plan implementation period).

3.2.3 Eight sites/areas have been identified for major employment development up to 2026 (Table 3-2). For each of these sites the area for the identified employment has been provided but no indication of the overall number of jobs to be allocated has been supplied. As such, for the purposes of the WCS assessment, the overall land requirement (190 hectares) had been divided by the total employment requirement (25,000 jobs) to determine the number of jobs per hectare (131.5 ha) and this factor applied to the individual employment site allocations. The figure of 131.5 jobs per hectare correlates well to other WCS undertaken in East Anglia, with an average of around 140 jobs per hectare.

3.2.4 These figures have been used in the assessments of capacity and to determine the additional infrastructure required to service total growth in the study area.

Table 3-2: Key Employment Growth Areas within Greater Norwich

PGA	Employment Zone/Name	Employment Type	Area (Ha)	No. Jobs Equivalent
NPA1	Norwich City Centre	Offices	10	1,315
	Airport	Airport Related Industries	30	3,950
NPA2	Rackheath	General Employment	25	3,290
NPA3b	Extension to Broadland Business Park	General Employment	25	3,290
NPA7	Hethel	High Tech Engineering	20	2,630
	Wymondham	General Employment	15	1,975
NPA8	Norwich Research Park	Health and Life Sciences/Offices	55	7,235
NPA9	Longwater	General Employment	10	1,315
TOTALS			**190**	**25,000**

3.3 Water Company Planning

3.3.1 The requirement to deliver new infrastructure as part of a water cycle strategy is largely dependent on the investment planning cycle of water companies which dictates the phasing and delivery timescales of the major infrastructure solutions required for any WCS. Therefore, it is important to provide an explanation for how water companies plan for new infrastructure.

3.3.2 Water companies currently plan for Asset Management and the financial procurement required for this through the Asset Management Plan (AMP) process which runs in 5 year cycles. The cycles (or AMPs) have been running since 1990 after the privatisation of the Water Industry in 1989 and are numbered sequentially since the first AMP which ran from 1990 to 1995. Future AMPs relevant to this study are shown in Table 3-3. The Water Services Regulation Authority (Ofwat) is the economic regulator of the water and sewerage industry in England and Wales, and regulates this overall process.

Table 3-3: AMP Periods and Corresponding Years

AMP	Years
AMP5	2010 - 2015
AMP6	2015 - 2020
AMP7	2020 - 2025
AMP8	2025 - 2035
AMP9	2035 - 2040

3.3.3 In order to undertake maintenance of its existing assets and to enable the building of new assets (asset investment), water companies seek funding by charging customers over an AMP according to the level of investment they need to make in that period. The process of determining how much asset investment required is undertaken in conjunction with:

- the Environment Agency as the regulator determining investment required to improve the environment;
- the Drinking Water Inspectorate (DWI) who determine where investment is required to improve quality of drinking water; and,
- Ofwat who along with the Environment Agency require Water Companies to plan sufficiently to ensure security of supply (of potable water) to customers during dry and normal years.

3.3.4 The outcome is a Business Plan which is produced by each Water Company prior to each AMP setting out the required asset investment over the next 5 year period, the justification for it and the price increases they consider are required to fund it.

3.3.5 Overall, the determination of how much a Water Company can charge its customers is undertaken by Ofwat. Ofwat will consider the views of the Water Company, the other regulators (Environment Agency, DWI) and consumer groups such as the Consumer Council for Water when determining the price limits it will allow a water Company to set in order to enable future asset investment. This process is known as the Price (or Periodic) Review (PR) and is undertaken in 5 year cycles in line with the timing of new AMPs. When Ofwat make a determination on a Water Company's business plan, the price limits are set for the proceeding five year AMP period allowing the water company to raise the funds required to undertake the necessary investment which will also be undertaken in that 5 year AMP period.

3.3.6 At the time of undertaking the Stage 2b GNWCS stage, AWS have received the final determination from Ofwat on the 2009 Price Review 2009 (PR09), whereby they have been told how much they can charge their customers over the 5th AMP period covering 2010 – 2015 (known as AMP5). Several schemes for investment for growth in the next five year period have been approved by Ofwat and hence funding through price increases approved. In addition schemes to address existing environmental problems have also been approved. Details are

provided in the Technical report, and where relevant, are discussed in this planning based document.

3.4 The Habitats Directive and the Review of Consents

3.4.1 There are many policy and legislative requirements that need to be considered in the WCS process; principally the EU Water Framework Directive (WFD) and the EU Habitats Directive (HD). Both are discussed in further detail in the accompanying Technical Report; however, specific mention is given in this section to the Habitats Directive as it has a significant influence on both the wastewater and water supply strategies, owing to an ongoing review process that has been undertaken by the Environment Agency and Natural England over several years and is due to be completed in March 2010.

3.4.2 The review process is referred to as the Review of Consents (RoC) process. The process requires the Environment Agency to review all of the existing discharge consents or abstraction licences it has issued for both discharges and abstractions to and from rivers or groundwater. The review is to determine whether, when used to their maximum permitted level, the current licences and consents are likely to be impacting on the integrity of ecologically designated sites which are protected under the Habitats Directive. The licences and consents being reviewed were issued prior to sites becoming designated, so the review is a retrospective process necessitated by the new legislative requirements brought in by the Habitats Directive and is transposition into UK law as the Habitats Regulations.

3.4.3 The potential effects of the consents and licences are considered in isolation and in combination with others. In relation to consents to discharge, the pollutant load of these discharges is considered as well as the impact of the volume of discharge on habitat integrity; whilst for abstraction licences, the direct impact of reduced water availability in a groundwater or river system is determined for its impact on any protected habitat reliant on the river or groundwater.

3.4.4 The RoC process goes through several stages:

- Stages 1 & 2 - identifying all consents and licences which could impact on designated sites;
- Stage 3 - undertaking Appropriate Assessments (AA) of sites potentially affected by licences and abstraction, determining which permissions cannot be ruled out as having an impact; and,
- Stage 4 - Site Action Plans are produced for each designated site, which identifies and appraises options. It sets out the action the Environment Agency propose to take on each consent or abstraction which cannot be ruled out as having an impact as a result of the review. The options for licences or consents are generally to affirm them, modify them or revoke them.

3.4.5 If the conclusion is to revoke or modify any permission, the Environment Agency must work with the licence or consent holder to ensure that they are compensated by considering alternatives for replacing the lost permission.

3.4.6 At the time of undertaking the GNWCS Stage 2b report, the Environment Agency was in the process of consulting on its Stage 4 findings for the water resources based RoC. Stage 4 reports on the Site Action Plan (SAP) for consents which cannot be ruled out as not impacting on designated sites.

3.4.7 Specifically for water resources and the GNWCS, the key licences being considered as part of the RoC are the abstractions direct from the Wensum at Costessey Abstraction Point as well as from boreholes in close proximity to the Wensum located at Costessey, potentially impacting the Wensum SSSI and SAC. In terms of wastewater, discharge consents for permitting discharge into the River Wensum SAC are also being considered, along with Broads SAC downstream.

3.4.8 The assessments for the water quality and water resources RoC covering the Broads Special Area of Conservation and Broadlands Special Protection Area is complete and has been signed off. These findings have been used in this WCS.

4 Wastewater Strategy

4.1 Introduction

4.1.1 The additional 40,000 homes and jobs that remain to be delivered in the GNDP area will generate additional wastewater, which will need to be collected, transmitted to a treatment facility, and treated prior to discharge to a water body. It is critical to the growth plans to demonstrate that there is suitable current or future infrastructure and environmental capacity for this wastewater to be managed in a sustainable way.

4.1.2 With the preferred options for growth in each PGA known, it was possible to develop the overall wastewater strategy.

4.2 Outline of Methodology

4.2.1 In developing the wastewater strategy for growth, there were three key considerations:

- Firstly, there needs to be adequate treatment facilities in terms of Wastewater Treatment Works (WwTW) to physically be able to accept and treat the flow.
- Secondly, irrespective of available physical capacity for treating flows, an assessment needs to be made of the capacity of receiving watercourses to accept the increase in discharges, without adversely impacting on the water quality of the watercourse, or the aquatic ecology which relies on the watercourse as a habitat. There are several layers of legislation and policy setting out the standards which watercourses need to achieve in terms of water quality and aquatic ecology and these are discussed in greater detail in the accompanying Stage 2b Technical Report. For the purposes of this planning based document, the key principal legislative requirements are to ensure that watercourses meet the requirements as set out in the WFD and the HD.
- Thirdly, untreated wastewater needs to be collected and transmitted from growth areas to treatment facilities through a wastewater network (sewerage system). Therefore, there needs to be capacity in the existing system to accept further flows, or there needs to be options to build new sewer connections. Adding more untreated wastewater flow to networks that are currently at capacity increases the risk of sewer flooding incidents in urban areas and increases the frequency of overflows of untreated wastewater into watercourses.

4.2.2 A strategy was therefore developed that considered all three of the main 'capacity' requirements as discussed above. The detailed methodology used to develop the strategy is included in the Stage 2b WCS Technical Report. The proceeding summary sets out the steps undertaken in the methodology:

- the volume of wastewater likely to be generated at each PGA was calculated;
- the capacity (or treatment headroom) was calculated at each WwTW likely to receive wastewater from each growth area to give an approximation of the number of new dwellings that could connect to each WwTW before existing capacity was reached;
- an optimisation process was undertaken whereby the wastewater was sent to the nearest WwTW with capacity until the capacity of the nearby WwTW had been utilised; and

- the overall assessment included an assessment of the availability of capacity in the wastewater network to transmit the flows, and the potential impact on water quality and ecology of the receiving watercourse as a result of additional discharges.

4.2.3 The purpose of the methodology was to ensure that the capacity in existing infrastructure was utilised first, thereby meeting East of England Plan requirements and ensuring that:

- costs are minimised in terms of new infrastructure requirements
- pumping costs (and hence CO_2 emissions) are minimised by reducing the distance over which wastewater is transmitted; and
- early phasing opportunity is maximised, as opposed to waiting until new infrastructure is built and in place.

4.2.4 The methodology also ensured that the best strategy was developed to ensure that:

- changes to the consented (or licensed) conditions of discharges were minimised;
- impact on water quality of receiving watercourses as a result of discharges was minimised and downstream water quality standards as required under the WFD were met, where possible; and
- impact on the ecology of receiving watercourses as a result of discharges was minimised and downstream standards as required under the HD were met, where possible.

4.3 Wastewater Treatment & Phasing

4.3.1 In developing the optimal strategy the following issues were encountered and the following proposed solutions were developed.

4.3.2 Some of the WwTW local to the PGAs have limited or no treatment capacity within their current flow consent limits (i.e. only a small amount of [or zero] additional treated flow can be discharged under the consent conditions). In addition, many of the receiving watercourses where local WwTW discharge to are small, with a low capacity for dilution of pollutants and hence a low capacity to accept further discharges before WFD and HD water quality targets in the watercourses would be breached. To reflect this, many of the local WwTW have consented limits applied to the quality of discharges which are stringent and in many cases require treatment technology which is close to, or at a level considered to be achievable with Best Available Technology Not Entailing Excessive Cost (BATNEEC). Therefore, for the reasons stated above, not all wastewater generated can be transferred to the nearest WwTW.

4.3.3 The exception to this is Whitlingham WwTW to the east of Norwich. Whilst it has stringent quality consents due to downstream requirements of the Broads Special Area of Conservation/ Broadlands Special Protection Area (SPA) and the constituent Sites of Special Scientific Interest (e.g. the Yare Broads and Marshes, and Breydon Water SPA), it is a larger WwTW that discharges to a watercourse with a larger capacity to receive (and dilute) treated wastewater. Its current flow consent also has the largest amount of spare treatment capacity (enough to treat approximately 30,000 additional dwellings) and as such to avoid the requirement for new treatment facilities, a large proportion of the wastewater generated by the additional housing needed to be transferred to this WwTW.

4.3.4 However, capacity within the wastewater network to be able to transfer the wastewater to Whitlingham is limited (and hence suffers from sewer flooding and sewer overflow issues) and it would not be possible to transfer any significant amount of wastewater through Norwich city centre. It has therefore been agreed with AWS that the preferable solution would be for two large interceptor sewers to be built, running from the west of Norwich to the south (broadly along the route of the A47) and to the north, with each NPA serviced by providing a link to a new rising mains which will link the NPAs with the interceptor sewer.

4.3.5 Not all NPAs would be able to connect to Whitlingham in a cost effective way due to the distance involved in pumping and the relatively low numbers of housing proposed to make it viable. In these cases, and where capacity in the local WwTW is limited, the wastewater strategy suggests that flow consents at local WwTW are increased and the quality conditions of the consent 'tightened' (or made more stringent) to mitigate the impact of additional load entering the watercourses.

4.3.6 A strategy was therefore developed which demonstrated how the spare treatment capacity at the various WwTW could be utilised to serve the wastewater treatment requirements of the new dwellings and proposed jobs. The strategy was also informed by an independent capacity analysis undertaken by AWS immediately prior to reporting of the Stage 2b WCS (see Technical Report for full details). This independent analysis took on board AWS' predictions for reducing occupancy rates (as a result of movement of local people as well as in migration) and increased water efficiency which would allow for a greater degree of capacity in some locations

4.3.7 The results are provided in Table 4-1. Figure 2 (Appendix A) demonstrates the strategy spatially, including the network connections required to deliver the strategy.

Table 4-1: Existing and future treatment capacity at the WwTW following treatment connection optimisation

PGA		Proposed Development		WwTW Selection			Dwelling Headroom (following employment growth)			
		Dwellings	Employment (No. Jobs)	WwTW serving NPA/RPA	% of PGA to WwTW	No. Dwellings to WwTW	Current (2009)	PGA in Isolation	Cumulative (All PGAs Growth)	2026 DWF as percentage of flow "headroom"
NPA1	North Sector	140	5,265	WHITLINGHAM	100%	140	29,506	27,778	-440	100%
NPA2	North East	9,100	3,290	WHITLINGHAM	100%	9,100	29,506	18,818	-440	100%
NPA3a	North East Sector	4,181	-	BELAUGH	52.5%	2,195	2,425	230	19	100%
				WHITLINGHAM	47.5%	1,986	29,506	25,932	-440	100%
NPA3b	East Sector	420	3,290	WHITLINGHAM	100%	420	29,506	27,498	-440	100%
NPA4	South East Sector	886	-	PORINGLAND	80%	709	751	42	42	98%
				STOKE HOLY CROSS	20%	177	0	-177	-177	134%
NPA5	South Sector	503	-	SWARDESTON-COMMON	100%	503	1,071	568	568	81%
NPA6	Long Stratton	1,927	-	LONG STRATTON	100%	1,927	1,429	-498	-498	115%
NPA7	Wymondham	2,750	4,605	WYMONDHAM	100%	2,750	4,602	1,491	1,343	89%
NPA8	South West	3,215	7,235	WHITLINGHAM	100%	3,215	29,506	24,703	-440	100%
NPA9	West Sector	3,106	1,315	WHITLINGHAM	100%	3,106	29,506	24,812	-440	100%
NPA10	North West	1,480	-	WHITLINGHAM	100%	1,480	29,506	26,438	-440	100%
RPA1	Reepham	241	-	REEPHAM	100%	241	0	-241	-241	126%
RPA2	Aylsham	600	-	AYLSHAM	100%	600	806	206	206	95%
RPA3	Wroxham	211	-	BELAUGH	100%	211	2,425	2,214	19	100%
RPA4	Acle	241	-	ACLE-DAMGATE LANE	100%	241	0	-241	-241	107%
RPA5	Hingham	148	-	WYMONDHAM	100%	148	4,602	4,093	1,343	89%
RPA6	Diss	537	-	DISS	100%	537	6,546	6,009	6,009	46%
RPA7	Harleston	779	-	HARLESTON	100%	779	1,791	1,012	1,012	74%
RPA8	Loddon	323	-	SISLAND	100%	323	1,591	1,268	1,268	72%
Norwich City	Norwich City	8,911	-	WHITLINGHAM	100%	8,911	29,506	19,007	-440	100%
Total		**39,699**	**25,000**			**39,699**				

4.3.8 In summary the strategy table (Table 4-1) shows that:

- for NPA5 (South Sector), NPA7 (Wymondham), RPA 2 (Aylsham), RPA3 (Wroxham), RPA5 (Hingham), RPA6 (Diss), RPA 7 (Harleston) and RPA8 (Loddon), there is sufficient capacity in the nearby WwTW to accept wastewater from the proposed development within the favoured option without the need to alter the flow consents;
- As a result of connections from several PGAs, capacity at Whitlingham WwTW will be fully utilised. Although the initial assessment for the GNDP strategy suggested that the current flow consent would be exceeded by a small percentage, the AWS strategy assessment provided subsequently assessed a greater number of houses but suggested sufficient capacity to accommodate them due to decreasing occupancy rate in new houses and more water efficient homes. Therefore, it has been assumed that the flow consent at Whitlingham will not be exceeded by the proposed growth. As a result, wastewater generated from growth at the following locations (including for employment) under the favoured option proposal can therefore be accommodated at Whitlingham WwTW without a change to the current consent provided that the interceptor sewers to service the PGAs are built:
    - NPA 1 (South Sector);
    - NPA 2 (North East Sector – inside NNDR);
    - NPA 3b (East Sector);
    - NPA 8 (South West Sector);
    - NPA9 (West Sector);
    - NPA10 (North West Sector); and
    - Norwich City.
- NPA 3a (North East Sector – Outside NNDR) is reliant on connection to Belaugh WwTW as well as Whtilingham WwTW; however there is sufficient capacity at both Belaugh and Whitlingham combined to provide sufficient treatment capacity without the need to alter the existing consents of either WwTW;
- For NPA4 (South East Sector), NPA6 (Long Stratton), RPA 1 (Reepham) and RPA 4 (Acle) there is insufficient capacity at local WwTW (Stoke Holy Cross WwtW, Long Stratton WwTW, Reepham WwTW and Acle WwTW respectively) to treat wastewater and connection to Whitlingham is not a viable option. Therefore, increases to the flow consent are required for these WwTW.

4.3.9 The final wastewater strategy shows that treatment capacity is available at various WwTW so long as consented limits on flow can be increased and treated at Stoke Holy Cross, Long Stratton WwTW, Reepham WwTW and Acle WwTW. However, although allowing for additional volume of discharge at these works is reasonably straightforward, there will be a potential impact on water quality and downstream ecology as a result of the additional load that will be discharge with the increase which may impact on both WFD and HD targets.

4.3.10 Water quality, ecology and phasing constraints are considered in the proceeding subsections of this report and are considered in further detail in the accompanying Technical Report.

Water Quality Constraints and Limits

4.3.11 Consents to discharge are issued and regulated by the Environment Agency to Wastewater Treatment Works in order to protect the water quality (and ultimately the ecology) of receiving watercourses and any waterbodies that are linked to the watercourse. The WFD and the HD are now the main governing pieces of legislation and policy with regards to water quality and ecological targets for waterbodies and hence the limits applied to consents to discharge.

The Water Framework Directive Constraints and Limits

4.3.12 The WFD, its aims and the standards developed to protect waterbodies are discussed in further detail in the Technical report, but the key issues relating to the legislation that affect wastewater generated from the proposed growth are included in this report. The WFD sets out that:

- all waterbodies (river stretches and lakes including Broads) should achieve 'Good Ecological Status' (GES) or where heavily modified 'Good Ecological Potential' (GEP) by 2015, or by 2027 if there are overriding reasons why good status cannot be achieved by 2015; and
- waterbodies (river stretches and lakes including broads) should not be permitted to deteriorate below their current status as a result of direct impacts on watercourse (i.e. such as discharge from WwTW or agricultural runoff); and impacts which prevent a watercourse from attaining GES should be mitigated.

4.3.13 The Environment Agency has produced a series of River Basin Management Plans (RBMP) as required by the Directive. Within the plans, the Environment Agency have classified the status of each waterbody within the plan area, listed the pressures (or risk) affecting the current or future status or each waterbody, and set out a series of measures (Programme of Measures [POM]) which they consider necessary for each waterbody to achieve GES by 2015, or by 2027. The relevant plan to the Norwich WCS is the Anglian RBMP which, along with the other RBMP were signed off by the Secretary of State in December 2009.

4.3.14 The required standards for GES in a receiving watercourse dictate the quality conditions that the Environment Agency would apply to wastewater discharge consents. In line with the policy requirements of the Directive, if a watercourse is achieving better than GES (i.e. High Ecological Status), then the discharge consent conditions on quality will be even more stringent to prevent deterioration.

4.3.15 As part of the development of the Programme of Measures, the Environment Agency have undertaken a series of modelling exercises to determine which of the current discharge consents they have permitted are likely to prevent GES being achieved, and hence would need to be altered in order to comply with the WFD requirements. For consents relating to current AWS discharges, the Environment Agency put forward a priority list of consents that they considered needed to be altered in the AWS's current business planning period (AMP5 covering 2010 to 2015). These alterations are included in the National Environment Programme (NEP) and AWS have applied to Ofwat in their AMP5 business plan to allow price increases to fund the upgrades works required. Plans are therefore in place to improve treatment processes by 2015 at the following WwTW:

- Rackheath WwTW – flow and quality consents; and

- Acle WwTW – flow and quality consents.

Habitats Directive Constraints and Limits

4.3.16 In addition to compliance with the Water Framework Directive, WCS should also be compliant with the requirements of the Conservation (Natural Habitats &c) Regulations 1994 (as amended), which interprets the EU Habitats Directive into English law.

4.3.17 The Regulations require land use plans to take steps (through a Habitat Regulations Assessment) to ensure that a policy framework exists to enable their implementation without adverse effects (either alone or in combination with other plans and projects) on internationally designated wildlife sites, specifically Special Protection Areas (SPA), Special Areas of Conservation (SAC) and, as a matter of UK Government policy, sites designated under the Convention on Wetlands of International Importance 1979 ('Ramsar sites').

4.3.18 It was identified during Phases 1 and 2a of the GNWCS that the River Wensum SAC and Broads SAC/Broadland SPA (specifically the Yare Broads & Marshes SSSI and Bure Broads & Marshes SSSI) are those sites for which the development covered by the WCS may lead to adverse water quality effects since these sites are hydrologically connected to the three watercourses that would ordinarily be most likely to receive treated effluent – the River Wensum, the River Yare and the River Bure.

4.3.19 Water quality background and trends for the Broads SAC & Broadland SPA (Yare Broads & Marshes SSSI and Bure Broads & Marshes SSSI) and the River Wensum SAC is included in the Technical Report.

4.3.20 As described in section 3.4, all current discharge consents have been assessed for impact on sites designated under the Habitats Directive as part of the Review of Consents process. The consents were assessed as if operating to the full maximum consented flow limits. Those consents which could not be ruled out as having a significant effect have been included for alteration in the NEP and AWS will be undertaking these improvements over the course of AMP5 (2010 to 2015); in all cases the improvements impose a limit on the concentration of P that can be discharged to the BATNEEC standard of 1mg/l. These WwTW are:

- Sisland WwTW;
- Harleston WwTW;
- Reepham WwTW; and
- Long Stratton WwTW.

Planned Consented Scenario

4.3.21 For discharges not included in the NEP for AMP5, it can be assumed that the assessment works undertaken by the Environment Agency demonstrated either:

1. that the current discharge consent has 'no adverse effect' on the sites of European importance (under the Habitats Directive Review of Consents); or
2. the improvements required to the current discharge consent to achieve the 'no deterioration' or 'good status' objectives of the Water Framework Directive were not technically feasible or that the cost-benefit outcome was not favourable.

4.3.22 For these consents no modifications are currently required. As development growth progresses, there is scope for potential deterioration in water quality as the existing capacity in the discharge

consents is used up. As the consent has been issued, the potential deterioration is deemed 'planned' and is referred to in this WCS as the 'planned consented scenario'. Indeed the potential impacts of this on Habitats Directive sites has already been assessed as part of the Review of Consents, which considered the fully consented situation (see 1 above). It should be borne in mind that the current quality consent limits will be reviewed and if appropriate tightened as part of the next review of water company prices. This review and consent changes will come under the requirements of the Water Framework Directive to prevent deterioration or achieve 'good status' and will apply to all parameters. Consent modifications could be made as early as 2015 and so could have implications for the long term deliverability of the proposed development growth.

4.3.23 It therefore follows that where the wastewater strategy is not resulting in a WwTW exceeding its consented flow limit, there will be no requirement for the consent quality condition to be altered at this time, and planned growth can go ahead as per the favoured option. This scenario is the case for the following PGAs and associated WwTWs as detailed in Table 4-2.

Table 4-2: PGAs where no change in consent is required at WwTW to accommodate favoured option

PGA	Name	Associated WwTW
NPA1	South Sector	Whitlingham
NPA2	North East Sector – inside NNDR	Whitlingham
NPA3a	North East Sector – outside NNDR	Whitlingham & Belaugh
NPA5	South Sector	Swardeston Common
NPA7	Wymondham	Wymondham
NPA8	South West Sector	Whitlingham
NPA9	West Sector	Whitlingham
NPA10	North West Sector	Whitlingham
Norwich City	Norwich City Centre	Whitlingham
RPA2	Aylsham	Aylsham
RPA3	Wroxham	Belaugh
RPA5	Hingham	Wymondham
RPA6	Diss	Diss
RPA7	Harleston	Harleston
RPA8	**Loddon**	**Sisland**

Required Consent Alterations – Planned Consented Scenario

4.3.24 As previously described, NPA4 (South East Sector), NPA6 (Long Stratton), RPA 1 (Reepham) and RPA 4 (Acle) lack sufficient capacity in local WwTW (Stoke Holy Cross WwTW, Long

Stratton WwTW, Reepham WwTW and Acle WwTW respectively) to treat wastewater and connection to Whitlingham is not a viable option.

4.3.25 Therefore, increases to the flow consent are required for these WwTW, requiring an increase in consented flow limits and as a result, a tightening of the quality conditions applied to them to ensure compliance with WFD and HD targets.

4.3.26 To determine what the changes in quality consents might need to be (and to determine if they are achievable), modelling using the Environment Agency's River Quality Planning (RQP) software was undertaken as part of the WCS. The full analysis is provided in the Technical Report, and a summary of the results are provided in this planning report.

4.3.27 Three key water quality parameters have been modelled. Two of the parameters, namely BOD (Biochemical Oxygen Demand) and Ammonia (Ammoniacal Nitrogen or NH4) are termed the sanitary determinands on the basis that they can affect the availability of dissolved oxygen upon which aquatic ecology is reliant, or in the case of Ammonia, can be directly toxic to fish species. The third parameter is Phosphorous (P) which is a nutrient that is considered limiting in freshwaters. Limiting means that in unpolluted waters, lack of available P is the key factor which restricts growth of aquatic plant life and algae. However, when available P is in excess of normal concentrations it can lead to prolific growth of algal species which occurs at the detriment to other species (by smothering other plant and animal habitat and reducing available dissolved oxygen). The end result is that excess concentrations of P can effectively reduce the natural biodiversity of a watercourse. It is for these reasons that the three parameters have associated target values set under the WFD and indirectly through the RoC process for the HD.

4.3.28 The results of the modelling are provided in Table 4-3, and are colour coded to show which parameters are compliant at each WwTW for each scenario.

Table 4-3: Water Quality Consent Modelling Results – required consent limits in mg/l.

	Acle			Long Stratton			Reepham			Stoke Holy Cross		
	BOD	NH4	P	BOD	NH4	P	BOD	NH4	P	BOD	NH4	P
Current Consent	29	13	-	20	16	1	30	10	1	50	-	-
Compliance with WFD	10.5	1.2	0.2	7	0.5	0.1	4.8	0.7	0.1	50	10	2.5
Load Standstill (compliance with HD)	27	12	(2)	9.5	8	0.5	28	9.5	0.9	44	(17)	1.8
Best Case Recommended Consents	**10**	**1**	**1**	**7**	**1**	**1**	**5**	**1**	**1**	**50**	**10**	**2**

Key	No consent tightening required	Consent tightening within BATNEEC	Consent limited to BATNEEC	Consent beyond BATNEEC required

4.3.29 With upgrades to the treatment process, Stoke Holy Cross WwTW can achieve compliance with WFD and HD requirements if the recommended consent conditions are set at 50mg/l of BOD, 10mg/l of Ammonia and 2mg/l for P. These consent targets are considered to be achievable within the limits of BATNEEC; however, the works currently has a very 'relaxed' discharge consent and hence significant investment would be required to improve treatment process in order to achieve the much tighter Ammonia and P consents proposed at the WwTW requiring significant time and cost. *Despite this, it is considered that growth in NPA4 is achievable*.

4.3.30 With process upgrades, Acle WwTW can achieve WFD compliance for BOD and Ammonia within the limits of BATNEEC, but would be unable to achieve compliance with the WFD standard for P within the limits of BATNEEC. With a consent limit of 1mg/l of P, there would be no increase in loading of P as a result of growth and as such would not adversely impact on downstream sites over and above that of the current consent and is therefore considered to be sufficient to meet the requirements of the HD. The recommended consent is therefore 10mg/l of BOD, 1 mg/l of Ammonia and 1mg/l of P; however, the works currently has a more relaxed discharge consent and hence it is not required to treat discharge to a very high level and as such significant investment is likely to be required to improve treatment process in order to achieve the much tighter BOD, Ammonia and P consents proposed at the WwTW requiring significant time and cost. *Growth in RPA4 is only achievable if the WFD target for P in the River Bure immediately downstream of the WwTW is ignored.*

4.3.31 The analysis shows that Reepham WwTW would be unlikely to achieve WFD compliance for any of the determinands within the limits of BATNEEC. This is also the case, even if the Blackwater Drain only has to achieve Good Status under the WFD, as opposed to the current High Status. With a consent limit of 1mg/l of P, there would be only a small increase in loading of P as a result of growth and as such would be unlikely to adversely impact on downstream sites over and above that of the current consent and is therefore considered to be sufficient to meet the requirements of the HD. The WFD in this instance requires a tighter P consent for compliance than the Habitats Directive *Growth in RPA 1 will not allow WFD targets for the Blackwater Drain to be met, although impacts on the Wensum SAC under the Habitats Regulations are considered to be negligible if a P consent of 1mg/l is met at Reepham WwTW* .

4.3.32 The analysis shows that, if all the growth planned for NPA 6 (Long Stratton) were to go ahead, the receiving watercourse downstream of Long Stratton WwTW (The Hempnell Beck) would be unlikely to achieve WFD compliance for Ammonia and P within the limits of BATNEEC. If the Hempnall Beck only has to achieve Good Status under the WFD as opposed to the current High Status, the Ammonia consent could theoretically be achieved; however, it would still not be possible to achieve the WFD P target. Additionally, to comply with the HD would require a P consent considered unachievable within BATNEEC for the growth levels proposed. However, a large proportion of the planned growth (approx 75% - 1,400 homes) could go to the WwTW and not result in the flow consent being exceeded. *All growth in NPA 6 will not allow WFD targets for the Hempnall Beck to be met for P and Ammonia, and downstream impacts on the Broads Marshes SAC cannot be ruled out; however 1,400 homes could be accommodated within the current consent.,*

4.3.33 It should be noted that Reepham's consents have been calculated based on the targets of the Blackwater Drain. The drain is a small drainage watercourse with a low flow such that during summer conditions the flow is almost entirely made up of treated effluent discharge. Consideration could therefore be given to using targets in the downstream water course i.e. the River Wensum; however the current Environment Agency position is that 'The WFD objectives for 'no deterioration' and 'good status' need to be met in all waterbodies.

4.3.34 In addition, there is a large degree of 'headroom' built into Reepham's flow consent. AWS figures provided immediately prior to submission of the Final Stage 2b report suggest that a new flow consent is required at Reepham when dry weather flow is 300m^3/d less than the consented limit and a new flow consent has recently (2009) been agreed with the Environment Agency to reflect this. Theoretically, this means that the 300m3/d is not available as headroom, because AWS are stating that a new flow consent would be required. However, there is scope for this headroom to be 'freed up' and hence if the small number of additional housing could be accommodated within

this headroom, there would be no requirement to alter the quality conditions of the consent under the planned consented scenario.

4.3.35 The consent requirements for each of the WwTW under the planned consented scenario are shown in Figure 5a (Appendix A) and discussed in detail in the Technical Report.

Other Water Quality Scenarios

4.3.36 Whilst the 'planned consented scenario' demonstrates an achievable solution for the majority of the proposed growth at present, it should be acknowledged that there will be a longer term requirement for all of the receiving watercourses to achieve good ecological status by 2027 at the latest. By allowing for this scenario, there is a small risk that not all WFD targets will be achievable in the longer term within the limits of BATNEEC once more detailed catchment analysis has been undertaken and once the implications of growth are better understood. This is particularly the case in the study area, where the low lying and generally slow flowing watercourses are already impacted as a result of current pressures and are not achieving GES for some parameters (such as Phosphorous). It may be that as time progress, the limits of BATNEEC are improved such that solutions are available and tighter consents will be applied' however, this cannot be known at this point in the planning for the growth agenda.

4.3.37 The water quality modelling undertaken for this study demonstrates that more stringent quality targets will be required on future discharges if all sections of watercourses (including immediately downstream of discharges) are to achieve GES (or maintain High Status) by 2027. It is important to note that this is the case in many situations for current discharge consents limits, irrespective of whether additional growth is factored into the assessment. However, whilst the Environment Agency cannot currently alter consents that will not be exceeding their consented flow limit (unless identified in the NEP), it is important to consider that future WFD compliance may be compromised by the additional growth proposed at the discharge consent standards currently achievable within BATNEEC.

4.3.38 As a result of this and as part of this WCS, other scenarios have been modelled to show what would be required for the following:

- achieving all WFD targets for GES (and where applicable High Status) at all locations in a waterbody, including immediately downstream of WwTW discharges;
- allowing watercourses currently achieving 'High Status' to deteriorate to 'Good Status' on the basis that 'Good Status' is the key objective of the WFD[4]; and
- what the deterioration in WQ would be downstream if consents are restricted to limits of BATNEEC.

4.3.39 The modelling results for these scenarios are discussed and detailed in the Technical Report. In summary, the following points can be made.

4.3.40 To achieve the WFD standards at all locations under future growth conditions, the majority of the effluent discharge consents will need to be altered. Based on industry standards it is considered that, although tight, the BOD and ammonia standards under the WFD can be met at each WwTW within BATNEEC. However, the following WwTW consents for Ammonia would need to be tighter than BATNEEC:

[4] NB, it is also the case that a key objective of the WFD is to prevent deterioration, hence allowing a watercourse to deteriorate from high to good is not in keeping with the WFD policies even though its main objective would be maintained.

- Reepham WwTW[5],
- Diss WwTW;
- Long Stratton WwTW;
- Swardeston Common WwTW; and
- Whitlingham WwTW.

4.3.41 Despite this, insensitivities in the modelling would likely mean that a BATNEEC consent of 1mg/l of Ammonia would meet downstream compliance (with the exception of Long Stratton). This would need to be demonstrated by AWS, alongside a consideration of technical feasibility, cost-benefit, and sustainability including carbon cost.

4.3.42 The analysis also shows that it will only be possible to achieve the required WFD P standard downstream of the WwTW within BATNEEC at Belaugh and Stoke Holy Cross WwTWs. All other WwTW will require a consent of less than BATNEEC to achieve the proposed WFD instream standard for P (see Figure 5a). However, an analysis was undertaken on the downstream deterioration that would occur if the consents were limited to BATNEEC for P (i.e. 1mg/l of P), and the results showed that there were only three WwTW where limiting consent requirements to that achievable under BATNEEC would result in a deterioration (compared to current flows and quality) downstream of greater than the 10% as listed below:

- Harleston WwTW - 19% deterioration in P concentrations;
- Poringland WwTW – 19% deterioration in P concentrations; and
- Wymondham WwTW – 20% deterioration in P concentrations.

Scenarios used in the Wastewater Strategy

4.3.43 Although analysis has been undertaken for several scenarios, the wastewater strategy (and hence infrastructure requirements) has been based on the planned consented scenario (where a WwTW is within its flow consent) and attaining compliance with the WFD and HD quality targets downstream where a WwTW is likely to exceed its consent.

4.3.44 For completeness, the proposed consents taken forward in the assessment have been included in Table 4-4,(and in Figure 5a) along with the consent required to achieve WFD and HD (but limiting to BATNEEC with implications of the BATNEEC limit).

[5] It should be noted that there is no upstream or downstream monitoring information for the Reepham site meaning that the mid-class estimate of 0.43 mg/l (90%ile) for good ecological status was used for Ammoniacal-N. The works discharges into a small watercourse and as such there is less dilution available for the additional effluent discharge than offered at other works discharging into larger watercourses.

Table 4-4 Consent requirements for the Wastewater Strategy (planned consented scenario taken forward for the strategy)[6]

WwTW	PGA	Flow Consent Exceeded	Current Consent			Planned consented (Proposed Strategy)			WFD Compliance Scenario (limit to BATNEEC)			Implication of BATNEEC Limit	PGA growth achievable?
			BOD	Amm	P	BOD	Amm	P	BOD	Amm	P		
			95%ile	95%ile	Mean	95%ile	95%ile	Mean	95%ile	95%ile	Mean		
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l		
ACLE-DAMGATE LANE	RPA4	✓	29	13	-	10	1	1	10	1	1	**P consent not achievable under proposed strategy - Limiting P to BATNEEC results in a 4% d/s deterioration compared to current**	**No** – P standard not achievable within current BATNEEC limitations
AYLSHAM	RPA2	×	40	5	1	40	5	-	40	5	1	**None under proposed strategy** - Limiting P results in a 0.01% d/s deterioration for WFD compliance scenario compared to current operation	**Yes** – under planned consented
BELAUGH	NPA3a (52% of growth) & RPA3	×	30	10	-	30	10	-	30	10	1	No BATNEEC Limit required	**Yes**
DISS	RPA6	×	12	5	2	12	5	2	12	1	1	**None under proposed strategy** - Limiting P results in a 43% d/s improvement and limiting Amm results in a 70% improvement for the WFD compliance scenario compared to current operation.	**Yes** – under planned consented
HARLESTON	RPA7	×	17	5	1	17	5	1	9	1	1	**None under proposed strategy** - Limiting P results in a 19% d/s deterioration for WFD compliance scenario compared to current operation	**Yes** – under planned consented
LONG STRATTON	NPA6	✓	20	16	1	7	1	1	7	1	1	**P and Ammonia consent not achievable under proposed strategy - Limiting P to BATNEEC results in a 35% d/s deterioration compared to current (90% Ammonia improvement)**	**No –** Ammonia standard and P standard not achievable.

[6] It should be noted that the current quality consent limits presented in this table will be reviewed and if appropriate tightened as part of the next review of water company prices (PR14). This review and consent changes will come under the requirements of the WFD to prevent deterioration or achieve 'good status' and will apply to all parameters. Consent modifications could be made as early as 2015 and so could have implications for the long term deliverability of the proposed development growth

			Current Consent			Planned consented (Proposed Strategy)			WFD Compliance Scenario (limit to BATNEEC)				
PORINGLAND	NPA4	×	18	-	-	18	-	-	7	1	1	**None under proposed strategy** - Limiting P results in a 19% d/s deterioration for WFD compliance scenario compared to current operation	**Yes** – under planned consented
REEPHAM	RPA1	✓	30	10	1	5	1	1	5	1	1	**All parameter consent not achievable under proposed strategy - Limiting P to BATNEEC results in a 0.01% deterioration compared to current (90% Amm & 82% BOD improvement)**	**No** – ammonia, BOD and P standards not achievable
SISLAND	RPA8	×	20	5	1	20	5	1	15	2.5	1	**None under proposed strategy** - Limiting P results in a 5% d/s deterioration for WFD compliance scenario compared to current operation	**Yes** – under planned consented
STOKE HOLY CROSS	NPA4 (20% of growth)	✓	50	-	-	50	10	2.5	50	10	2.5	No BATNEEC Limit required	**Yes**
SWARDESTON-COMMON	NPA5	×	15	5	-	15	5	-	7	1	1	**None under proposed strategy** - Limiting P results in a 8% d/s deterioration and limiting Amm results in a 75% improvement for the WFD compliance scenario compared to current operation	**Yes** – under planned consented
WHITLINGHAM TROWSE	NPAs1,2, 3a(50%),3b, 8,9, 10 and Norwich City	×	20	7	1	20	7	1	10.5	1	1	**None under proposed strategy** - Limiting P results in a 9% d/s deterioration and limiting Amm results in a 72% improvement for the WFD compliance scenario compared to current operation	**Yes** – under planned consented
WYMONDHAM	NPA7 & RPA5	×	12	4	1	12	4	1	9	1.5	1	**None under proposed strategy** - Limiting P results in a 20% d/s deterioration for WFD compliance scenario compared to current operation	**Yes** – under planned consented

Colour coding definition
No change from current consent
Change required but within BATNEEC
Change at BATNEEC but achievable
Change beyond BATNEEC required, but consent limited to BATNEEC

Wastewater Treatment - Phasing Constraints

4.3.45 Where improvements are proposed for WwTW requiring new consents, the changes in quality consent are significant and as such will require upgrades to be made to the treatment processes at each of the WwTW. Such improvements take time to undertake and funding will need to be sought via the next Periodic Review Process for the AMP6 period running between 2015 and 2020. Improvements to the process capacity of each WwTW will then have to be undertaken incrementally in order to allow wastewater flow from development to be taken without impacting on each WwTWs ability to meet the new consent conditions. This will impact upon phasing of development in the PGAs affected by these changes and this is reflected in the infrastructure assessments for each PGA in section 7.2.

Other constraints

4.3.46 As well as constraints on limits to discharge wastewater, some WwTW in the study area have physical constraints associated with the operation or expansion of the WwTW which would need to be rectified in order for the full flow capacity at each WwTW to be utilised affecting early phasing of some development. These WwTW are listed below with the reason for the constraint and identified in detail in Section 6.2:

- Acle WwTW (RPA4) – the WwTW is located in Flood Zone 3 and as such, any development here will need to comply with the requirements of PPS25. If process upgrades require more land, specific mitigation will be required to offset any loss in flood plain storage;
- Aylsham WwTW (RPA2) – The WwTW currently has difficulties in reaching its consent conditions. Although these conditions do not need to change as a result of growth, investment is likely to be required early in AMP5 (2010 - 2015) to allow growth to be accommodated without further compromising compliance with the consent and downstream quality in the River Bure; and
- Whitlingham WwTW (NPAs 1,2,3a,3b,8,9,10 and Norwich City) – there is a constraint on the physical inlet to the WwTW which restricts the maximum volume of wastewater that can enter the WwTW for treatment; therefore not all the treatment capacity can be utilised until a scheme has taken place (in AMP5 – 2010 to 2015) to upgrade the inlet to the WwTW.

Solutions Beyond BATNEEC

4.3.47 Requirements to meet WFD and HD targets has meant that proposed growth at the following PGAs will either be difficult or not possible to achieve:

- RPA1 – Reepham (241 dwellings): WFD compliance not possible immediately downstream as a result of growth. HD likely to be achievable;
- RPA4 – Acle (241 dwellings): WFD compliance not possible immediately downstream as a result of growth. HD is achievable; and
- NPA6 – Long Stratton (1,927 dwellings): Neither WFD nor HD compliance is possible as a result of growth (at maximum proposed allocations).

4.3.48 Neither Reepham nor Acle have any current dwelling capacity; however, Long Stratton has capacity for approximately 1,400 homes (see Table 4-1). This means that whilst the full proposed housing number could not be delivered under the planned consented scenarios, up to

1,400 new dwellings could be accommodated before the current flow consent is exceeded and under the planned scenario, would not require a change in quality consents.

4.3.49 Therefore in total, 1,009 dwellings (241 at Reepham, 241 at Acle and 527 at Long Stratton) out of the proposed 40,000 cannot be delivered and meet with WFD and HD compliance.

4.3.50 For the 1,009 dwellings, either the growth needs to be allocated to other PGAs where WwTWs do have capacity, or an agreement needs to be reached at policy making level that these potential non-compliance issues with the WFD and HD are acceptable in order to achieve the growth agenda, or further more detailed analysis is required for innovative solutions that would allow growth to take place and still meet the legislative and policy requirements. The level of study that would be required to determine individual solutions would require a site specific assessment once it is known where development is likely to take place in each PGA; but some of the options that could be considered as solutions include:

- Consideration of the discharge to ground for treated wastewater, either from existing WwTW, or via new package treatment plants built specifically for new development;
- Construction of a wetland system downstream of treated effluent discharge to increase uptake of P and reduction of BOD and Ammonia in final discharge from a WwTW; or
- Re-use of treated effluent within buildings for non potable use, thereby reducing the volume of discharge from new development; this would also have the benefit of reducing demand for water in these developments.

4.3.51 It is recommended that the findings of other WCS are closely monitored and any innovative solutions identified could be transferred to the GNDP WCS.

WwTW Consent Assessments

4.3.52 A high level risk assessment has been carried out on the current consents to identify the potential difficulties in tightening of consents as a result of development in the area i.e. those works which are already operating close to BATNEEC will have more difficulty and likely incur more costs in achieving tighter consents under future growth conditions. This information is presented in the Technical Report, and has been used in the PGA infrastructure assessments in this planning report (Section 7.2).

4.4 Wastewater Network and Phasing

4.4.1 In addition to phasing implications due to the need for treatment upgrades, there is also a requirement to consider phasing restrictions as a result of the need to build new wastewater network transmission (sewer) infrastructure to service new development and to allow connection to each WwTW.

4.4.2 As previously described capacity within existing networks (particularly through Norwich City) is limited, hence the requirement for the connecting interceptor mains around Norwich to link several of the NPAs to Whitlingham WwTW.

4.4.3 Construction of such a large scale sewer will require a considerable amount of planning lead in time as well as construction time. In addition, significant expenditure will be required to deliver it. This is discussed further in sections 7 (PGA infrastructure requirements) and 8 (infrastructure costings).

4.4.4 Some development will be able to take place during early phases of growth by making use of the existing capacity within current wastewater networks. In order to define network capacity, network modelling using hydraulic models is required; however, AWS are in the process of rebuilding their network model of the study area and this has not been available to inform the Stage 2b WCS. Independent analysis was undertaken by Scott Wilson as part of the Stage 2a WCS and therefore, this has been used to determine where there is potential capacity to connect early phases of development in each NPA and RPA. The network analysis was undertaken for the Stage 2a WCS and is reported in detail in the Stage 2a report and summarised in Appendices of the Stage 2b Technical Report. The findings have been used in the PGA infrastructure requirement section of this report (section 7.2).

5 Water Supply Strategy

5.1 Introduction

5.1.1 Water resources are an important factor to be considered in developing a growth strategy for an area. Despite being in an area of low rainfall, the GNDP study area benefits from having large quantities of groundwater held within the chalk aquifers which underlie large parts of the East of England region. These aquifers also provide important feeds to the baseflow of the region's rivers and numerous wetland areas. It is therefore important to take a regional perspective when assessing the water resources of an area.

5.1.2 The East of England is one of the driest parts of the country and this combined with the high demand from its residents (both permanent and tourist populations) and from industry (including agriculture), means that the GNDP area lies within an area of 'serious water stress' (Environment Agency, 2008).

5.2 Deriving a Water Supply Strategy

5.2.1 The creation of a sustainable water supply strategy for new development is reliant on two aspects:

- the availability of raw water resources prior to treatment for potable use; and
- the availability of water supply infrastructure (such as network mains) to treat the water and transfer treated water to the PGAs.

5.2.2 Development of an optimised water supply strategy for the GNDP growth area is therefore a combination of both water resource availability and water supply infrastructure.

Calculation of Future Demands

5.2.3 The future demand for water as a result of growth is dependent on two key factors:

- The number of people likely to be living in the new dwellings provided (the Occupancy Rate or OR); and
- The amount of water used per person in the future (per capita consumption, or PCC)

5.2.4 Likely future demands have been calculated for the GNDP study area, based on a single assumed occupancy rate of 2.1 people per home. This figure has been used as an estimate to reflect that occupation of new homes will be partly made up of movement of indigenous people, and not solely as a result of inward migration from outside of the study area.

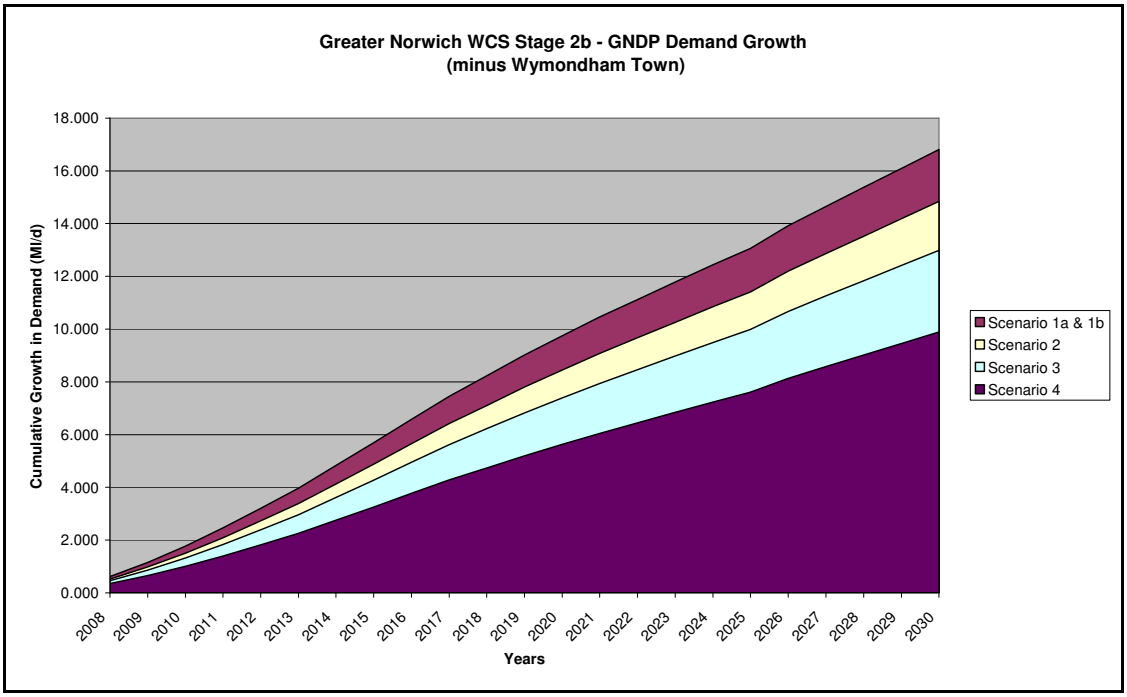
5.2.5 The same OR has been used for all scenarios; however a series of different demand scenarios have also been developed to demonstrate the range of future demand savings that could be made if new homes are made more efficient and designed such that its occupants use less water. For each scenario, an allowance for non residential use (including from future employment) has been applied.

5.2.6 How these scenarios were derived is detailed in the Technical Report and a summary of the results represented here. A more detailed breakdown of demands per PGA are also included in the Technical Report.

5.2.7 Figure 5-1 shows the increase in demand expected for the four different water use scenarios. The results show that additional demand as a result of new homes and employment could vary between approximately 10 million (or Mega) litres a day (Ml/d) and 17 Ml/d. The lower figure reflects the demand if all new homes were designed to meet the highest level in the Code for Sustainable Homes (CSH) i.e. Level 5/6 using 80 litres per head per day (l/h/d); the higher figure reflects future demand if customers in new homes used the same average daily amount of water as they do currently 141 l/h/d[7].

5.2.8 For the purposes of future planning and this WCS assessment, scenario 2 has been used which reflects the future water use that AWS expects customers (and hence is planning for in its WRMP) in new homes to use on the basis that they will all be metered, and more water efficient as a result of requirements under the Building Regulations and the Code for Sustainable Homes. The likely additional demand is therefore expected to be between 14 Ml/d and 15 Ml/d.

Figure 5-1: Demand Growth for four different water use scenarios[8]



5.3 Water Resource Availability

5.3.1 Previous stages of the GNWCS have identified that locally available water resources are limited or fully utilised (through existing licences) as reported in the Environment Agency's Catchment Abstraction Management System (CAMS). Therefore, the supply to the study area is reliant on management of existing licences or transfer of water across its management zones (known as

[7] Current average use is of 141 l/h/d is based on the average daily amount used by customers with a meter and those without.
[8] Note Wymondham is not included in this assessment as it is served by a separate Water Resource Zone from the rest of the study area

Water Resource Management Zones or WRZ). How AWS aim to achieve this and accommodate growth is set out in their company wide plan for managing water resources over the next 25 year planning period (The Water Resources Management Plan or WRMP). Therefore, the WRMP has been used as the main information source for determining the availability of water resources for the Stage 2b WCS.

5.3.2 Although Water Companies have been producing such plans for some time (as required by the Environment Agency) the current version of the WRMP is the first statutory plan that AWS (and all English Water Companies) have had to produce, and hence it is subject to a high level of scrutiny and consultation and ultimately requires signing off from Defra.

5.3.3 In August 2009, the Secretary of State (SoS) for the Environment announced his decision on the next steps of English water companies' WRMPs. Along with seven other water companies, AWS's WRMP required further information in support of their proposals in order for the SoS to make a decision on whether it could be published as a final plan. The timing of the GNWCS required to support the Core Strategy means that the final WRMP was not available in time to inform this study.

5.3.4 For the purposes of this final Stage 2 WCS report, an assessment has been made based on information provided by AWS in its draft WRMP (2008) and in their Statement of Response to the consultation on the draft WRMP (AW, 2009). The Environment Agency's response to the draft WRMP (Environment Agency, 2008) has also been considered. It is recommended that when the final WRMP is made available, that the findings of this WCS are revisited.

Available Water Resources

5.3.5 In its draft WRMP (from 2008), AWS have taken future growth into account within the Norwich and Broads WRZ, and predicted a significant deficit in the zone's supply/demand balance as a result of this growth. This deficit is in line with the 14 – 15 Ml/d extra demand assessed as being required in this study to support growth up to 2021.

5.3.6 As well as proposals for better managing demand from customers (including reductions in water lost through leakage in supply pipes), the company has therefore considered a range of water resource options over the next 25 year period to make up for this deficit in supply. Options were initially put forward in the draft plan in 2008; however, as described previously, changes have been made to the draft plan and the initial water resource options proposed have also changed.

5.3.7 Until the final WRMP is made available sometime in 2010 and the options confirmed, the likely water resource schemes to go forward have been taken from AWS's Statement of Response to the consultation on the draft WRMP (2009) as well as the Environment Agency's response to the draft WRMP (Environment Agency, 2008).

5.3.8 The selection of sources being promoted and the volumes of water they could supply are shown in Table 5-1.

Table 5-1: Available Water Resources for the Greater Norwich Study Area

Resource Options [9]	Extra Water Available (Ml/d)
Increased Groundwater abstractions through existing abstraction licences (Thorpe St. Andrew B/h)	4
New Groundwater Resource Development (probably within Norwich)	4
Whitlingham Effluent Flow compensation scheme	12.3
Total	**20.3**

5.3.9 Further detail on the schemes proposed is included in the Technical Report; however, the current information from AWS's water resource planning is that there is sufficient water available (up to 20 Ml/d additional) to meet the demand of future growth (predicted to be between 14-15Ml/d).

Review of Consents – Implications

5.3.10 Specifically for the water resources and the GNWCS, the key consents being considered as part of the Habitats Directive RoC are the abstractions direct from the Wensum at Costessey abstraction point, as well as from boreholes in close proximity to the Wensum located at Costessey. Both abstraction licences (when used to their maximum) can potentially impact on the Wensum SSSI and SAC by reducing available flow and water levels for the species within the 7km downstream stretch of the SAC that are reliant (directly or indirectly) on specific flow conditions.

5.3.11 At the time of undertaking the GNWCS Stage 2b report, the Environment Agency was in the process of consulting on its Stage 4 findings which reports on the Site Action Plan (SAP) for the Wensum SAC for consents which cannot be ruled out as not impacting on designated sites. This stage determines the level of alteration required to a licence and considers options for remediating the impact. Because the consultation process with licence and consent owners was ongoing, the full Stage 4 SAP was not made available in time for completion of the Stage 2b GNWCS report.

5.3.12 However, the following information from the RoC was made available:

- Stage 3 Appropriate Assessment reports (with some licence specific information removed);
- discussions with Natural England over the likely conclusions regarding the Costessey licences; and
- an Executive Summary for the consultation on the River Wensum SSSI and SAC Stage 4 SAP (without full figures and outputs).

5.3.13 The conclusion drawn from the interim information provided is that the groundwater abstractions at Costessey, in combination with the surface water abstraction direct from the River, are likely to be impacting on the integrity of the 7km stretch of the River Wensum SAC located downstream of

the abstraction point. Advice from the Environment Agency and Natural England is that there is potential that the permitted abstraction volume from the licences may have to be altered significantly in order to allow the River Wensum to reach its environmental outcomes. This is termed as a "sustainability change". Further information on how the requirement for a sustainability change has been determined and a discussion around the efficacy of this process is included in the Technical Report.

5.3.14 The Environment Agency have indicated that the Stage 4 SAP for the Wensum SAC will not be complete until March 2010 and hence will not be available to fully inform this Stage 2b GNWCS which is required to inform the Examination of the Joint Core Strategy prior to this date. Until March 2010, there is some considerable uncertainty as to the sustainability change that will be implemented for the Costessey licence and whether it will result in a reduction (termed a 'sustainability reduction') of permitted abstraction volumes. Discussions between AWS (as the licence holder), the Environment Agency and Natural England are ongoing. Owing to the sensitivities around the process and the implications on AWS's WRMP, exact details of these discussions have not been made available for the GNWCS.

5.3.15 AWS's draft WRMP (2008) had not made any significant allowance for a sustainability change in the Costessey licence. Although it acknowledged that there is "a significant risk that the Environment Agency will seek sustainability reductions" the plan went on to say that "we have been advised to include only a nominal sustainability reduction for the intake west of Norwich" (i.e. at Costessey).

5.3.16 Under the RoC process, there will be a lengthy period over which solutions to the licence alterations will be discussed between Natural England, the Environment Agency and AWS. At present, the proposed effluent compensation scheme could be considered to be both a new resource but also a solution to any reductions in abstractions required as a result of the sustainability change. The WCS has shown that the increase in treated flow proposed for Whitlingham would result in dry weather discharge of over 66Ml/d allowing plenty of transfer capacity to both compensate for a potential sustainability reduction and provide additional resource required for growth. However, this would require a high degree of additional study to determine its suitability as an option and there remains considerable uncertainty as to the eventual solution that will be implemented.

5.3.17 As a worst case, it could be considered that the current baseline with respect to available water resources needs to be reduced by a significant amount to allow for the sustainability change. This could represent a much larger deficit of water supply than can be replaced by the proposed new water resource schemes as included in AWS's Statement of Response. However, any losses as a result of the Review of Consents process have to be compensated for by the Environment Agency where the removal or alteration of a licence impacts upon the existing operations of the licence owner and as such a solution to the loss of abstraction will need to be provided. The Environment Agency would grant AWS sufficient time and funding to implement a solution to replace any required reduction in supply, and the Environment Agency have confirmed that there would be no loss to overall supplies whilst the solution is being implemented. The uncertainty is around what this solution will be and when it can be implemented but the Environment Agency support the position that the RoC sustainability change should not affect AWS's to meet growth in the study area.

5.3.18 Once the final sustainability change is known and the Wensum SAP is available, the WCS should be revisited to alter the baseline of available water supply and reconsider what the water resource scheme developments will need to be. The delay to the issuing of AWS's final WRMP

will in part be related to this issue, and as such the WCS should also be updated with the final plan at the same time.

Phasing of Water Resources Developments

5.3.19 Notwithstanding the sustainability change at Costessey, the assessment has shown that the water resources should be available for supplying the additional demand assuming a solution to the reduction can be implemented. Therefore, it is important to consider the timing at which the currently proposed new resources will be available in comparison to the trajectory of growth and hence when the water will be required.

5.3.20 Table 5-2 summarises the phasing of schemes required under the planned demand for occupants of new housing (Scenario 2 from Figure 5-1).

Table 5-2: Phasing of WR developments

Water Resource	Earliest Date required	AMP required
Spare capacity in existing groundwater licences	2010 onwards	AMP5 (2010 to 2015)
New groundwater resource development	2015 onwards	AMP6 (2015 to 2020)
Effluent compensation scheme	2019 onwards	AMP6 (2015 to 2026)

5.3.21 The additional growth forecast for the Greater Norwich study area will require extra groundwater to be abstracted from sources with spare licensed capacity e.g. Thorpe St Andrew Borehole as from 2010. As this additional abstraction is currently permitted under the existing abstraction licence, no new infrastructure is required in order to utilise this available water.

5.3.22 Where significant investment is required for schemes such as the new groundwater resource and the effluent transfer scheme, the investment for these will be required in AMP6 (2015 onwards) and hence funding will be sought in the next periodic review process (2014).

5.3.23 In terms of sensitivity, if new homes were built to a much higher level of water efficiency (80l/h/d as required under levels 5 and 6 of the Code for Sustainable Homes), the new groundwater scheme would not be required until 2017 and the effluent compensation scheme until 2028.

5.3.24 Climate change is predicted to change the amount of water available both in rivers and groundwater over the next 25 years; however, in the case of the GNDP study area, the effect on water resource timing is minor and would not significantly change the timings of when new resources are required. The climate change impacts are reported in the Technical Report, but the most sensitive factors with regards to timing of available water for new development is the success of proposed demand management measures and the future water efficiency of new homes.

Ecological Consequences of Different Resource Options

5.3.25 In terms of environmental constraints associated with each of the resource options referred to in section 5.3.8, detail is discussed in the technical report however the **Table 5-3** summarises the key issues:

Table 5-3: Resource Options and Ecological Consequences

Resource Options	Ecological Consequence
Spare GW licences (Thorpe St. Andrew B/h)	No major issues identified – No licences other than Costessey are considered to be impacting on European Sites
New GW Resource Development (probably within Norwich)	To confirm aquifer from which abstraction to take place; however impact is likely to be small. Despite this, any new abstraction will need to demonstrate that there are no adverse effects on non HD sites and be considered in tne overall sustainability of the local water resources (the CAMS process).
Effluent Compensation scheme (see note below)	Further details about this scheme are required before a final view can be given; however, a solution is likely to be achievable

5.4 Water Efficiency Strategy

5.4.1 Given the scarcity of raw water resources availability in the East of England, it is key that the WCS process considers options for how demand from new development can be managed via effective policy to ensure that future demand for new water supply is minimised.

5.4.2 There is also potential that a WCS can influence policy on water use from existing customers to further secure future water supplies and reduce generation of wastewater from new properties, thereby increasing capacity headroom in both supply and wastewater treatment capacity. A water efficiency strategy has therefore been developed for the GNWCS to feed into policy recommendations for the LDF.

5.4.3 The detail of how the water efficiency strategy has been derived is included in the Technical Report. This includes details of modelling undertaken of different water use strategies for new homes in combination with managing demand from existing homes. Consideration has also been given to the feasibility of achieving water neutrality: a concept whereby the total amount of water demand within a planning area is the same (or less) even when allowing for additional demand from new development required in the RSS. In order for the water neutrality concept to work, the additional demand created by new development needs to be offset by reducing the demand from existing population and employment. If this can be achieved, the overall balance for water demand is 'neutral'.

The Water Efficiency Plan for the GNDP Study Area

5.4.4 Before considering the measures which can be promoted through policy in the GNDP Joint Core Strategy, it is important to consider the baseline condition i.e. current customer use and plans already in place by AWS to manage demand as part of the Water Resource Management Plan process.

5.4.5 A comparison with average water use by different groups of AWS's customers is shown in Table 5-4.

Table 5-4: Summary of Water Usage by AWS and Average UK WASC Customers

Customer Type	AWS Customers (l/h/d)	Average UK Water and Supply Company Customers (l/h/d)
Customers with a water meter	141	131
Customers without a meter	158	151
Overall average	150	145

Source: Ofwat Report 2007-08

5.4.6 In general, AWS customers' water use figures for both metered and un-metered customers are slightly above industry average for UK Water and Sewerage Companies' customers and hence there is room for demand management measures to be successful in reducing the existing baseline demand for water supply. One of the most successful means of reducing existing demand is through the installation of a water meter in homes that do not currently have a meter, Having water supply metered generally has the effect of reducing demand and customers are more aware of when they may be wasting water, resulting in savings of around 15 litres per person per day.

5.4.7 Levels of metering within the Anglian Region presently stands at around 60% (AWS's Statement of Response to the draft WRMP, 2009). The levels of metering are much higher than most other UK Water Companies (with the exception of South West Water) typically around 25% (Ofwat, 2007-08). However, AWS is proposing to actively encourage customers to opt for a water meter to increase the number of properties which are metered. A *targeted enhanced metering programme* is suggested to increase metering levels in certain 'key' areas by up to 75% by 2015 and 90% by 2035 (AWS Statement of Response 2009). This will further reduce existing demand and has been accounted for in AWS supply/demand balance for the GNDP area.

5.4.8 A further means of reducing demand is through reducing leakage from supply pipes. Because water demand is measured as the treated water which enters the supply system, water lost from the supply network is considered as a 'demand'.

5.4.9 The current level of leakage as reported by AW is around 18% i.e. this represents the proportion of the treated water put into supply that is lost to leakage from the network (based on 2007/08 figrues). This is low in comparison with an industry average for UK companies of 27%. AWS proposed to continue to operate at the current leakage level until AMP 7 (2020 onwards) when there will be further targeted leakage reduction schemes.

5.4.10 To supplement the metering programme and targeted leakage, AWS are promoting the use of good practice for water efficiency and are implementing the use of targeted cistern devices to reduce toilet flushing demand in existing properties (in AMP5) as well as domestic water audits (also in AMP5). Water audits are undertaken of water use in domestic properties free of charge in people's homes to demonstrate where they may be wasting water and what they can do to minimise this wastage.

5.4.11 Even allowing for AWS's planned reduction in usage up to the end of the RSS period, there will still be a significant amount of new demand as a result of new development. It is therefore important to look at further ways in which policy can further reduce overall demand for water over the LDF planning period.

Water Neutrality

5.4.12 To determine if the GNDP planning area can be water neutral after growth as planned in the RSS, calculations were undertaken to determine if the increase in demand for water from the new development can be met through improving water efficiency in existing homes. The modelling scenarios and the methodologies involved are detailed in the Technical Report along with a breakdown of assessment in individual towns (as opposed to the GNDP study area a whole).

5.4.13 As a summary: a series of scenarios were run which combined a range of different efficiency levels in new homes (based on water use targets in the Code for Sustainable Homes [CSH]) with a range of potential demand management scenarios in existing homes achieved through different levels of metering and retrofitting of water efficient devices. These are summarised in the following tables:

Table 5-5: Demand Management Options for Existing Homes

Option	Potential Saving	Measures Included
Option 1	35.8l/h/d	Meter, Low flush toilet and a low flow shower.
Option 2	30.4 l/h/d	Meter and the use of low use fittings.
Option 3	28.7 l/h/d	No Meter, Low Flow Toilet and Low Flow shower.
Option 4	23.3 l/h/d	No Meter and low use fittings

Table 5-6: New Homes Water Use Scenarios (based on the Code for Sustainable Homes)

Code Level	water Use	Potential saving over existing
No code – current use	150l/h/d	N/A
Levels 1 & 2	120 l/h/d	30 l/h/d
Levels 3 & 4	105 l/h/d	45 l/h/d
Levels 5 & 6	80 l/h/d	70 l/h/d

5.4.14 The results are discussed in full in the Technical Report; however, the analysis showed that as long as the GNDP planning area is considered as a whole, water neutrality could theoretically be achieved if:

- all new houses are built to a standard meeting Levels 5 or 6 in the CSH ; and either
- all existing homes were fitted with low flush toilets and a low flow shower; or
- all currently unmetered properties were fitted with a meter and low use fittings were installed in all existing homes.

5.4.15 In reality it is unlikely that all new homes would be expected to meet levels 5 & 6 under the CSH and 100% metering would be achieved; however, it gives an indication of the benefits that can be delivered by considering policies that require high water efficiency in new build and the potential funding of a retrofitting programme, which could be part funded through developers.

5.4.16 A more realistic scenario is the introduction of low use fittings in existing homes and a CSH level 3 or 4 (105 l/h/d) for new build. This shows that whilst neutrality would not be achievable, savings would be such that total demand in 2026 would only increase by approximately 2.5 Ml/d, and if water meters were fitted in the remaining 40% of existing properties in Norwich, this would be reduced to 1.68 Ml/d more.

5.4.17 Further detail of how the water savings could be delivered (for new and existing homes) are provided in the Technical Report.

5.5 Water Supply Infrastructure

5.5.1 Whilst the water strategy has demonstrated a potential set of raw water resource solutions, consideration as to how the treated water will be delivered to the growth areas is given in this section.

5.5.2 Through the provision of the water supply network layout, it was possible to review the connectivity of the PGAs to the existing supply network. The main water treatment Works (WTW) for the study area is Heigham WTW. From this central point much of the supply to the GNDP area is supplied and hence there is a good connectivity between Heigham WTW as a distribution centre and the PGAs.

5.5.3 In terms of available water supply infrastructure, all of the NGAs are well connected to existing mains. Until the final WRMP is made available, it is not possible to determine how the water will be transferred to the NGAs. However, for this assessment, the assumption used in the Stage 2a WCS has been used to that all water would be distributed from Heigham WTW to the west of Norwich city centre. An assessment has therefore been made for each of the PGAs and is described in section the PGA analysis in section 7.2.

6 Flood Risk & Surface Water Management

6.1 Flood Risk to Development

6.1.1 The level 1 Strategic Flood Risk Assessment has identified the main areas of fluvial flood risk in Greater Norwich. The great majority of development supported by the Joint Core Strategy has been located away from areas of fluvial flood risk as a result. A level 2 Strategic Flood Risk Assessment will provide detail on the main areas of fluvial flood risk in Norwich itself. This will enable the implementation of government flood risk policy in relation to development, through the PPS25 Sequential Test and Exception Test.

6.1.2 At the present point in the planning process, it has not been possible to determine specific flood risk (and hence flood defence mitigation infrastructure) required for each PGA. This is because specific site details are not known and it cannot be determined whether development within the large growth areas presented might be restricted by different flood zones.

6.1.3 Therefore, flood risk to PGAs has been considered on a site area basis by assessing how much of the PGA area is within a flood zone (taken from the SFRA where available, or EA flood maps if not) and therefore, how likely it is that development types (and extent of development) might be restricted under the requirements of PPS25. The assessment for flood risk to each PGA is summarised in the PGA analysis in section 7.2. Site specific Flood Risk Assessments will be required from developers where necessary through the planning application process.

6.2 Surface Water Management

6.2.1 Surface Water Management is a key consideration when assessing development within large areas. PPS25 requires that new development does not increase the risk of flooding elsewhere by managing surface water runoff generated as a result of developing land. Altering large areas of land by urbanising it fundamentally alters the way in which rainfall drains to watercourses and has the potential to increase the rate and amount of water that enters watercourses causing an increase in flood risk. In many cases, the management of surface water is achieved via a requirement to restrict runoff from developed sites to that which occurs from the pre-development site usage and this is achieved by incorporating a range of Sustainable Drainage Systems (SuDS) which aim to maximise the amount of rainwater which is returned to the ground (infiltration) and then to hold back (attenuate) excess surface water. Incorporating SuDS often requires a large amount of space and for large developments often requires the consideration of large scale strategic features such as balancing ponds which can attenuate and store large volumes of water generated during very heavy rain storms to prevent flood risk downstream.

6.2.2 It is therefore essential that surface water drainage is managed separately from wastewater, both to reduce impact on the existing combined system and to meet the requirements of national and regional policy.

6.2.3 As one of the settlements nationally identified as having the highest number of properties at risk from surface water flooding, a DEFRA funded Surface Water Management Plan is to be produced for the urban area of Norwich by March 2011. As “Lead local flood authority”, this project is being led by Norfolk County Council. The plan has two main functions. Firstly, it will identify existing built up areas most prone to surface water flooding and propose solutions.

Secondly, it will inform planning policies for surface water flooding in LDF documents subsequent to the Joint Core Strategy.

6.3 Suitability of SuDS

6.3.1 At the present point in the planning process, it has not been possible to determine outline requirements of the SuDS features that could be possible at each of the growth areas. This is because specific site details are not known and hence it is not possible to consider potential sizes of surface water attenuation features or specific topographic/geological constraints at each site.

6.3.2 In order to give an indication of SuDS suitability for the Stage 2b WCS, the likely capacity for infiltration type SuDS for the PGAs as a whole has been considered. An assessment has therefore been made based on the geological conditions of the PGAs as a whole. The detail on the specific conditions which limit SuDS are included in the technical report, but in summary the assessment has been made on the following criteria:

- the presence of an aquifer underneath the site;
- the rate at which water is able to pass through the soil and underlying geology (referred to as its permeability); and
- the requirement to protect groundwater used as potable supply underneath sites from the effects of pollution as a result of different types of above ground development.

6.3.3 Due to the reliance of the study area on abstractions from groundwater, consideration of the protection of groundwater from pollution as a result of above ground development is a key and hence the SuDS suitability assessment has used information on 'Source Protections Zones' and areas of 'Groundwater Vulnerability'. It is also important to consider that the East of England Plan policy ENV9 requires that:

> "*In preparing local development documents, take into account (amongst other documents), the Environment Agency's groundwater vulnerability and groundwater source protection zone maps. The protection of water resources and provision for water abstraction should take into account environmental constraints*".

6.3.4 The SuDS suitability assessment for each PGA is summarised in the PGA analysis in section 7.2. It should be noted that the SuDS suitability maps (provided in the appendices of the Technical Document) and the policy area assessments for SuDS are indicative and are only meant as a guide to developers. Decisions should be made on a site by site basis depending on a specific site risk assessment and should be made in accordance with the Environment Agency's Groundwater Protection Policy.

7 PGA Analysis – Infrastructure Requirements

7.1 Introduction

7.1.1 This section presents the detail on the water services infrastructure requirements for each of the policy areas that have significant growth levels. It includes:

- detail of the strategic infrastructure required to service the areas with wastewater and water supply provision; and
- advice on phasing of wastewater and water supply infrastructure both spatially and temporally (i.e. when and where).

7.2 Policy Area Assessments

7.2.1 Each of the policy assessment areas has been considered in detail in the proceeding sections. An accompanying map of key water cycle issues is included for each PGA based on the assessments undertaken in this Stage 2b study. It should be noted that the mapped PGAs in Section 7.3 are indicative only and are only identified for the purposes of the Water Cycle Study, not to show exact boundaries of future growth areas. Each assessment includes an infrastructure timeline for that policy area. A brief description of how these assessments were undertaken is included in the Technical Report.

7.2.2 It should be noted that for raw water resources, the timing of when these resources will need to be developed is relevant to the study areas a whole and the timing is therefore the same for each PGA. In addition, it has been shown that SuDS features need to be installed within the first year of site development such that they are in place to provide flood protection (and water quality benefits) during construction and prior ro site establishment.

7.2.3 It is important to note that whilst broad phasing is available for 'town areas' in the study area, proposed housing phasing for each NPA is not currently known, hence best estimates have been made of when infrastructure will need to be phased in. The majority of the larger scale development growth is not expected to commence until 2015; however, growth proposed for NPA3a as a result of the proposed Rackheath Ecotown, brownfield development within Norwich City and a floating target of between 1800 and 2000 homes across Broadland and South Norfolk, is likely to take place before 2015.

7.2.4 Table 3-3 provides a summary of the AMP periods and the years they will span. At the time of completing the GNWCS, AWS are about to commence on the AMP5 cycle.

7.3 NPA1 - North Sector (North of Airport)

Growth Summary

7.3.1 A total of 140 new dwellings are proposed for NPA 1 and 5,265 new jobs.

Wastewater Treatment

7.3.2 Due to a lack of capacity at nearby WwTWs, the preferred treatment strategy is to transfer wastewater flow to Whitlingham WwTW. Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.3.3 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.3.4 There are no 'strategic'[10] sewers within the proposed NPA1 area; however, the existing sewer as shown running through the centre of the NPA in the accompanying figure (75mm leading to 80mm) is likely to have sufficient headroom to allow approximately 500 properties (increasing to 2000 down catchment) which is adequate to take all the proposed flow from this NPA. Analysis of the main trunk sewer through Norwich has indicated that this small amount of growth (housing and employment) could be accommodated through Norwich, and hence no new sewer networks would be required.

7.3.5 Wastewater transmission should not present a limitation on phasing beyond 2010; however, this should be confirmed with AWS once the hydraulic model of the network is available from June 2010.

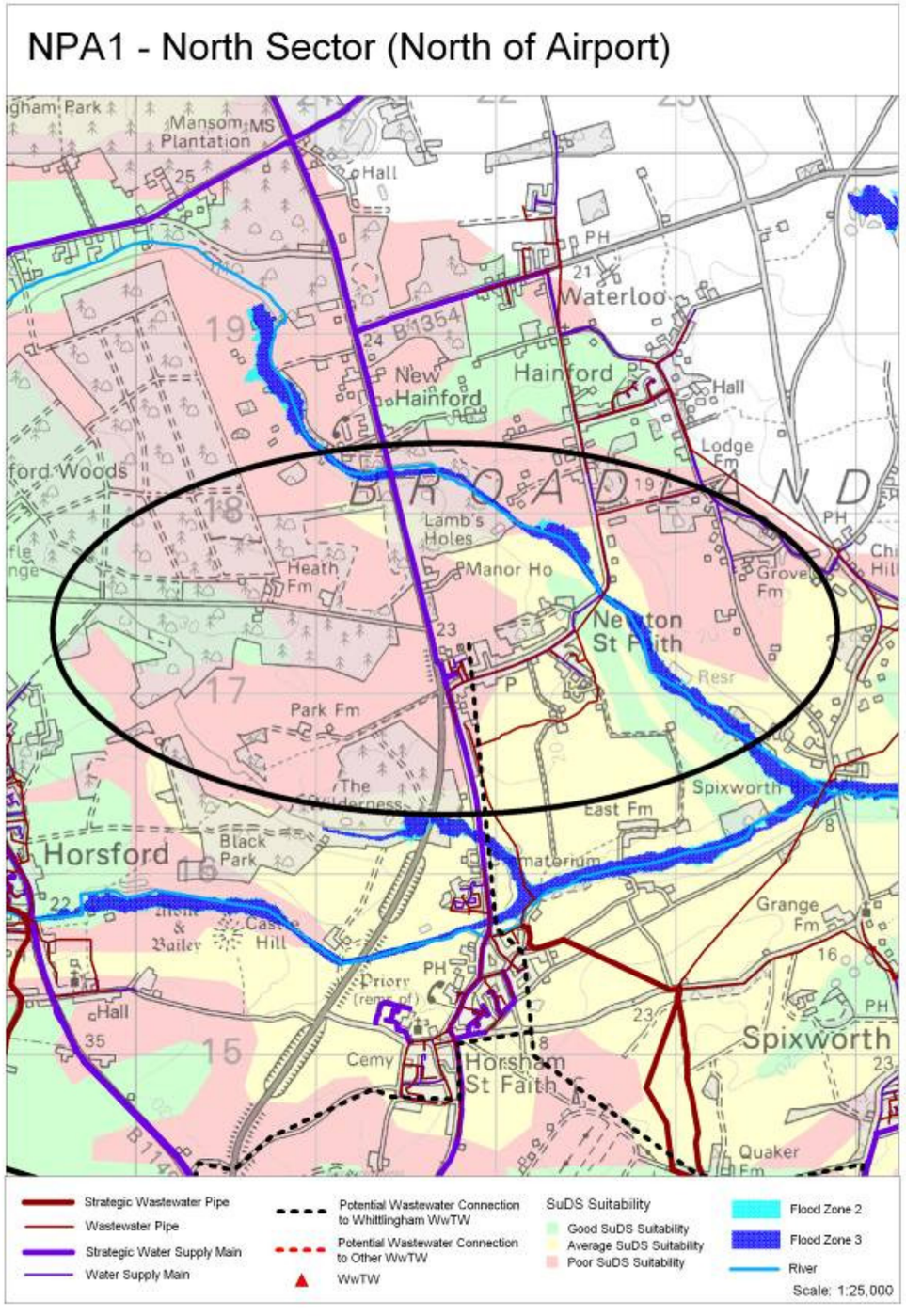
Local Connection

7.3.6 Extensive local connections will be required at developer level if development is proposed to the north, west or east of the NPA which will need to be funded through requisition under the Water Resources Act 1991.

Water Resources

Water Supply Infrastructure

7.3.7 The accompanying figure highlights that a strategic water supply main runs through the centre of the NPA which should have sufficient capacity to supply the proposed dwellings once raw water resources are developed. Local connections will be required at a developer level which will need to be funded through requisition under the Water Resources Act 1991.



[10] Strategic in this case is defined as greater than 200mm

Water Neutrality (WN)

7.3.8 Due to limited existing population in the NPA, WN for NPA1 is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

7.3.9 Only a small area of the NPA running through the east of the area is located within Flood Zone 3 (1% annual probability of a flood) or Flood Zone 2 (between 1% and 0.1% probability of river flooding), hence development should be able to proceed outside of the floodplain and the NPA will hence be able to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

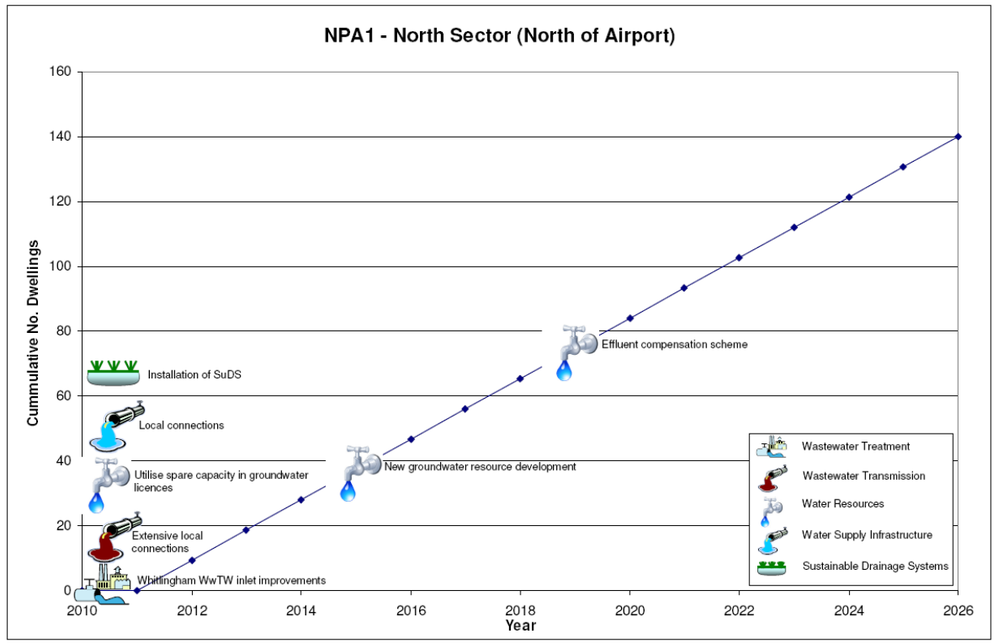
SuDS Suitability

7.3.10 Approximately 65% of the NPA including the western half has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy), hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds which could be developed for strategic linkage with the river.

7.3.11 Development around the existing village of Newton St Faith will have greater suitability for SuDS due to higher permeability soil and geology. SuDS such as Swales and Soakaways are more likely to be suitable here.

7.3.12 There are no SPZs in the NPA; hence any type of development or SuDS type should be suitable in this NPA in terms of water abstraction protection, although site specific assessments will still be required.

Figure 7-1: NPA 1 – Infrastructure timeline and phasing



7.4 NPA 2 - North East Sector (Inside NNDR)

Growth Summary

7.4.1 A total of 9,100 new dwellings are proposed for NPA 2, which includes 3,290 new jobs.

Wastewater Treatment

7.4.2 Due to a lack of capacity at Rackheath WwTW, the preferred treatment strategy is to transfer wastewater flow to Whitlingham WwTW. Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.4.3 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.4.4 There is a large 'strategic' sewer within NPA2 which is estimated to have capacity for an additional 4000 dwellings to transfer to Whitlingham WwTW. This sewer does not run through Norwich city and hence its capacity could be utilised by development in this NPA for early phasing. However, 2,000 dwellings from NPA3a are likely to come forward first as part of the Rackheath Ecotown and as such only 2,000 dwellings could be accommodated before the new interceptor sewer is constructed.

7.4.5 It is estimated that the earliest that this interceptor sewer would be operational is AMP7 (2020 onwards) This would affect phasing as shown in the infrastructure timeline for the North East Sector (see Figure 7-2).

7.4.6 A further option for providing this additional network would be for the developer(s) to requisition a wastewater sewer to connect the remaining development direct to Whitlingham for use in AMP7;

Local Connection

7.4.7 Extensive local connections will be required at developer level if development is proposed anywhere other than bordering the current north eastern boundary of Norwich city.

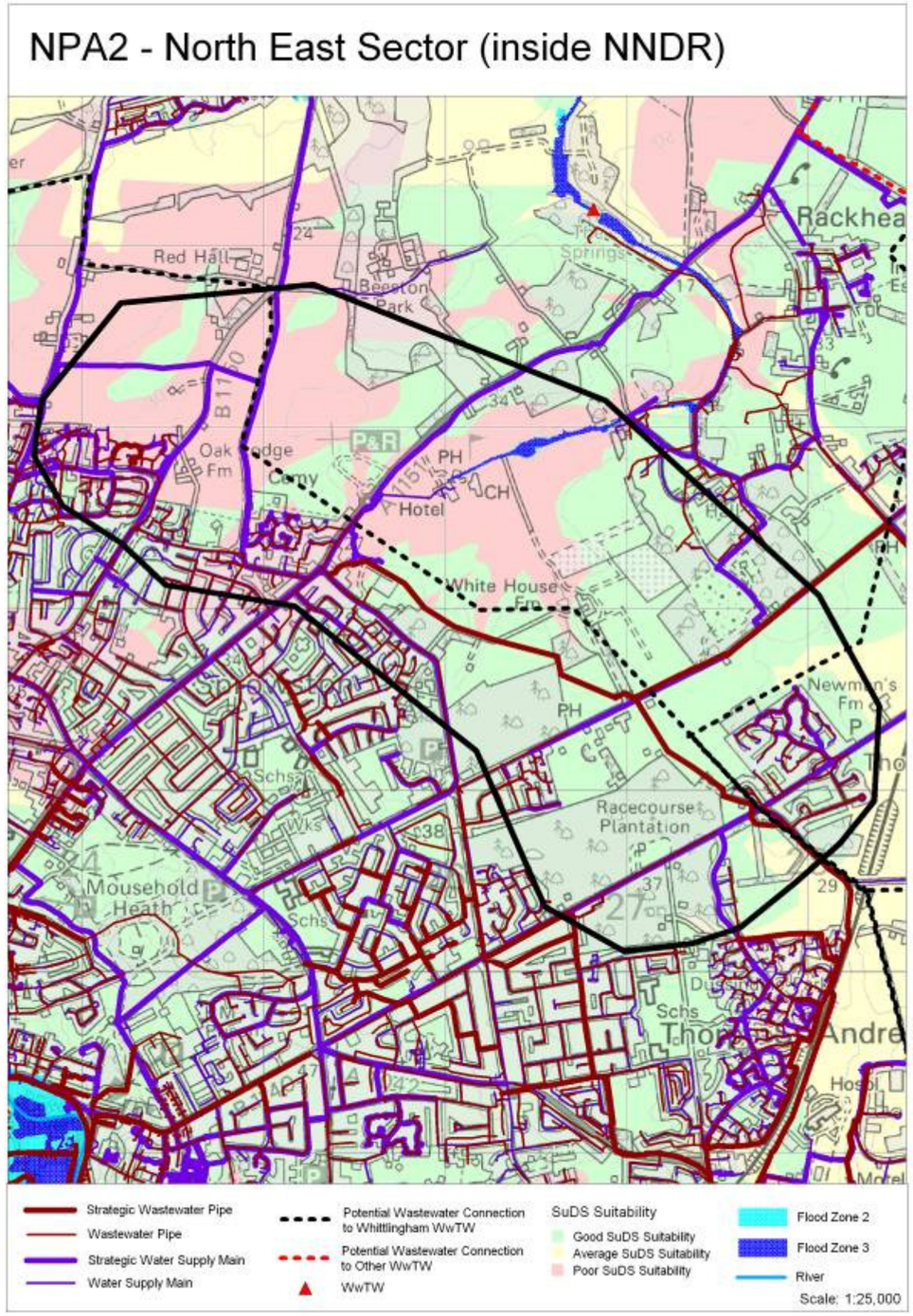
Water Resources

Water Supply Infrastructure

7.4.8 The accompanying figure highlights strategic water supply mains to the centre, north west and south east of the NPA. Connection to these mains should be sufficient for new development, although local pumping stations /connections will be required if development is proposed south of the centre of the NPA.

Water Neutrality (WN)

7.4.9 Due to limited existing population in the NPA, WN for NPA2 is assessed as part of Norwich City as a whole.



7.4.10 WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

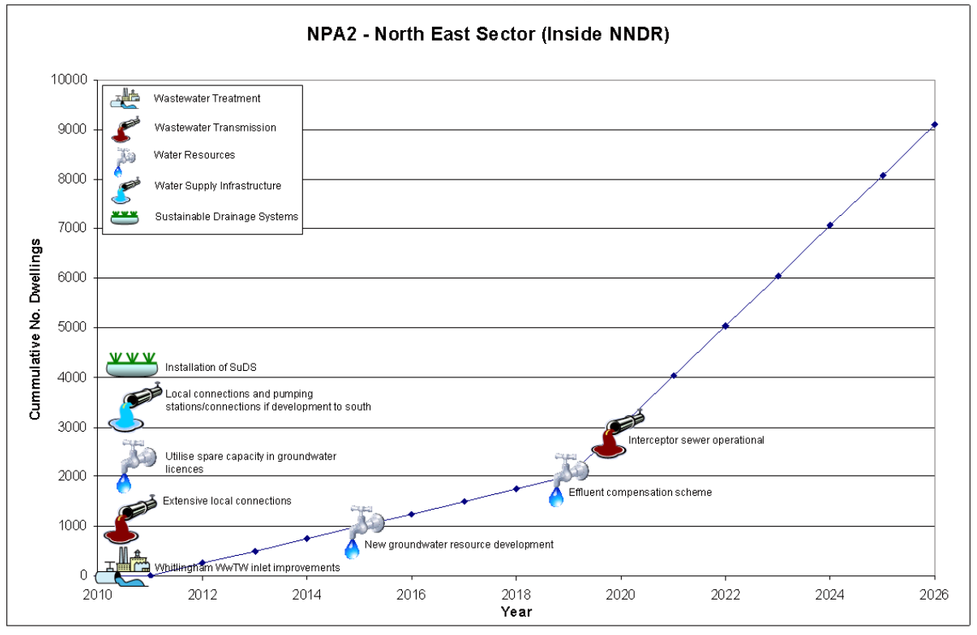
7.4.11 The extent of Flood Zones 3 and 2 within this NPA is minimal hence development should be able to proceed outside of the floodplain and the NPA will hence be able to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS Suitability

7.4.12 Approximately 60% of the NPA including the southern half has good SuDS suitability and is therefore likely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy), hence greenfield attenuation requirements can be partly met through infiltration SuDs such as Swales and Soakaways. Runoff that can be infiltrated will however be slightly restricted in the central southern section of this NPA due to the presence of a total catchment area of a source protection zone. Infiltration SuDS in the central and southern half of the NPA will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed.

7.4.13 The use of infiltration SuDS in the northern half of the NPA is variable with pockets of land suitable for these preferred SuDS and which will not be limited by SPZs (although site specific assessments will still be required). Developers should undertake site specific infiltration tests to determine whether infiltration is possible and therefore whether infiltration drainage techniques or surface water storage SUDS are more appropriate.

Figure 7-2: NPA 2 – Infrastructure timeline and phasing



7.5 NPA 3a - North East Sector (Outside NNDR)

Growth Summary

7.5.1 A total of 4,181 new dwellings are proposed for NPA 3a which includes for the dwelling numbers for the proposed Rackheath Ecotown.

Wastewater Treatment

7.5.2 Wastewater generated at NPA3 will be split between nearby Belaugh WwTW to the north east (52% = 2195) and a strategic transfer to Whitlingham WwTW (48% = 1986).

7.5.3 Belaugh WwTW has been shown to have sufficient capacity to accept growth from NPA3a and RPA3 (Wroxham) without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Some growth from the North Norfolk district (Hoveton) is also expected to utilise Belaugh WwTW. Dependent on the level of growth from outside the GNDP area, more flow may need to be transferred to Whitlingham WwTW from NPA3a; however, this will not affect the wastewater network capacity which will be able to accept the flow and AWS have indicated capacity to take more growth at Whitlingham WwTW within the current flow consent than is planned for in this WCS.

7.5.4 Similarly, Whitlingham WwTW has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required at this works. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.5.5 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.5.6 In terms of connection to Belaugh, the 2195 new dwellings would be unlikely to be able to utilise existing network capacity and as such only a small amount of early phasing could be transferred. A new strategic main would need to be commissioned which could be complete by the end of AMP6 (2019) or earlier if (2015) if the developer requisitions a new sewer for AWS adoption.

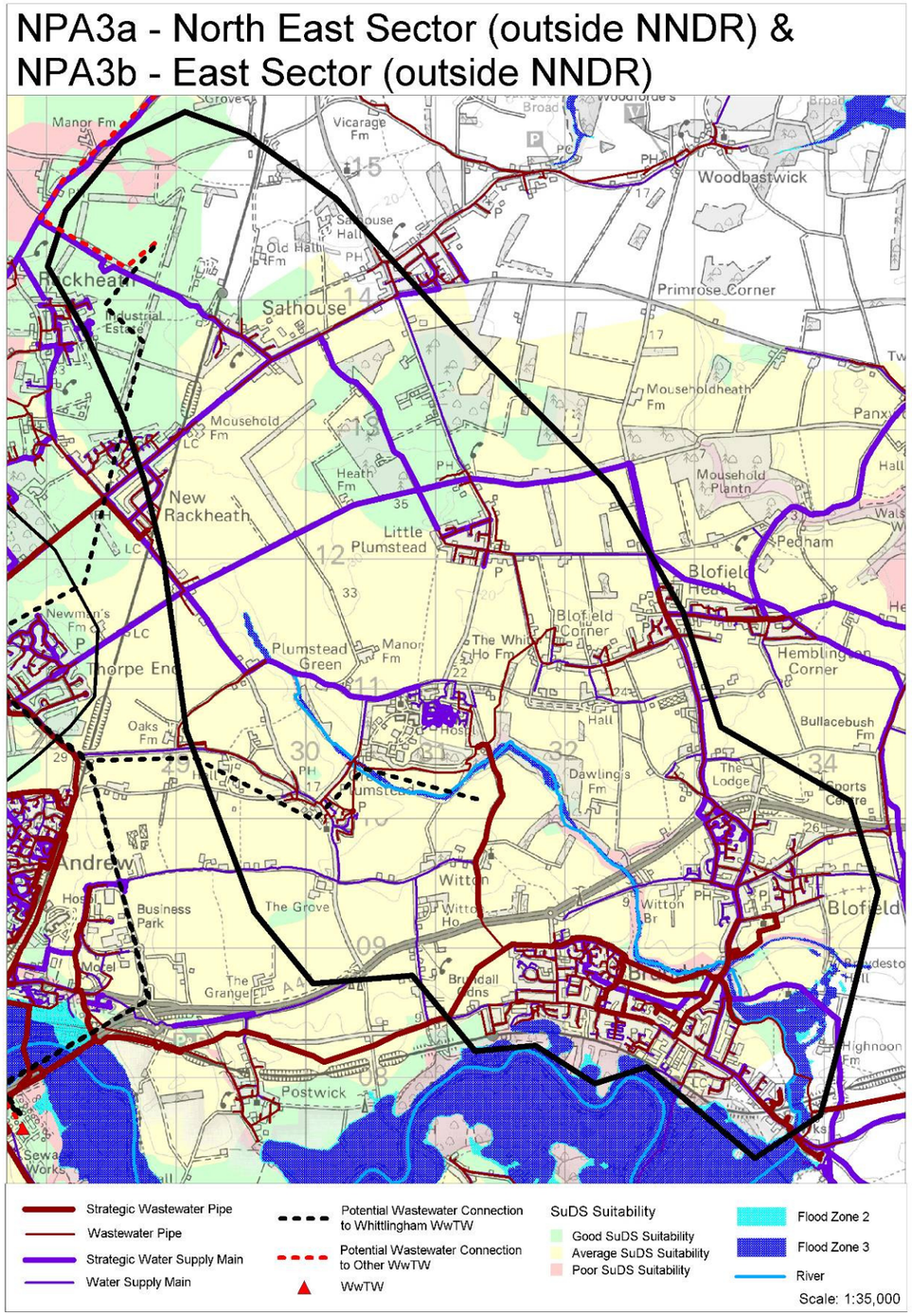
7.5.7 However, there is a large ‘strategic’ sewer to the west of NPA3a which has been calculated to have sufficient capacity to accommodate up to 4,000 homes. Therefore, early phasing for the Ecotown could utilise this main whilst the connection to Belaugh is completed, allowing the 1,986 dwellings connecting to Whitlingham to go ahead initially.

7.5.8 In terms of connection to Whitlingham: there is a large ‘strategic’ sewer to the west of NPA3a; however, it would connect to the existing strategic sewer which is likely to accommodate NPA2 and hence is unlikely to have capacity to utilise it unless development in these two NPAs is co-ordinated and phased. The remaining development would have to link to the northern interceptor sewer as described in the wastewater strategy. It is estimated that the earliest that this interceptor sewer would be operational is AMP7 (2020 onwards). This would affect phasing as shown in the infrastructure timeline for the North East Sector (see Figure 7-3).

7.5.9 A further options for providing this additional network would be for the developer(s) to requisition a wastewater sewer to connect the remaining development direct to Whitlingham for use in AMP7;

Local Connections

7.5.10 Extensive local connections will be required at developer level for the majority of the NPA other than development in proximity to Salhouse and New Rackheath.



Water Resources

Water Supply Infrastructure

7.5.11 The accompanying figure highlights strategic water supply mains to the centre, north west and central south of the NPA. Connection to these mains should be sufficient for new development, although local pumping stations and connections will be required

Water Neutrality (WN)

7.5.12 Due to limited existing population in the NPA, WN for NPA3a is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

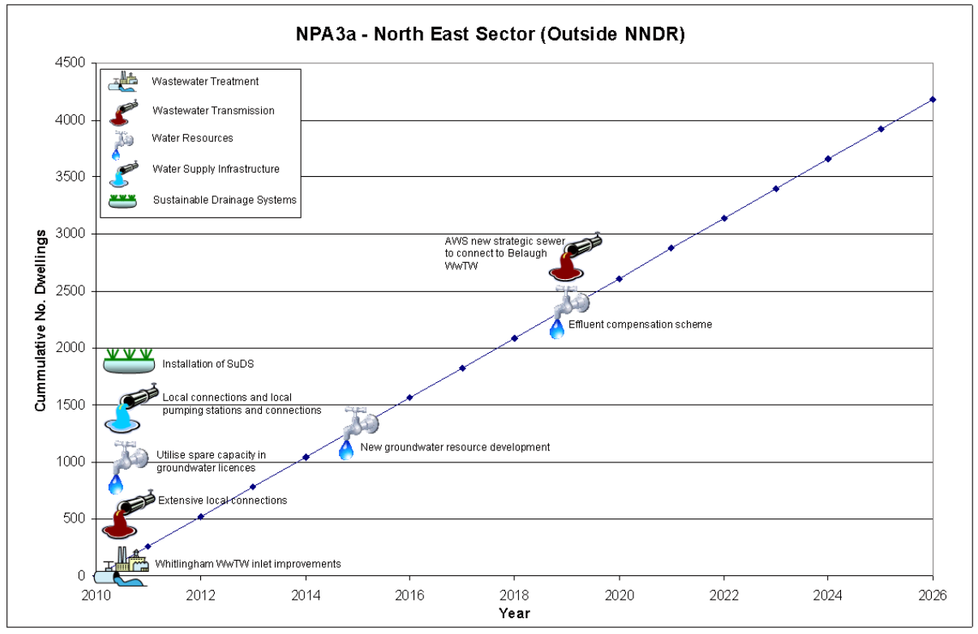
Flood Risk & the Sequential Test

7.5.13 There are no designated Flood Zones 3 and 2 within this NPA.

SuDS Suitability

7.5.14 The NPA has an average (to the south) and good (to the north) suitability for infiltration SuDS; hence a mixture of surface water storage features and infiltration SuDS will be required. There are no significant SPZs in this NPA, although the presence of a small area of total catchment to the north west will mean that Infiltration SuDS proposed in this area will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed. Site specific risk assessments will be required for all development and SuDS proposals

Figure 7-3: NPA 3a – Infrastructure timeline and phasing



7.6 NPA 3b - East Sector (Outside NNDR)

Growth Summary

7.6.1 A total of 420 new dwellings are proposed for NPA 3b, which includes a proposed 3,290 new jobs.

Wastewater Treatment

7.6.2 Due to a lack of capacity at nearby WwTWs, the preferred treatment strategy is to transfer wastewater flow to Whitlingham WwTW. Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.6.3 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.6.4 There is a large 'strategic' sewer to the south of NPA3b (450mm); which is estimated to have sufficient capacity to accept the additional dwellings (420) and this sewer's capacity increases to the south of the NPA such that sufficient capacity could be available for housing and employment. Employment growth will be required to requisition new network connections to the strategic network main to the south of the NPA. This could be achieved in AMP6.

Local Connection

7.6.5 Some small scale local connections will be required at developer level for the NPA.

Water Resources

Water Supply Infrastructure

7.6.6 The accompanying figure to NPA3a (Covers NPA3b also) highlights a strategic water supply main to the centre of the NPA. Connection to these mains should be sufficient for new development, although local connections will be required at developer level

Water Neutrality (WN)

7.6.7 Due to limited existing population in the NPA, WN for NPA3b is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

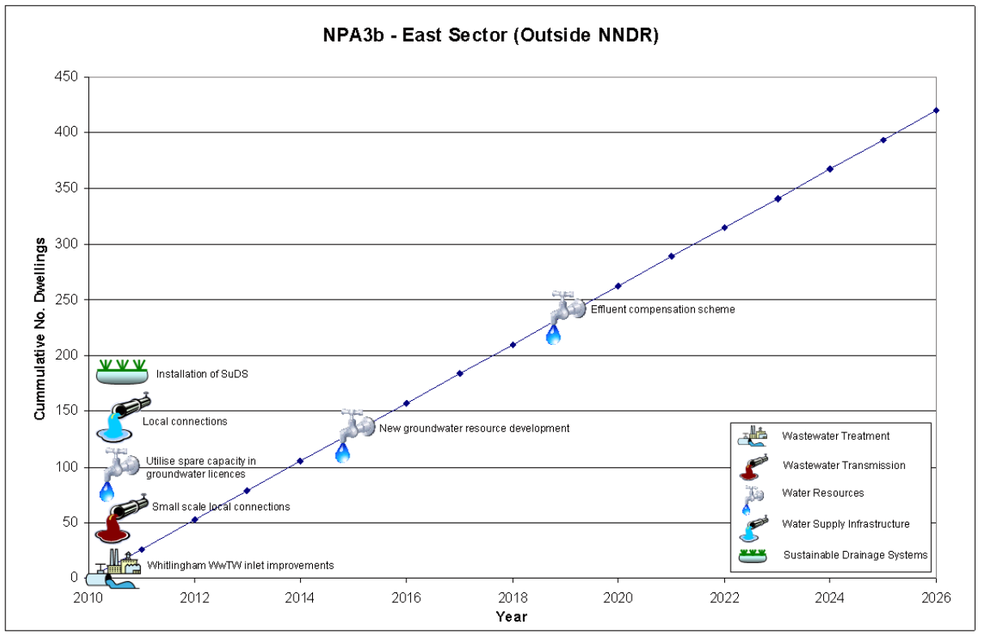
7.6.8 The extent of Flood Zones 3 and 2 within this NPA is minimal hence development should be able to proceed outside of the floodplain and the NPA will hence be able to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS Suitability

7.6.9 The majority of the NPA has an average suitability for infiltration SuDS; hence a mixture of surface water storage features and infiltration SuDS will be required. Runoff that can be infiltrated will however be restricted in the central southern section of this NPA due to the presence of a SPZs 1 and 2 associated with a local abstraction close to the hospital. Types of development will therefore also be restricted around the hospital. Infiltration SuDS in the majority of the NPA will require some form of water quality control such as oil interceptors of runoff (other than clean roof runoff) due to a total catchment across the whole NPA.

Infrastructure Timelines

Figure 7-4: NPA 3b – Infrastructure timeline and phasing



7.7 NPA 4 - South East Sector (vicinity of Poringland)

Growth Summary

7.7.1 A total of 886 new dwellings are proposed for NPA 4.

Wastewater Treatment

7.7.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, the wastewater strategy proposes that development in NPA4 will have wastewater treated at both Poringland WwTW (80% of NPA growth = 709 dwellings) and Stoke Holy Cross WwTW (20% of NPA growth = 117 dwellings).

7.7.3 Poringland WwTW has been shown to have sufficient capacity to accept growth from 80% of the growth from NPA4 (709 dwellings) area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required.

7.7.4 Stoke Holy Cross does not have sufficient capacity to take the remaining 116 dwellings and therefore requires an increase in flow consent to be granted as well as process upgrades to treat the effluent to a higher standard to protect downstream water quality. Modelling has shown that the tighter consents are achievable within BATNEEC and will allow WFD and HD downstream to be met; however, upgrades won't be completed until the middle of AMP6 (2020), so connection of development of the 116 dwellings will have to be phased later in the plan period

7.7.5 In terms of wastewater treatment, up to 709 dwellings can be delivered early in the phasing, but the remaining 116 (connecting to Stoke Holy Cross) cannot connect until 2020 onwards.

Wastewater Transmission

Strategic Connection

7.7.6 It is considered that the relatively low number of dwellings proposed at Poringland can make use of capacity in existing sewers, although this would need to be confirmed by AWS through detailed modelling at a site specific stage. At this stage there is considered to be no impact on phasing anticipated as a result of wastewater transmission.

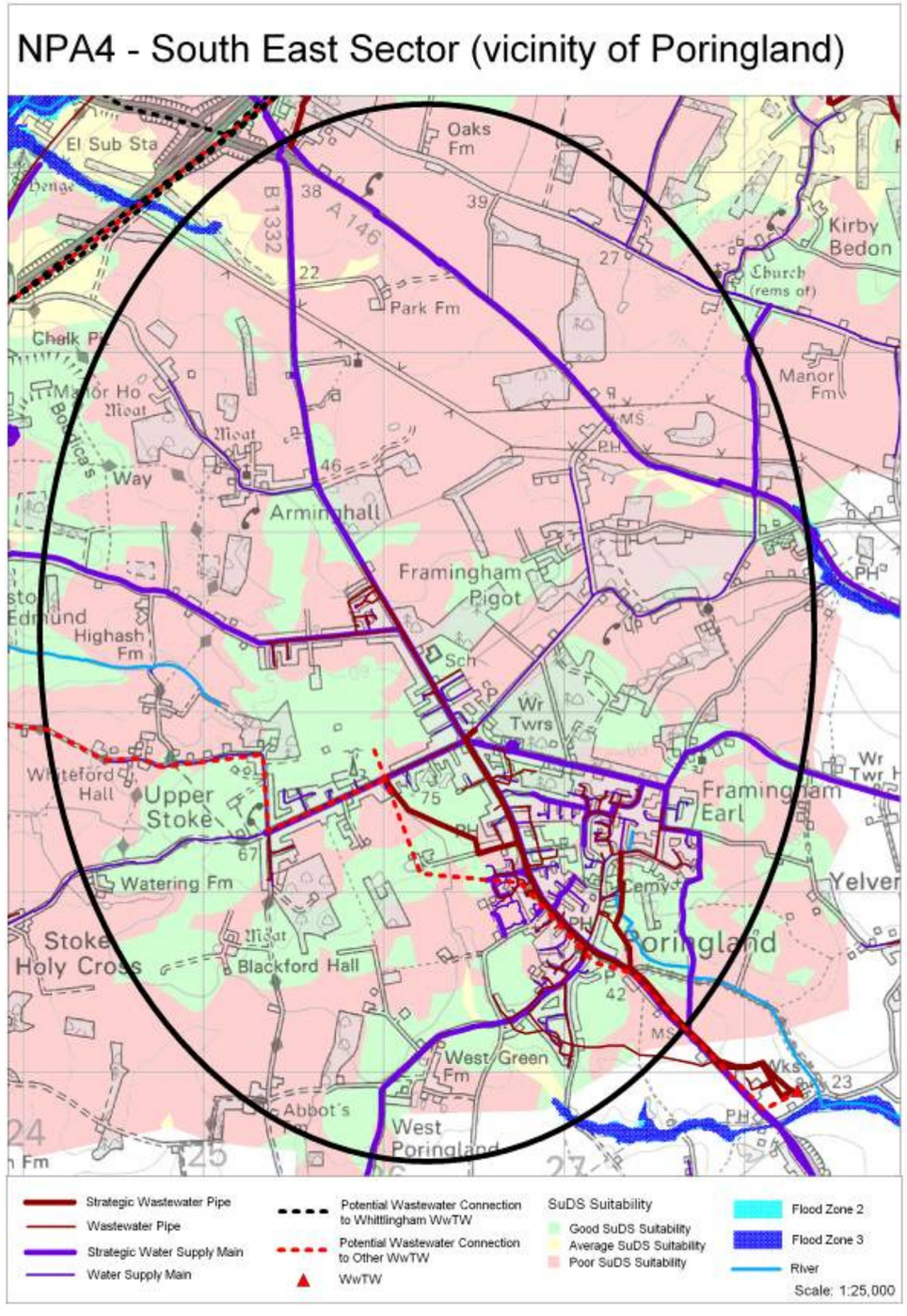
Local Connection

7.7.7 Extensive local connections will be required at developer level if development is proposed anywhere other than around Poringland.

Water Resources

Water Supply Infrastructure

7.7.8 The accompanying figure highlights a strategic water supply mains throughout the NPA. Connection to these mains should be sufficient for the proposed new development, although extensive local connections will be required at developer level if development is proposed anywhere other than around Poringland.



Water Neutrality (WN)

7.7.9 Due to limited existing population in the NPA, WN for NPA4 is assessed as part of Norwich city as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

7.7.10 There are no designated Flood Zones 3 and 2 within this NPA, though Flood Zones 3 and 2 cross the northwest, east and southeast boundary of the area.

SuDS Suitability

7.7.11 Most of the NPA (particularly in the north) has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds.

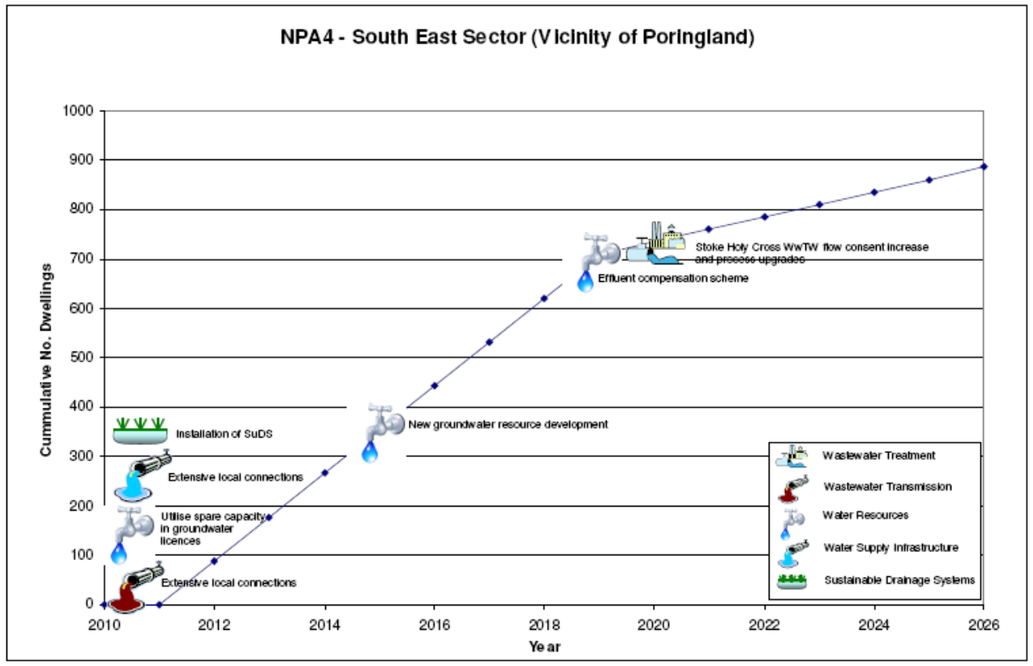
7.7.12 Development around Poringland and Upper Stoke will have greater suitability for SuDS due to higher permeability soil and geology. SuDS such as Swales and Soakaways are more likely to be suitable here.

7.7.13 Development and certain infiltration types to west will be restricted by SPZ 1, 2 and 'total catchment' designations due to two water abstractions to the west and northwest of the NPA. Infiltration SuDS in the majority of the west of NPA will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed due to a 'total catchment' across the whole of the western part of the NPA.

7.7.14 The use of infiltration SuDS in the eastern half of the NPA is variable with pockets of land suitable for these preferred SuDS and which will not be limited by SPZs. Developers will need to refer to the accompanying figure to determine whether surface water storage SuDS are more likely than infiltration.

7.7.15 Developers should also make reference to the DEFRA funded Poringland Integrated Urban Drainage Study. The document examines in some detail the geology around Poringland, its influence upon surface water drainage, the suitability of SuDS and gives guidance on implications of developing in certain areas.

Figure 7-5: NPA 4 – Infrastructure timeline and phasing



7.8 NPA 5 – South Sector

Growth Summary

7.8.1 A total of 503 new dwellings are proposed for NPA 5.

Wastewater Treatment

7.8.2 It is recommended that wastewater generated at NPA3 should be sent to nearby Swardeston WwTW to the west of the NPA

7.8.3 Swardeston Common WwTW has been shown to have sufficient capacity to accept growth from NPA5 without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required and no impact on phasing is anticipated as a result of wastewater treatment

Wastewater Transmission

Strategic Connection

7.8.4 It is considered that the relatively low number of dwellings proposed at Swardeston can make use of capacity in existing sewers, although this would need to be confirmed by AWS through detailed modelling at a site specific stage.

7.8.5 At this stage there is considered to be no impact on phasing anticipated as a result of wastewater transmission.

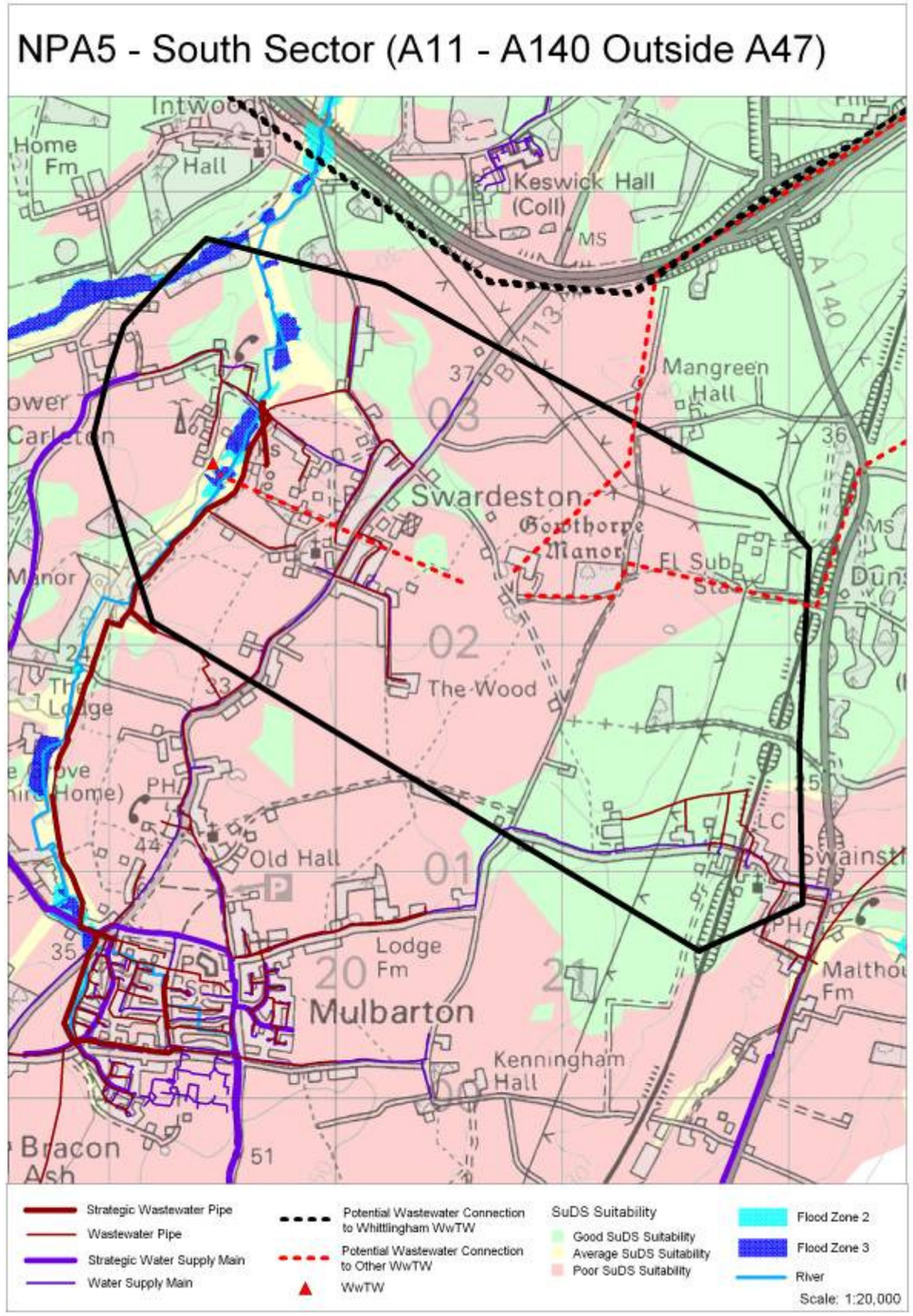
Local Connection

7.8.6 Extensive local connections will be required at developer level for the majority of the NPA other than development in proximity of Swardeston.

Water Resources

Water Supply Infrastructure

7.8.7 The accompanying figure highlights a single strategic main at the western boundary of the NPA – extensive local connections with pumping stations will therefore be required to service the NPA with water supply which could limit early phasing until the end of AMP5.



Water Neutrality (WN)

7.8.8 Due to limited existing population in the NPA, WN for NPA5 is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

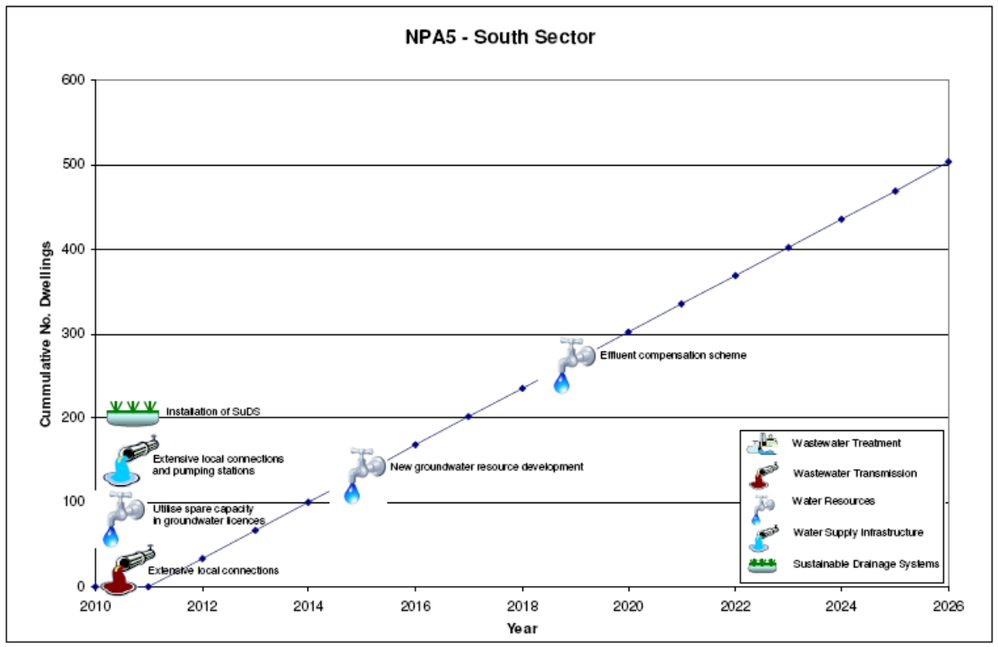
7.8.9 The extent of Flood Zones 3 and 2 within this NPA is minimal hence development should be able to proceed outside of the floodplain and the NPA will hence be able to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS Suitability

7.8.10 Most of the NPA (particularly central) has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy), hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds.

7.8.11 Development to the east will have greater suitability for SuDS due to higher permeability soil and geology. SuDS such as Swales and Soakaways are more likely to be suitable here. However an SPZ 2 designation will restrict development and certain infiltration types in this location, requiring some form of water quality control such as oil interceptors of runoff (other than clean roof runoff).

Figure 7-6: NPA 5 – Infrastructure timeline and phasing



7.9 NPA 6 – Long Stratton

Growth Summary

7.9.1 A total of 1,927 new dwellings are proposed for NPA 6.

Wastewater Treatment

7.9.2 To make use of capacity at local WwTWs and to reduce pumping and transmission costs, development in NPA6 will have wastewater treated at the existing WwTW at Long Stratton. This will require an increase in the volume of discharge to be consented, but it is considered that transferring flows a long distance to the next nearest WwTW is not feasible

7.9.3 Modelling has shown that it will not be possible to accommodate all of the growth and still meet the requirements of the WFD and HD downstream within the limits of BATNEEC. If all new wastewater flow was treated at the WwTW, the downstream quality of the Hempnall Beck would fail on Ammonia and P WFD targets and fail on HD targets for P.

7.9.4 Up to 1400 dwellings could be accommodated within the existing flow consent, hence this number of dwellings could go forward; however the remaining 527 would require an innovative wastewater solution such as reedbed wetlands, discharge to ground or a high specification package treatment plant. These options would need to be investigated on a site specific basis if the residual 527 dwelling target is to be met.

Wastewater Transmission

Strategic Connection

7.9.5 There is a single strategic sewer linking the NPA to Long Stratton WwTW which lies to the north west of the NPA. However, due to the large numbers of new dwellings proposed this sewer is considered unlikely to have sufficient capacity to accommodate all growth. A new strategic sewer would be required and if requisitioned by AWS could be provided in AMP5 (up to 2015)

Local Connection

7.9.6 Extensive local connections will be required at developer level for the majority of the NPA other than development in proximity of Long Stratton.

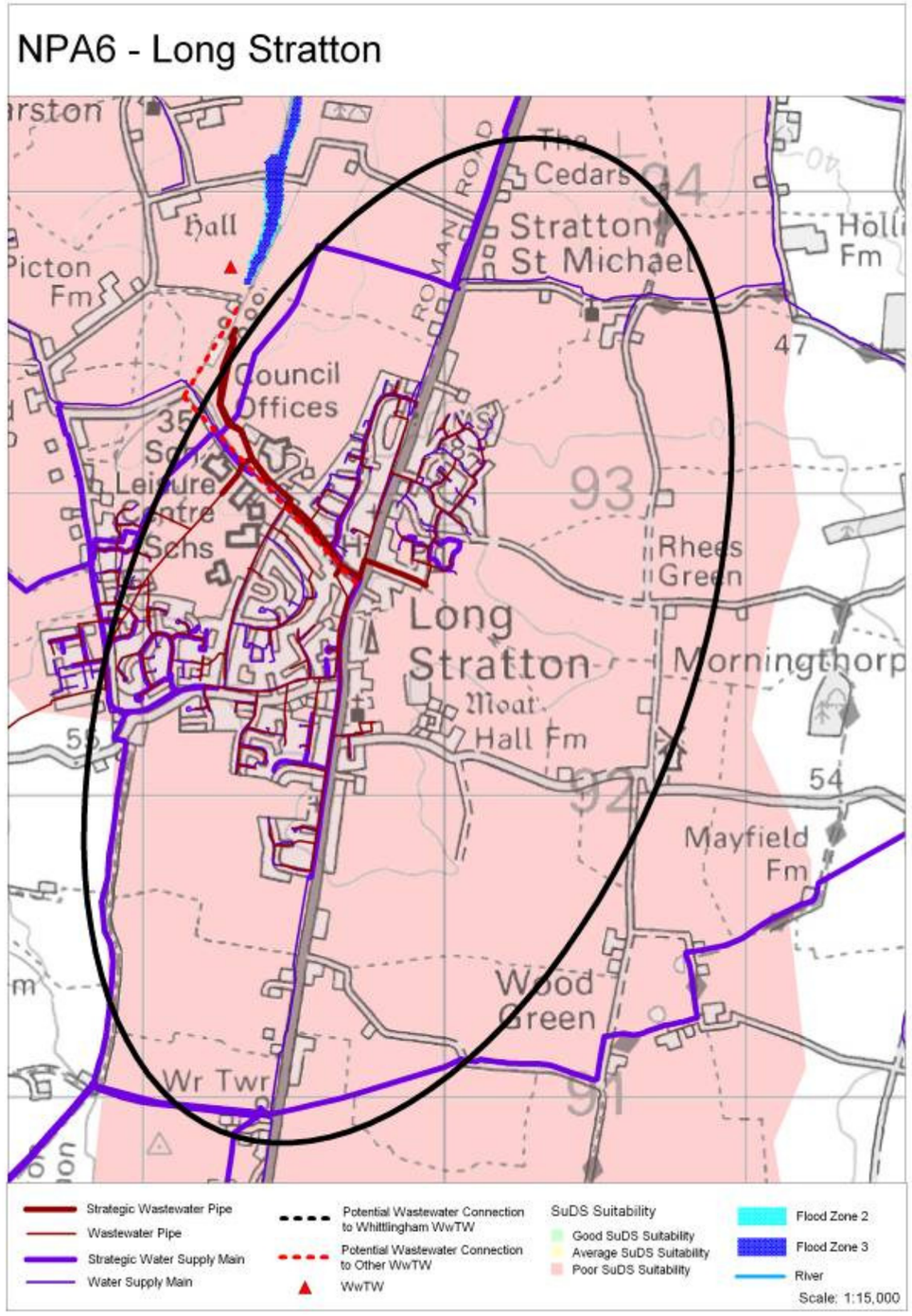
Water Resources

Water Supply Infrastructure

7.9.7 The accompanying figure highlights a single strategic main at the western boundary of the NPA which should be sufficient to service the proposed NPA; however, fairly extensive local connections with pumping stations will be required to service the rest of the NPA with water supply.

Water Neutrality (WN)

7.9.8 NPA6 has been assessed for WN as a single town. WN is not feasible for the town given the proposed growth levels but to meet the aspirations of the GNDP development area new homes in this NPA should aim to achieve high code levels under the CfSH.



Flood Risk & Management

Flood Risk & the Sequential Test

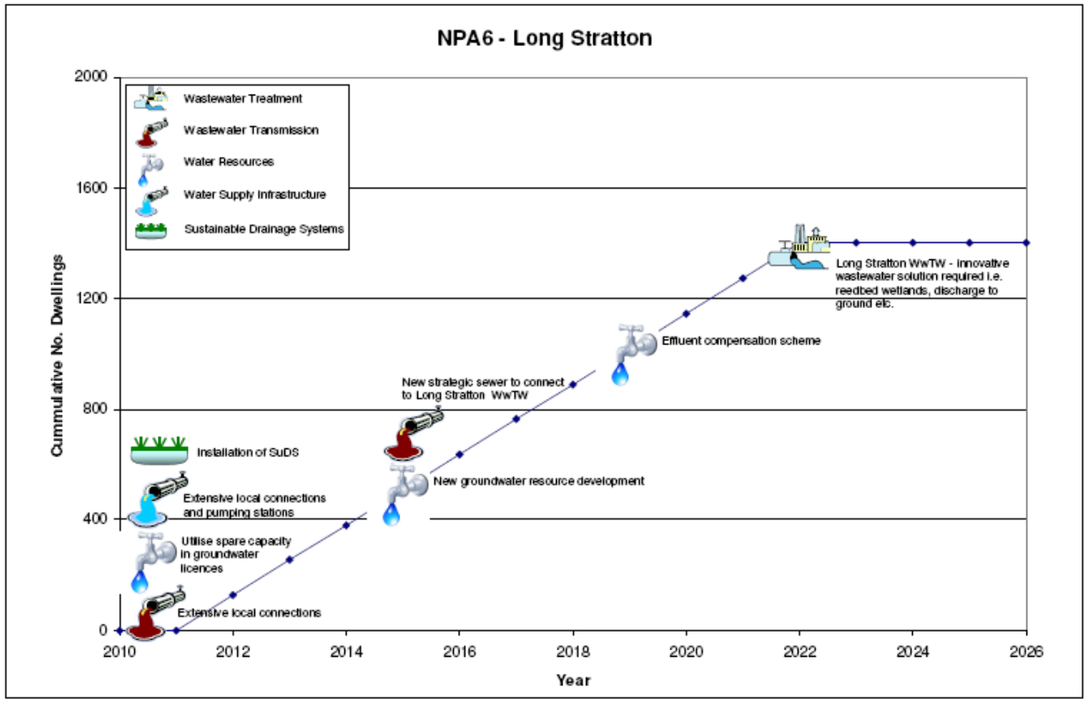
7.9.9 There are no designated Flood Zones 3 and 2 within this NPA.

SuDS Suitability

7.9.10 All of the NPA has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds.

7.9.11 Development will also be potentially restricted due to the presence of a 'total catchment' area across all of the NPA.

Figure 7-7: NPA 6 – Infrastructure timeline and phasing



7.10 NPA 7 – Wymondham

Growth Summary

7.10.1 A total of 2,750 new dwellings are proposed for NPA 7 along with 4,605 new jobs.

Wastewater Treatment

7.10.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, development in NPA7 will have wastewater treated at the existing WwTW at Wymondham. Modelling has shown that Wymondham WwTW has sufficient capacity to accept growth from both Wymondham and RPA 5 (Hingham) without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required and no impact on phasing is anticipated as a result of wastewater treatment.

Wastewater Transmission

Strategic Connection

7.10.3 Sewer connections in the town are good; however it is known that there are sewer flooding issues within Wymondham. For this reason, new strategic mains are likely to be required to service the significant level of growth. A small amount of development could take place to support early phasing; however, this would need to be confirmed by AWS via network modelling at the site specific assessment level. New sewers (if requisitioned) could be commissioned for use by the end of AMP5 (2015)

Local Connection

7.10.4 Extensive local connections will be required at developer level for developments to the south of Wymondham.

Water Resources

Water Supply Infrastructure

7.10.5 The accompanying figure highlights several significant strategic mains throughout the NPA which should be sufficient to service the proposed NPA with local connections.

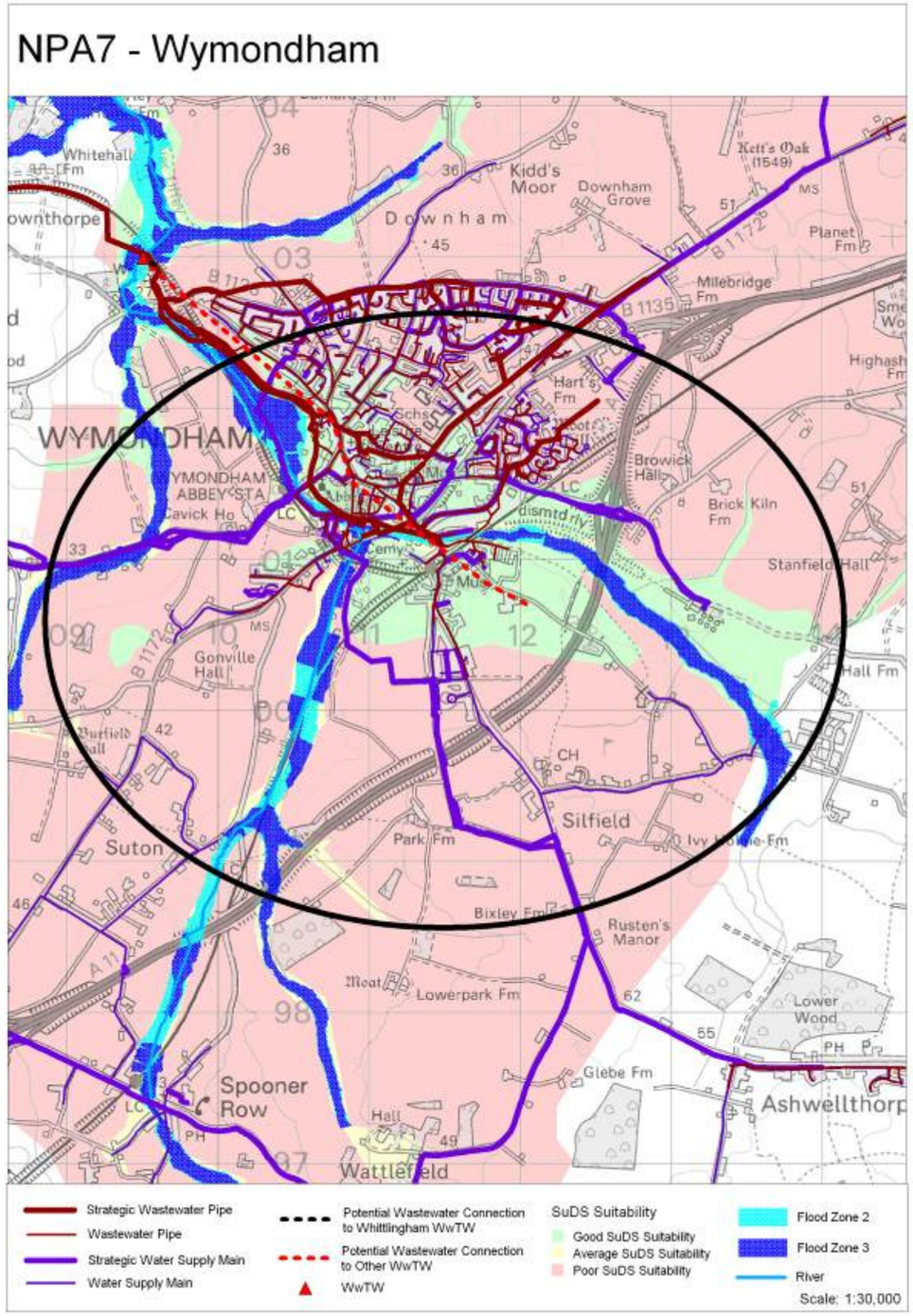
Water Neutrality (WN)

7.10.6 NPA7 has been assessed for WN as a single town. WN is not feasible for the town given the proposed growth levels but to meet the aspirations of the GNDP development area new homes in this NPA should aim to achieve high code levels under the CfSH.

Flood Risk & Management

Flood Risk & the Sequential Test

7.10.7 Areas of Flood Zones 3 and 2 transect the NPA from west to east and south to central. Development will therefore have to be carefully planned in these areas to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

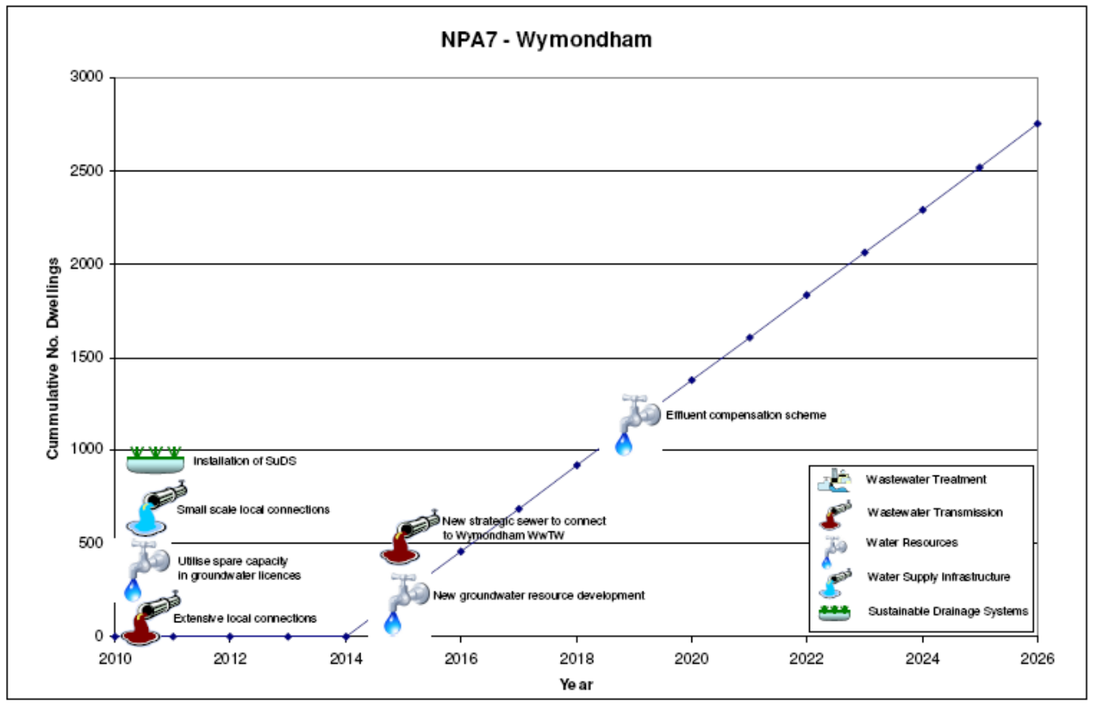


SuDS Suitability

7.10.8 Most of the NPA (except the existing developed area) has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds. Some development to the central and central east areas could be feasible for infiltration SuDs (Swales and Soakaways) and these should be promoted in the first instance

7.10.9 There are no SPZs in the NPA; hence any type of development or SuDS type should be suitable in this NPA in terms of water abstraction protection; however, developers should undertake site specific infiltration tests to determine whether infiltration is possible and therefore whether infiltration drainage techniques or surface water storage SUDS are more appropriate

Figure 7-8: NPA 7 – Infrastructure timeline and phasing



7.11 NPA 8 – South West Sector

Growth Summary

7.11.1 A total of 3,215 new dwellings are proposed for NPA 8 along with 7,235 new jobs.

Wastewater Treatment

7.11.2 Due to the significant levels of proposed growth in this NPA, and limited capacity of nearby WwTW (and limited network capacity in Norwich) wastewater generated at NPA8 will be required to transfer to Whitlingham WwTW making use of the proposed strategic wastewater interceptor sewer.

7.11.3 Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.11.4 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.11.5 There is a strategic sewer linking the NPA to the main Norwich wastewater network, however initial assessment has defined that these sewers downstream (in the vicinity of Cringleford) are already at capacity and cannot accept any further flow. This assessment would need to be confirmed by AWS via detailed network modelling; but for this assessment it is assumed that a new connection is required to the proposed strategic wastewater interceptor sewer.

7.11.6 It is estimated that the earliest that this interceptor sewer would be operational is AMP7 (2020 onwards). This would affect phasing as shown in the infrastructure timeline for the South West Sector (see Figure 7-9).

7.11.7 A further option for providing this additional network would be for the developer(s) to requisition a wastewater sewer to connect the remaining development direct to Whitlingham for use in AMP7.

7.11.8 Additionally, local attenuation could be provided on a site by site basis to allow some early phasing, and until the new interceptor sewer could be built. This would allow a low level of growth (perhaps up to 500 homes) to be built earlier.

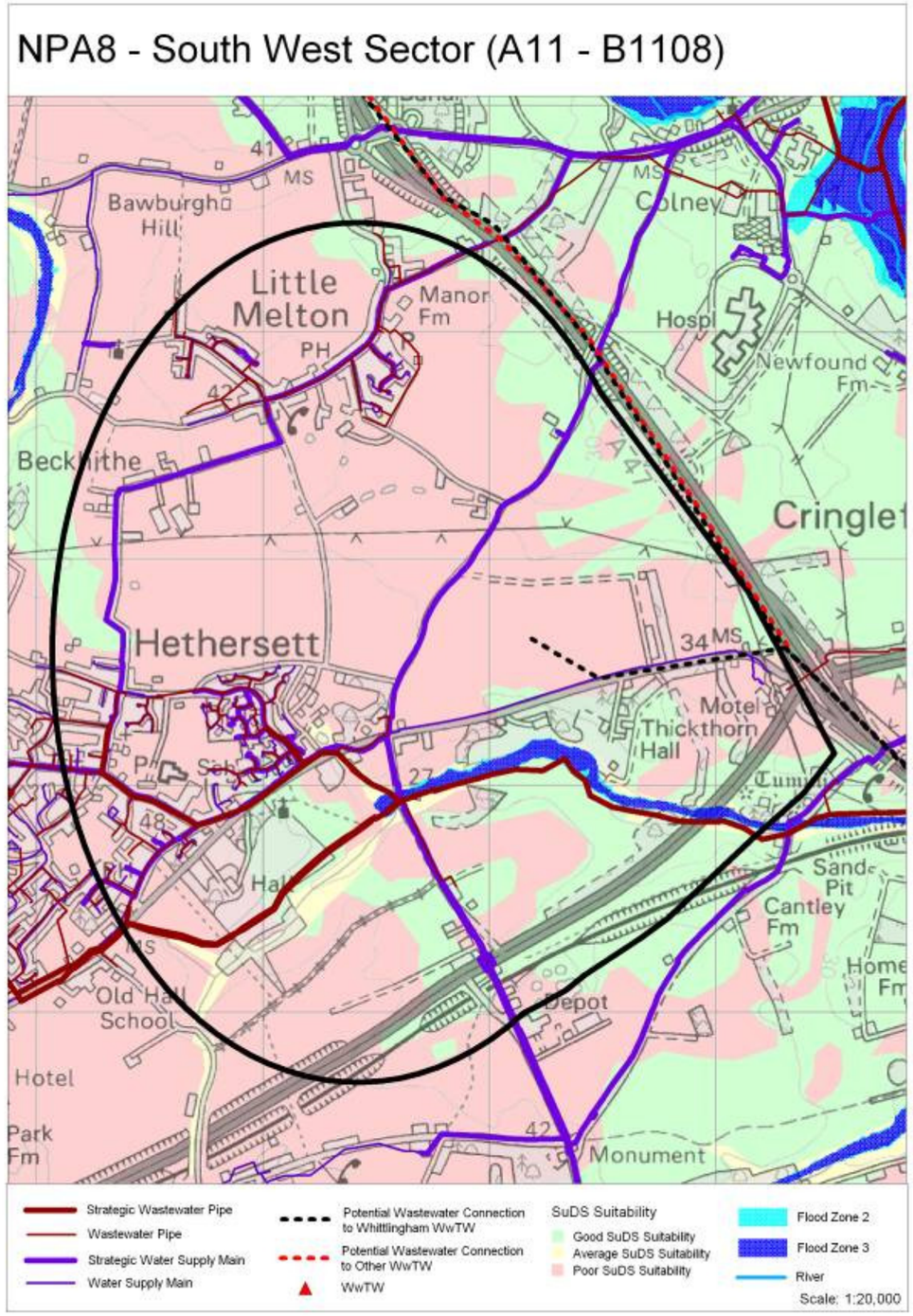
Local Connection

7.11.9 Extensive local connections will be required at developer level for the majority of the NPA other than development in proximity of Hethersett and Little Melton.

Water Resources

Water Supply Infrastructure

7.11.10 The accompanying figure highlights two strategic mains through the centre of the NPA and towards the western boundary of the NPA which should be sufficient to supply the majority of the development with water supply; however, extensive local connections with will be required



Water Neutrality (WN)

7.11.11 Due to limited existing population in the NPA, WN for NPA8 is assessed as part of Norwich city as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

7.11.12 Flood Risk & Management

Flood Risk & the Sequential Test

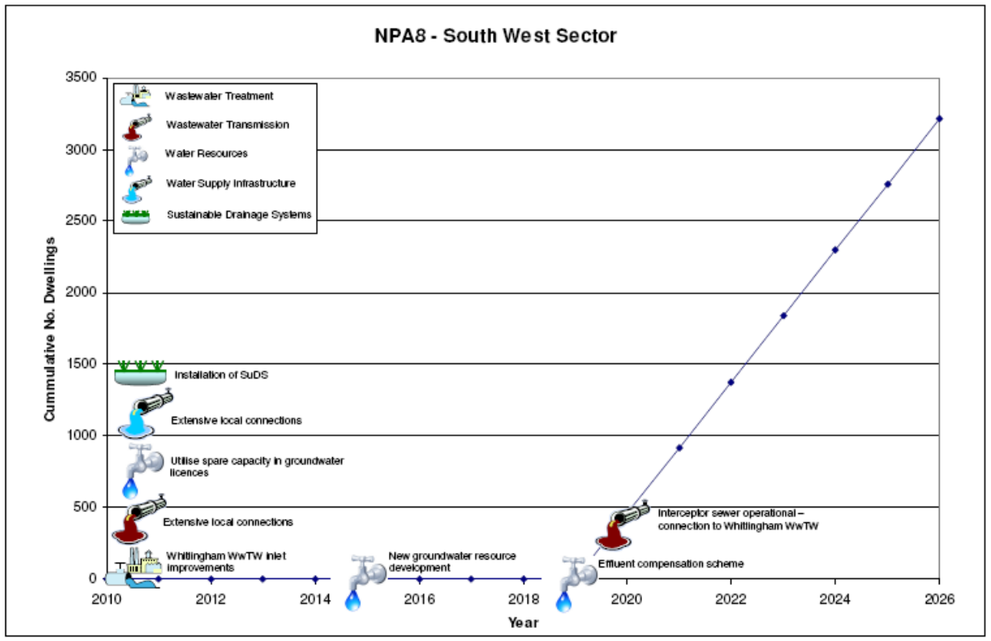
7.11.13 The extent of Flood Zones 3 and 2 within this NPA is minimal hence development should be able to proceed outside of the floodplain and the NPA will hence be able to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS Suitability

7.11.14 Most of the NPA (particularly central) has poor SuDS suitability and is therefore unlikely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy), hence greenfield attenuation requirements will largely have to be met through surface water attenuation features such as detention or balancing ponds.

7.11.15 An SPZ 2 designation to the southeast of the area and the designation of 'total catchment' across most of the NPA may also restrict types of development and certain infiltration types in this location, requiring some form of water quality control such as oil interceptors of runoff (other than clean roof runoff).

Figure 7-9: NPA 8 – Infrastructure timeline and phasing



7.12 NPA 9 – West Sector

Growth Summary

7.12.1 A total of 3,106 new dwellings are proposed for NPA 9, along with 1,315 new jobs.

Wastewater Treatment

7.12.2 Due to the significant levels of proposed growth in this NPA, and limited capacity of nearby WwTW (and limited network capacity in Norwich) wastewater generated at NPA9 will be required to transfer to Whitlingham WwTW making use of the proposed strategic wastewater interceptor sewer.

7.12.3 Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.12.4 Wastewater Treatment will not present a limitation on phasing beyond 2010

Wastewater Transmission

Strategic Connection

7.12.5 There are two strategic sewers linking the NPA to the main Norwich wastewater network, however initial assessment has defined that these sewers downstream (in the vicinity of Cringleford) are already at capacity and cannot accept any further flow. This assessment would need to be confirmed by AWS via detailed network modelling; but for this assessment it is assumed that a new connection is required to the proposed strategic wastewater interceptor sewer.

7.12.6 It is estimated that the earliest that this interceptor sewer would be operational is AMP7 (2020 onwards). This would affect phasing as shown in the infrastructure timeline for the South West Sector (see Figure 7-9).

7.12.7 A further option for providing this additional network would be for the developer(s) to requisition a wastewater sewer to connect the remaining development direct to Whitlingham for use in AMP7;

7.12.8 Additionally, local attenuation could be provided on a site by site basis to allow some early phasing, and until the new interceptor sewer could be built. This would allow a low level of growth (perhaps up to 500) homes to be built earlier.

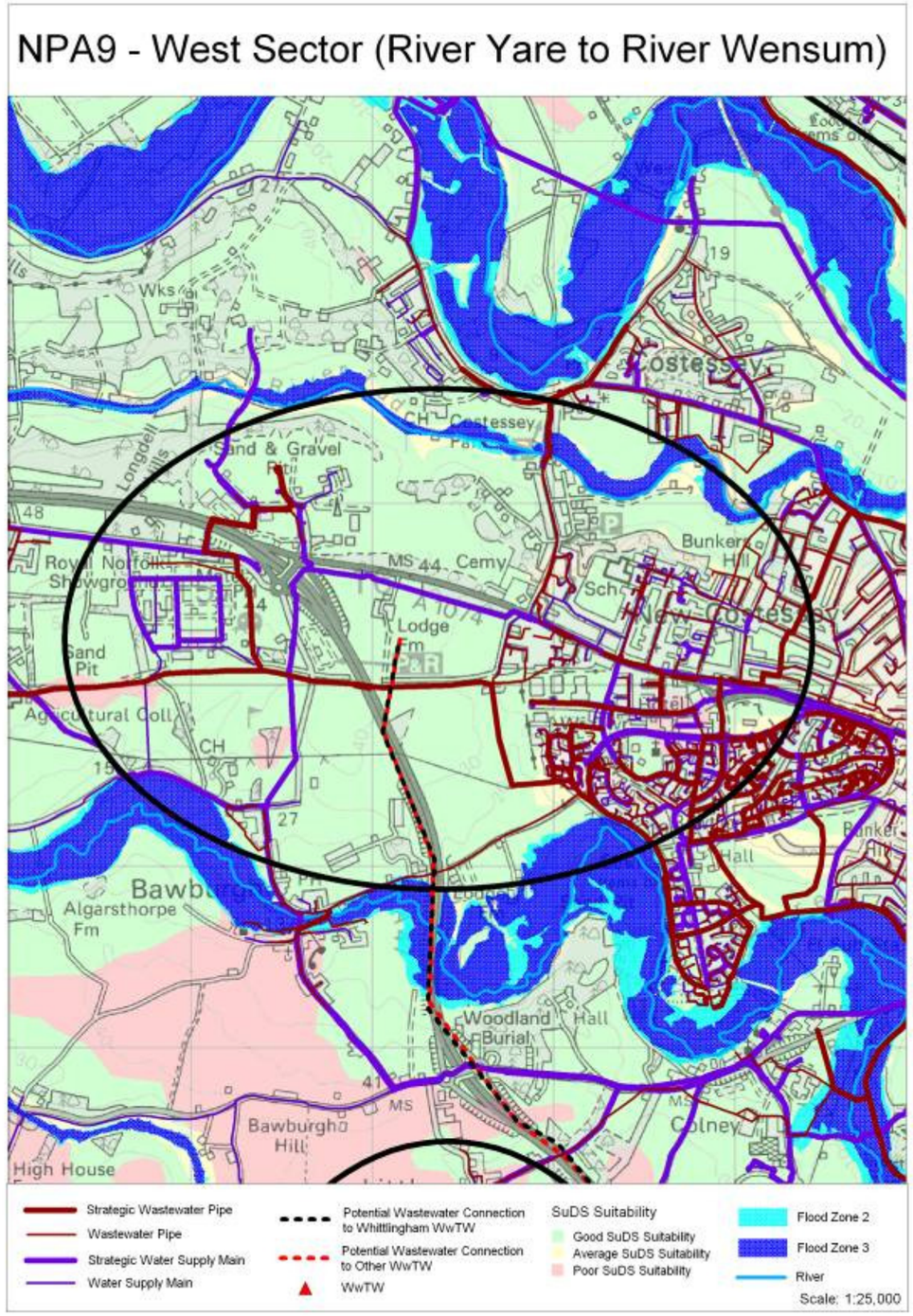
Local Connection

7.12.9 Extensive local connections will be required at developer level for development to the west of the NPA.

Water Resources

Water Supply Infrastructure

7.12.10 The accompanying figure highlights that the NPA is well connected with strategic water mains and is close to the main Heigham WTW; therefore there is sufficient infrastructure to supply the development with water supply, although local connections will be required.



Water Neutrality (WN)

7.12.11 WN for NPA9 is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

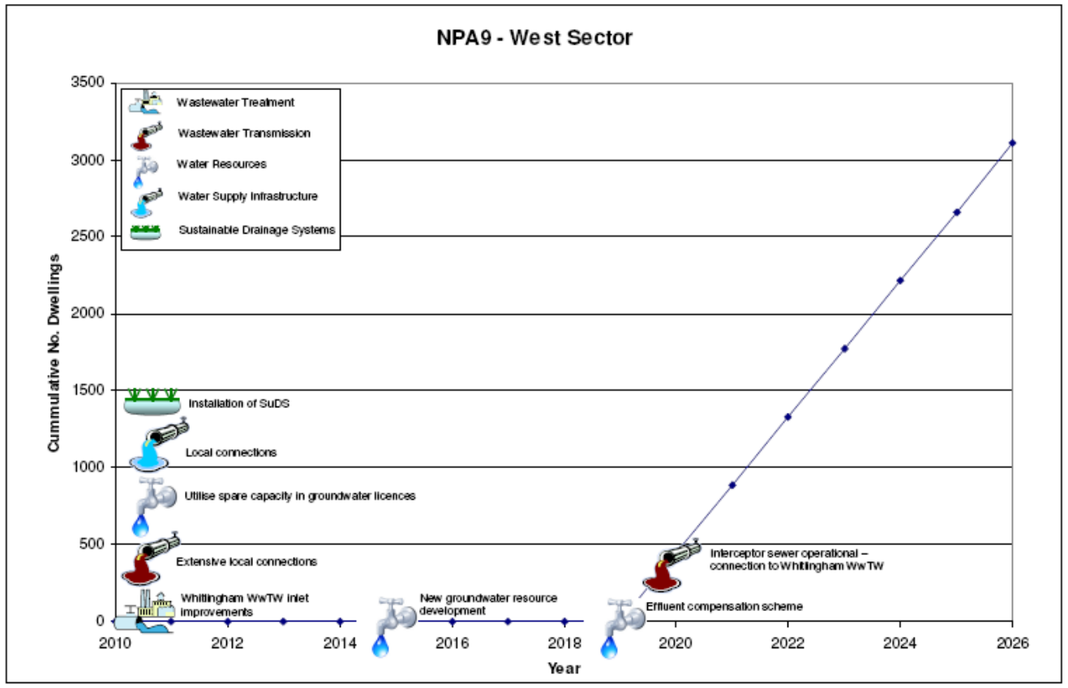
7.12.12 The extent of Flood Zones 3 and 2 within this NPA is fairly minimal; however development in the northern section of the NPA and at the south eastern tip would need to be carefully planned to enable the NPA to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS Suitability

7.12.13 Nearly all of the NPA has good SuDS suitability and is therefore likely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements can be partly met through infiltration SuDs such as Swales and Soakaways.

7.12.14 Runoff that can be infiltrated will however be slightly restricted in the south eastern section of this NPA due to the presence of SPZ 2 and 'total catchment' area of a source protection zone (Costessey abstraction). Infiltration SuDS here will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed.

Figure 7-10: NPA 9 – Infrastructure timeline and phasing



7.13 NPA 10 – North West Sector

Growth Summary

7.13.1 A total of 1,480 new dwellings are proposed for NPA 10.

Wastewater Treatment

7.13.2 Due to the significant levels of proposed growth in this NPA, and limited capacity of nearby WwTW (and limited network capacity in Norwich) wastewater generated at NPA9 will be required to transfer to Whitlingham WwTW making use of the proposed strategic wastewater interceptor sewer.

7.13.3 Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.13.4 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.13.5 There is a strategic sewer linking the south eastern corner of the NPA to the main Norwich wastewater network, however initial assessment has defined that the limited capacity of this sewer downstream will be required for infill growth in Norwich (and Norwich City NPA). This assessment would need to be confirmed by AWS via detailed network modelling. For this assessment it is assumed that a new connection is required to the proposed strategic wastewater interceptor sewer (Northern section).

7.13.6 It is estimated that the earliest that this interceptor sewer would be operational is AMP7 (2020 onwards). This would affect phasing as shown in the infrastructure timeline for the South West Sector (see Figure 7-9).

7.13.7 A further option for providing this additional network would be for the developer(s) to requisition a wastewater sewer to connect the remaining development direct to Whitlingham for use in AMP7;

7.13.8 Additionally, local attenuation could be provided on a site by site basis to allow some early phasing, and until the new interceptor sewer could be built. This would allow a low level of growth (perhaps up to 500) homes to built earlier.

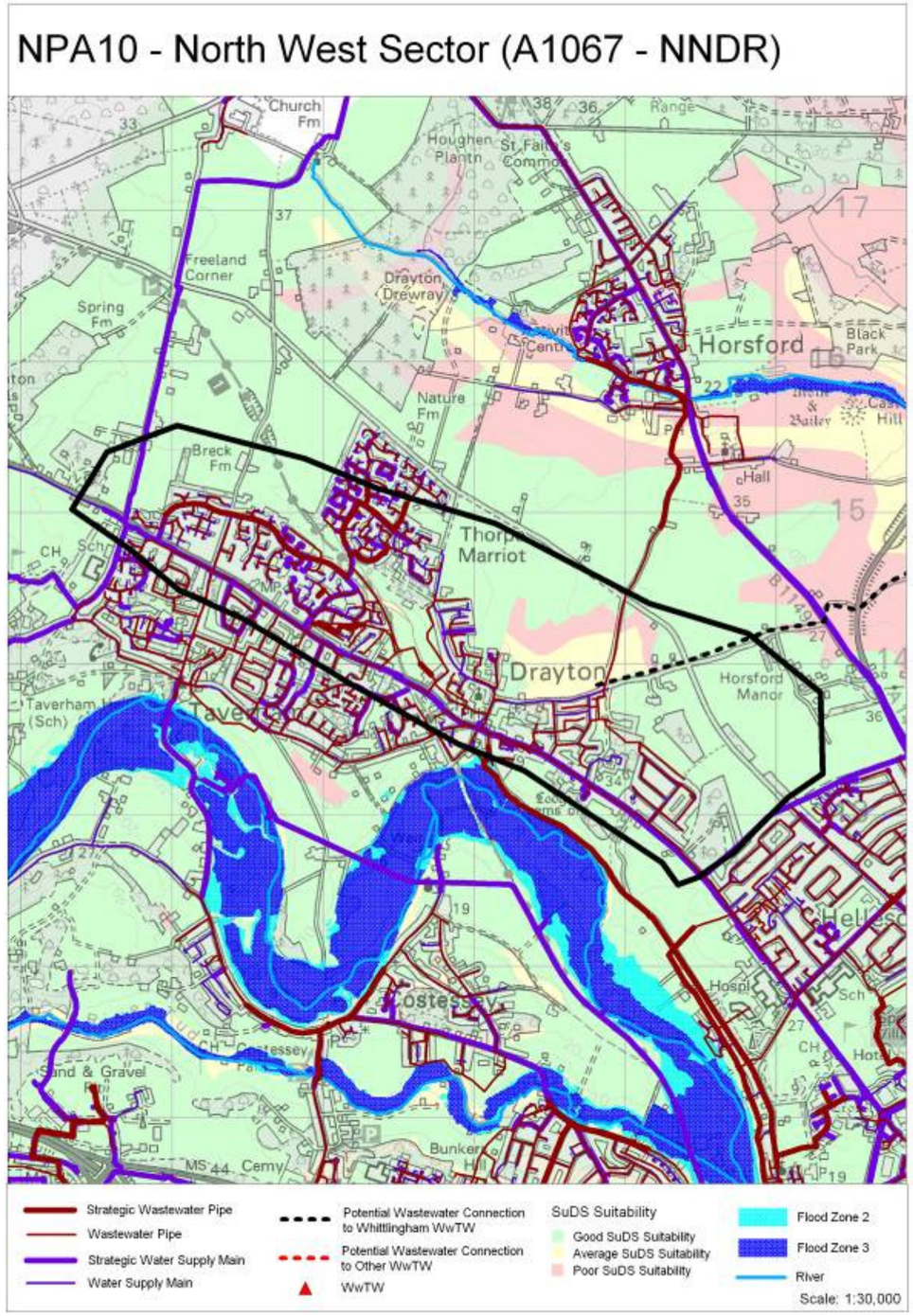
Local Connection

7.13.9 Local connections will be required at developer level in the NPA

Water Resources

Water Supply Infrastructure

7.13.10 The accompanying figure highlights that the NPA is well connected with strategic mains and is close to the main Heigham WTW; therefore there is sufficient infrastructure to supply the development with water supply, although local connections will be required in some areas.



Water Neutrality (WN)

7.13.11 WN for NPA10 is assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

Flood Risk & the Sequential Test

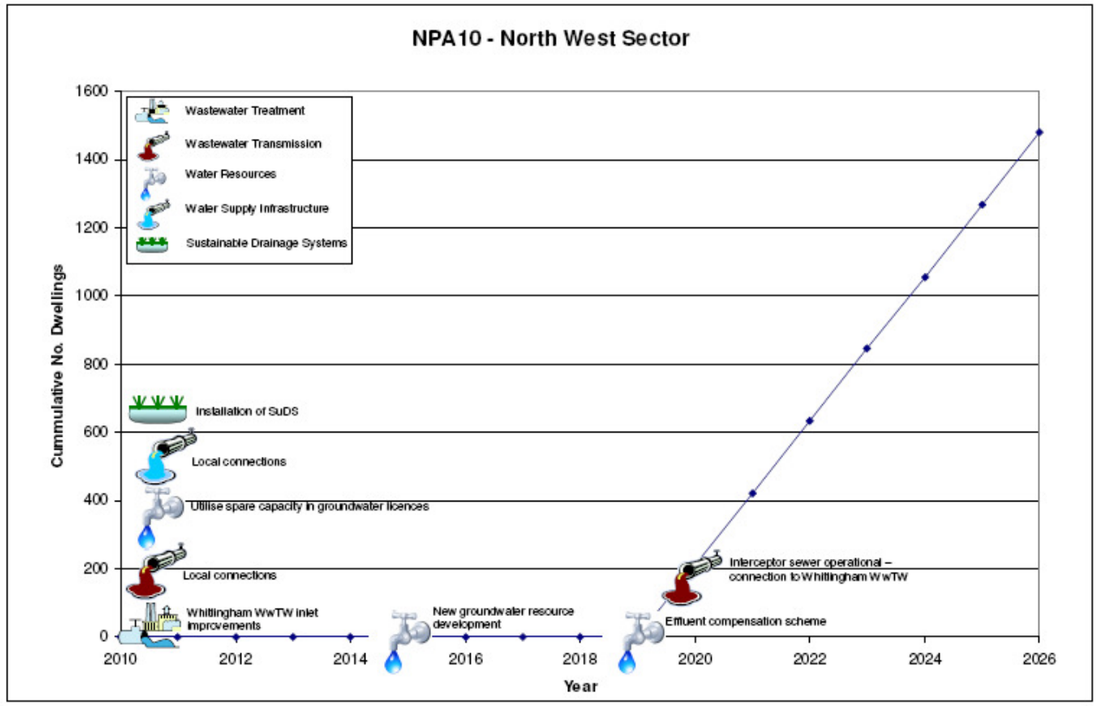
7.13.12 There are no designated Flood Zones 3 and 2 within this NPA.

SuDS suitability

7.13.13 Nearly the entire NPA has good SuDS suitability except a very small area to the north of Drayton. Therefore the NPA is likely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements can be partly met through infiltration SuDs such as Swales and Soakaways.

7.13.14 Runoff that can be infiltrated will however be slightly restricted to the far east and west of the NPA of a 'total catchment' area (and SPZ 2 in the west) of a source protection zone (abstraction to the west of the NPA). Infiltration SuDS here will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed.

Figure 7-11: NPA 10 – Infrastructure timeline and phasing



7.14 NPA11 – Norwich City Area

Growth Summary

7.14.1 A total of 8,911 new dwellings are proposed for Norwich City area.

Wastewater Treatment

7.14.2 Due to the significant levels of proposed growth in the City, and limited capacity of the city wastewater network, wastewater generated in the city will be required to transfer to Whitlingham WwTW making use of the proposed strategic wastewater interceptor sewer to the south.

7.14.3 Whitlingham has been shown to have sufficient capacity to accept growth from all locations in the study area without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Improvements to the inlet works will commence in early AMP5 (2010) to allow additional flow to reach the WwTW.

7.14.4 Wastewater Treatment will not present a limitation on phasing beyond 2010.

Wastewater Transmission

Strategic Connection

7.14.5 Several strategic sewers are located in the City; but the view of AWS (and one of the key assumptions of this study, endorsed by Scott Wilson independent calculations) is that there is limited capacity in the existing Norwich network. The capacity analysis undertaken for the Stage 2a WCS suggests that approximately 1,500 new homes could be connected to the existing network linking to Whitlingham

7.14.6 For the remaining 7,100 dwellings, the only option is to provide a new connection to the proposed strategic wastewater interceptor sewer (South) which would limit significant growth until AMP7 (2020) at the earliest. The connections would also have to be requisitioned by the developer(s) and contributions made to the strategic interceptor sewer.

7.14.7 However, development up to 2020 could be phased in conjunction with AWS by developers commissioning AWS to undertake modelling assessments for various development locations to ascertain of some limited capacity is available in some locations and whether smaller scale reinforcement funded by the developer could allow some degree of early phasing.

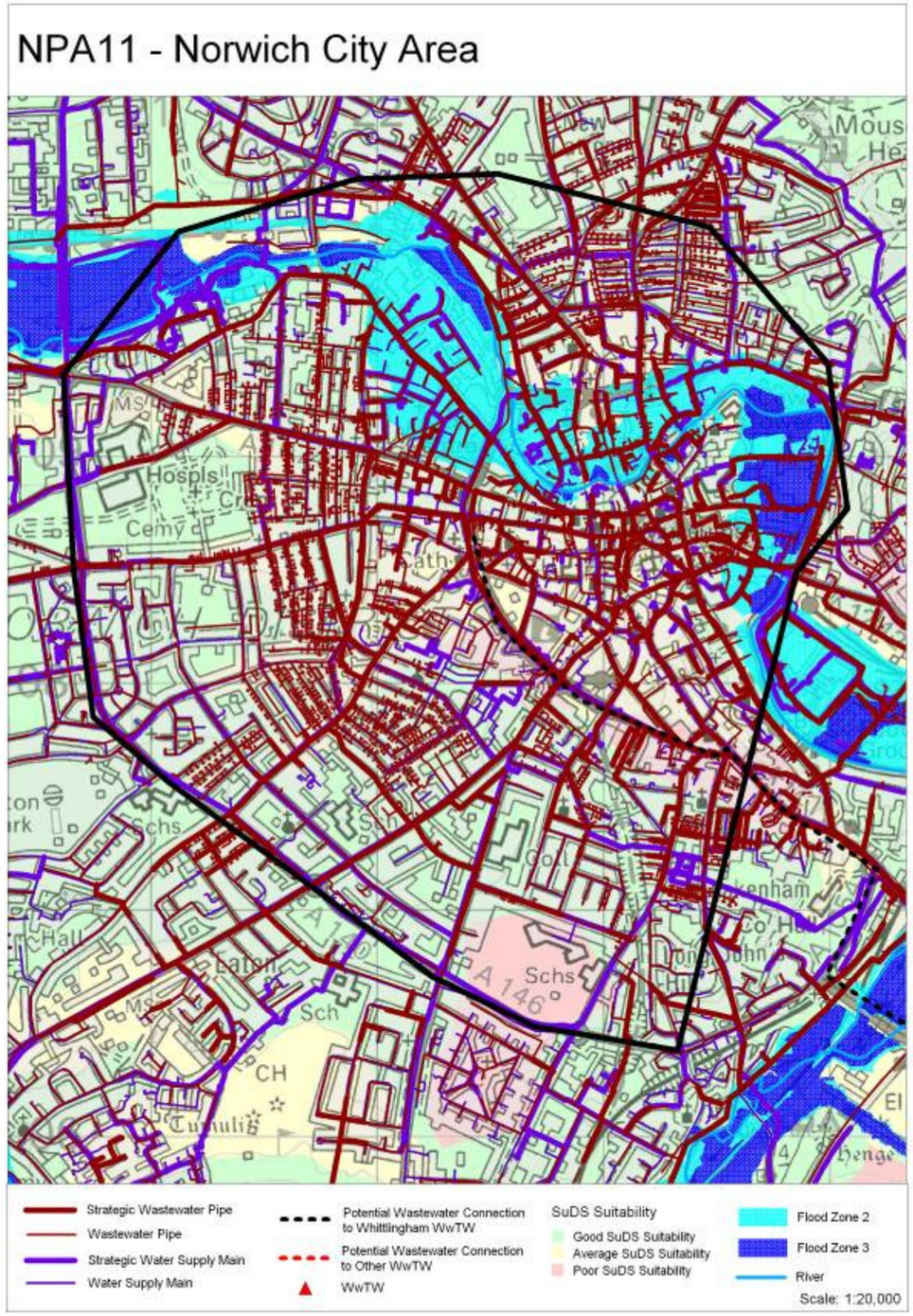
Local Connection

7.14.8 Limited local connections will not be required at developer level due to the well connected nature of the city's sewer network.

Water Resources

Water Supply Infrastructure

7.14.9 Extensive local connections will not be required at developer level due to the well connected nature of the city's water supply network.



Water Neutrality (WN)

7.14.10 WN for NPA11 is combined with the surrounding NPAs and as assessed as part of Norwich City as a whole. WN is potentially feasible if new homes in this NPA achieve code level 5 or 6 under the CfSH and existing homes within Norwich adopt either low flow toilets or showers, or adopt universal metering combined with a range of low water use fittings.

Flood Risk & Management

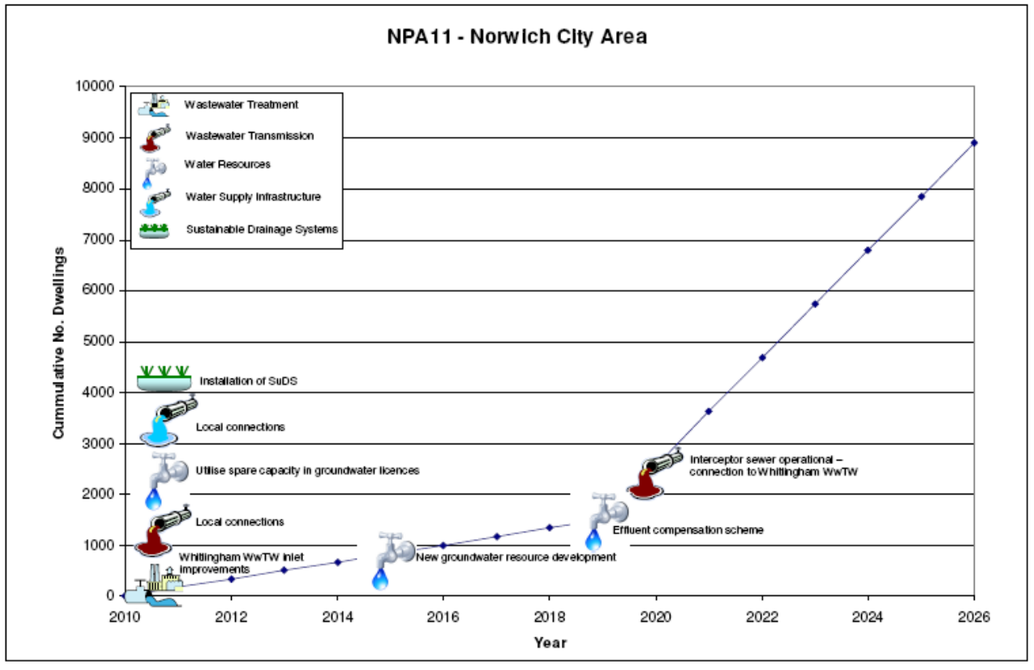
Flood Risk & the Sequential Test

7.14.11 The extent of Flood Zones 3 and 2 within this NPA is significant for sections to the north of proposed zone of development; therefore, development here will need to be carefully planned (and utilise the Level 2 SFRA) to enable the NPA to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.14.12 The majority of the NPA has good SuDS suitability and is therefore likely to be suitable for infiltration SuDS (the preferred SuDS option in the hierarchy); hence greenfield attenuation requirements can be partly met through infiltration SuDS such as Swales and Soakaways. However, the NPA is entirely covered by a SPZ, including a large zone of SPZ 1 in the centre which would restrict anything other than clean roof runoff to ground. Infiltration SuDS surrounding the centre will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed. Delivery of SuDS could therefore be problematic given space constraints and careful designing and planning (including tight policy) will be required to ensure no increase in flood risk as a result of development.

Figure 7-12: NPA 11 (Norwich City) – Infrastructure timeline and phasing



7.15 RPA 1 – Reepham

Growth Summary

7.15.1 A total of 241 new dwellings are proposed for Reepham.

Wastewater Treatment

7.15.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, development in RPA1 will have wastewater treated at the existing WwTW at Reepham. This will require an increase in the volume of discharge to be consented, but it is considered that transferring flows a long distance to the next nearest WwTW is not feasible

7.15.3 Modelling has shown that it will not be possible to accommodate all of the growth and still meet the requirements of the WFD and HD downstream in the Blackwater Drain within the limits of BATNEEC. If all new wastewater flow was treated at the WwTW, the downstream quality of the Blackwater Drain would fail on Ammonia and P WFD targets and fail on HD targets for P in the Wensum.

7.15.4 Treating wastewater would require an innovative solution such as reedbed wetlands, discharge to ground or a high specification package treatment plant. These options would need to be investigated on a site specific basis if the residual 492 dwelling target is to be met. Alternatively, if targets for WFD and HD compliance are moved to the downstream Wensum (ignoring the Blackwater drain), it is possible that compliance could be achieved. However, this would require policy negotiations with the EA.

7.15.5 It is considered that wastewater treatment currently presents an overall constraint to growth and phasing in RPA1.

Wastewater Transmission

Strategic Connection

7.15.6 The main sewer feeding the WwTW has an estimated capacity of 400 dwellings; sufficient to meet the requirements of proposed growth. Wastewater transmission would therefore not pose a constraint to new development; this assessment would have to be verified by network modelling via a pre-development enquiry.

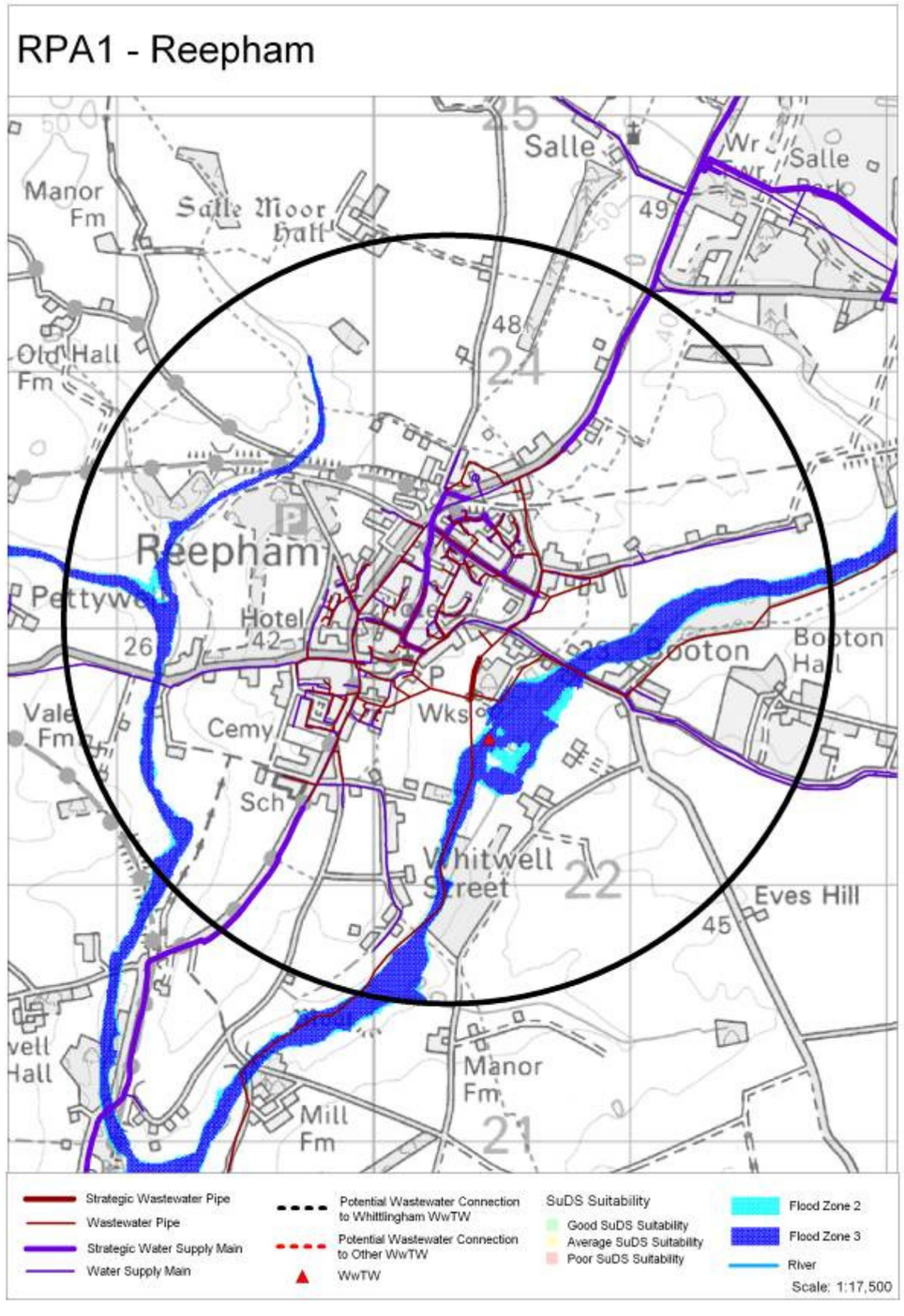
Local Connection

7.15.7 Local connections are likely to be required at a developer level for areas not immediately next to the town. Network modelling may also be required to determine feasibility for connecting to smaller connecting sewers in the town.

Water Resources

Water Supply Infrastructure

7.15.8 The accompanying figure highlights that there is a single water main servicing the area that should be sufficient to supply water to the proposed development. Local connections will be required with the potential for some small pumping stations.



Water Neutrality (WN)

7.15.9 Reepham has been assessed for WN as a single town. WN is theoretically feasible for the town even with development at codes 1 & 2 on the CfSH, so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving WN for the town as a whole is a definite possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.

Flood Risk & Management

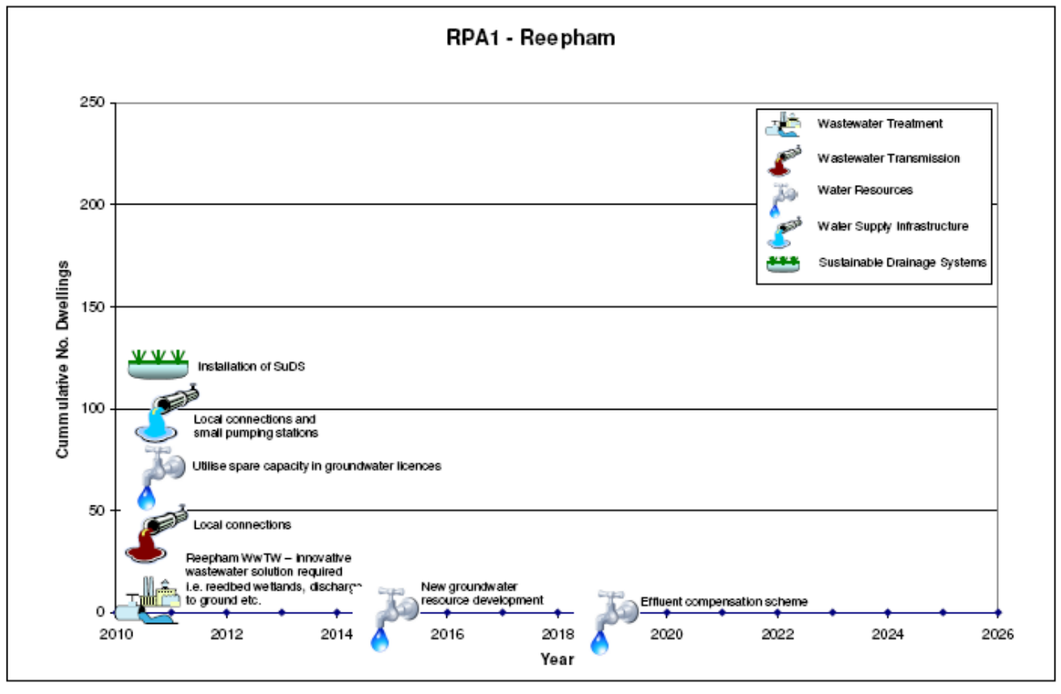
Flood Risk & the Sequential Test

7.15.10 The extent of Flood Zones 3 and 2 within this area is fairly minimal; however development to the southeast and west of the town would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.15.11 Reepham is not underlain by any SPZs; however, pollution control measures may also be required outside of SPZs, depending upon the nature of the development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-13: RPA1 – Infrastructure timeline and phasing



7.16 RPA 2 – Aylsham

Growth Summary

7.16.1 A total of 600 new dwellings are proposed for Aylsham.

Wastewater Treatment

7.16.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, development in RPA2 will have wastewater treated at the existing WwTW at Aylsham.

7.16.3 Aylsham has been shown to have sufficient capacity to accept growth from RPA2 without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. However, the WwTW at Aylsham has indentified process capacity constraints which would require upgrading to meet **existing consents;** an improvement scheme is due to take place during AMP5, hence the full capacity should be available to use by 2015.

7.16.4 Wastewater Treatment will not present a limitation on phasing beyond 2015

Wastewater Transmission

Strategic Connection

7.16.5 Aylsham has a well connected wastewater network system with two main sewers (north and south) feeding the WwTW. Approximate capacity assessments have determined a smaller capacity to the north sewer (419 dwellings) and hence not all the development can be accommodated in this sewer. However, the southern sewer has an estimated capacity of nearly 3,000 dwellings; sufficient to meet the requirements of the proposed growth.

Local Connection

7.16.6 Extensive local connections will not be required at developer level due to the well connected nature of the town's sewer network.

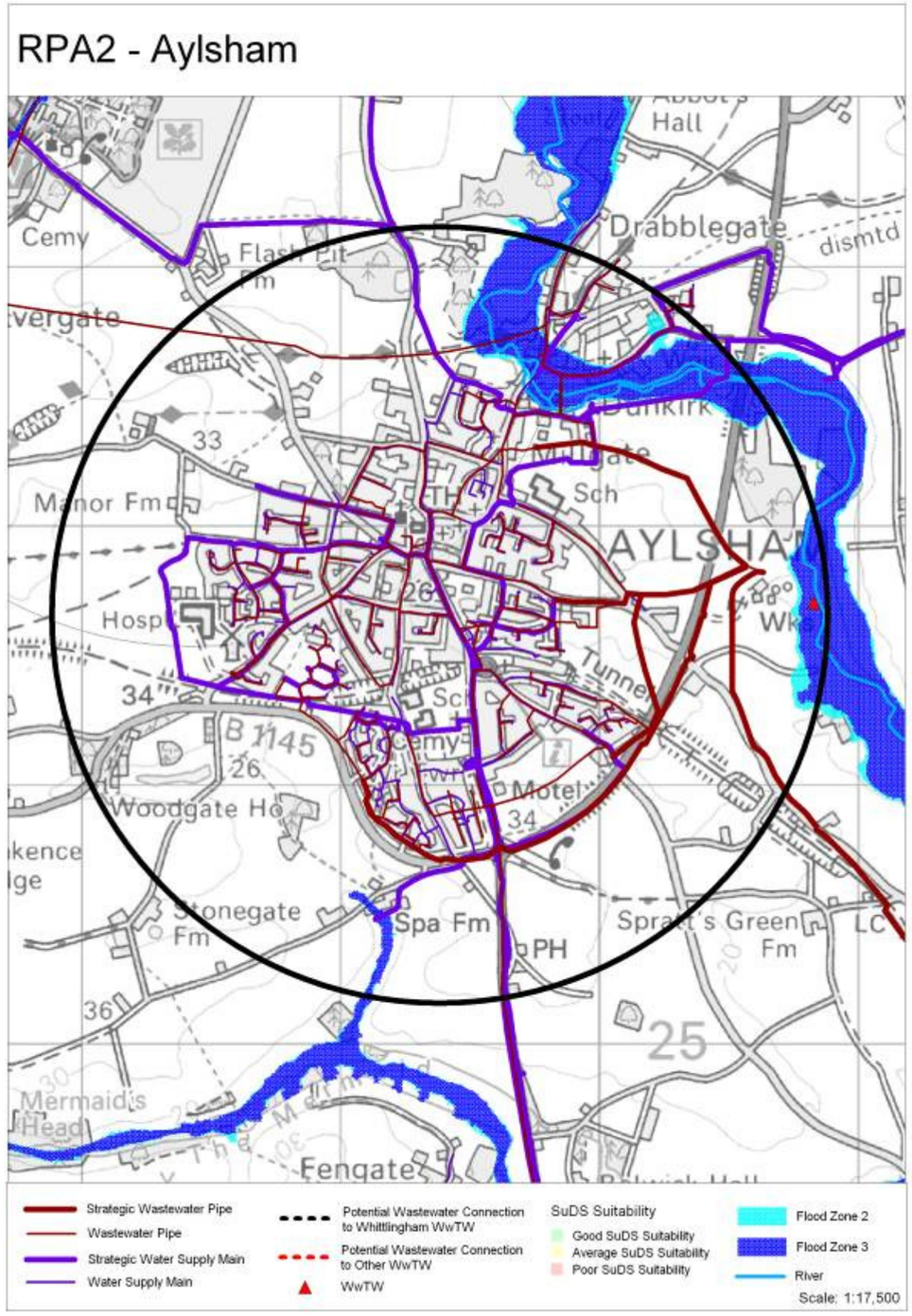
Water Resources

Water Supply Infrastructure

7.16.7 The accompanying figure highlights that there is a single (but well connected) water main servicing the area that should be sufficient to supply water to the proposed development. However, local connections will be required.

Water Neutrality (WN)

7.16.8 Aylsham has been assessed for WN as a single town. WN is theoretically feasible for the town even with development at codes 1 & 2 on the CfSH, so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving WN for the town as a whole is a definite possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.



Flood Risk & Management

Flood Risk & the Sequential Test

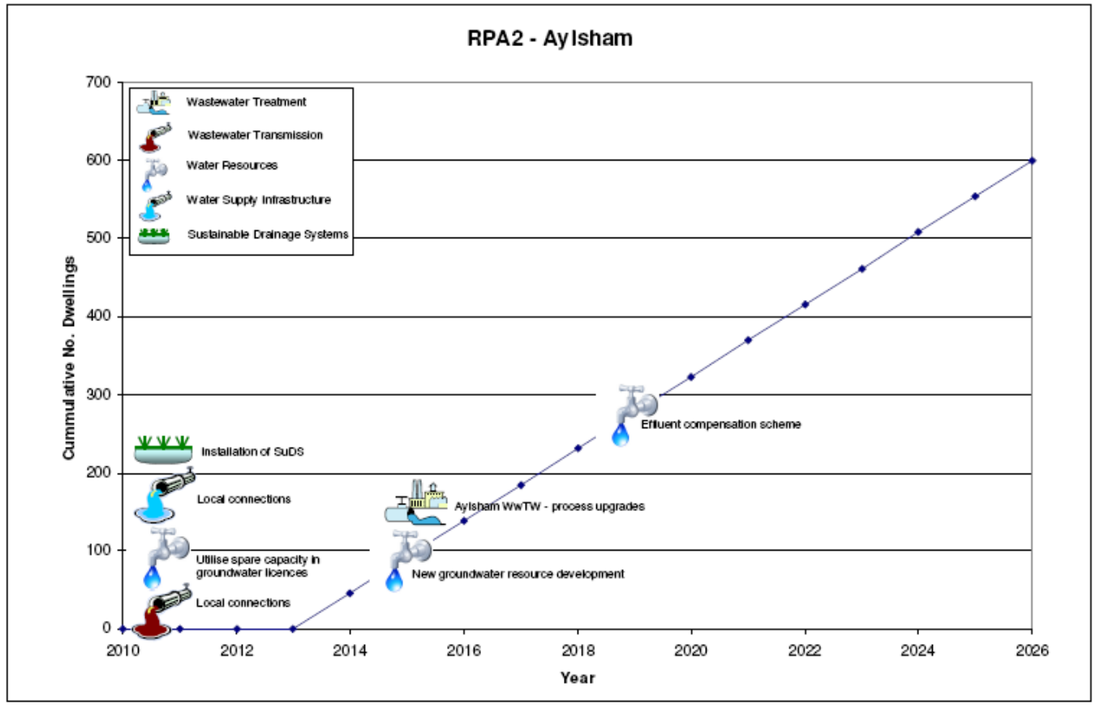
7.16.9 The extent of Flood Zones 3 and 2 within this area is fairly minimal; however development to the northeast of the town would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.16.10 The town's northern section area is entirely covered by a SPZ, including two zones of SPZ 1 near the town centre which would restrict development types here and will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed. Delivery of SuDS could therefore be problematic given space constraints and careful designing and planning (including policy) will be required to ensure no increase in flood risk as a result of development) in the north of the town.

7.16.11 Restrictions on the type or use of SuDS in the south of the main town are unlikely to be onerous if the area is suitable for infiltration; pollution control measures may also be required outside of SPZs, depending upon the nature of development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-14: RPA2 – Infrastructure timeline and phasing



7.17 RPA 3 – Wroxham

Growth Summary

7.17.1 A total of 211 new dwellings are proposed for Wroxham.

Wastewater Treatment

7.17.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, development in RPA3 will have wastewater treated at the existing WwTW at Belaugh.

7.17.3 Belaugh has been shown to have sufficient capacity to accept growth from RPA (and part growth from NPA3a) without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required. Some growth from the North Norfolk district (Hoveton) is also expected to utilise Belaugh WwTW. Dependent on the level of growth from outside the GNDP area, more flow may need to be transferred to Whitlingham WwTW from NPA3a to allow growth in RPA3 to go ahead; however, this will not affect the wastewater network capacity which will be able to accept the flow and AWS have indicated capacity to take more growth at Whitlingham WwTW within the current flow consent than is planned for in this WCS.

7.17.4 Wastewater Treatment will not present a limitation on phasing beyond 2010

Wastewater Transmission

Strategic Connection

7.17.5 Wroxham has a reasonably well connected wastewater network system with a main sewer feeding Belaugh WwTW. Approximate capacity assessments have determined sufficient capacity (up to 700 dwellings) to meet the requirements of the proposed growth.

Local Connection

7.17.6 Extensive local connections will only be required at developer level if development is proposed at distance from the existing town

Water Resources

Water Supply Infrastructure

7.17.7 The accompanying figure highlights that there is a single water main servicing the area that should be sufficient to supply water to the proposed development. Local connections will be required with potential for some local pumping.

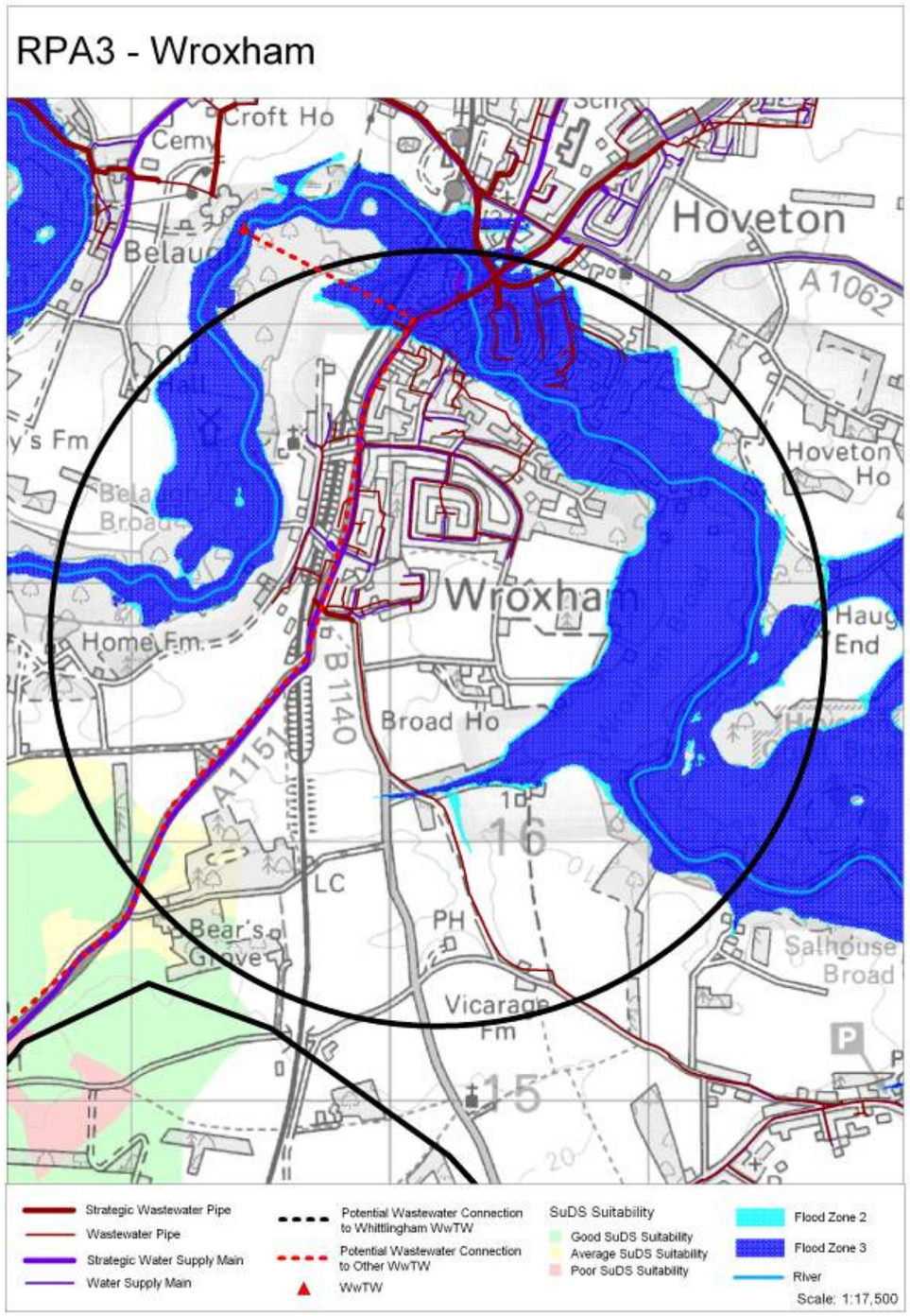
Water Neutrality (WN)

7.17.8 Wroxham has been assessed for WN as a single town. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the town even with development at codes 1 & 2 on the CfSH, so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving WN for the town as a whole is a definite possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.

Flood Risk & Management

Flood Risk & the Sequential Test

7.17.9 The extent of Flood Zones 3 and 2 within this area is fairly extensive. Development in the north and east of the town would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

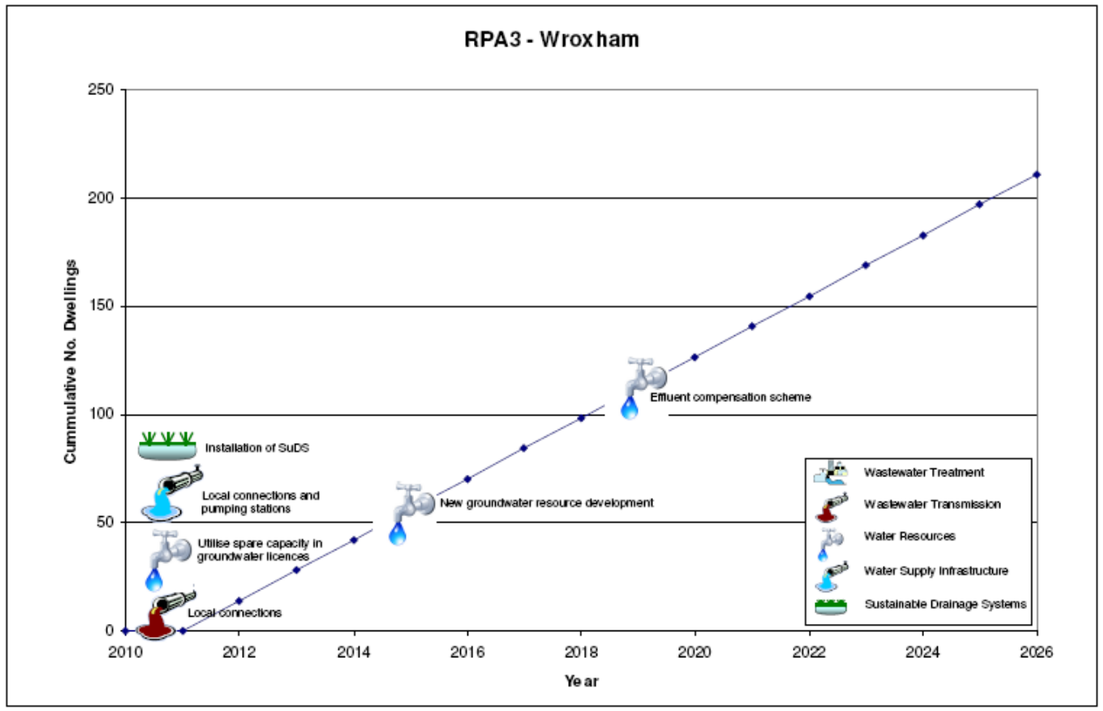


SuDS Suitability

7.17.10 The town's western area is covered by a SPZ 2 and 'total catchment', and is close to a SPZ 1 for an abstraction immediately to the west of the town. This would restrict development type to the west of the town and will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed.

7.17.11 Restrictions on the type or use of SuDS in the east of the main town are unlikely to be onerous if the area is suitable for infiltration; however, pollution control measures may also be required outside of SPZs, depending upon the nature of the development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-15: RPA3 – Infrastructure timeline and phasing



7.18 RPA 4 – Acle

Growth Summary

7.18.1 A total of 241 new dwellings are proposed for Acle.

Wastewater Treatment

7.18.2 To make use of capacity at local WwTW and to reduce pumping and transmission costs, the wastewater strategy suggests that development in RPA4 would have to have wastewater treated at the existing WwTW at Acle. . This will require an increase in the volume of discharge to be consented, but it is considered that transferring flows a long distance to the next nearest WwTW is not feasible

7.18.3 Modelling has shown that it will not be possible to accommodate all of the growth and still meet the requirements of the WFD due to the limitations of the P target within BATNEEC. HD downstream targets could be reached with consent of 2mg/l (within BATNEEC). Limiting to a BATNEEC limit of 1mg/l would result in only a 4% deterioration downstream, (considered to be within the 10% policy of the Environment Agency) and load standstill modelling suggests that a 2mg/l would meet requirement of the HD. If the deterioration of 4% was acceptable, growth could take place, but with the requirement for significant process upgrades which would take until the middle of AMP6 (at the earliest – 2020) to be in place.

7.18.4 Alternatively, if the deterioration is not acceptable, treating wastewater would require an innovative solution such as reedbed wetlands, discharge to ground or a high specification package treatment plant. These options would need to be investigated on a site specific basis.

7.18.5 It is considered that wastewater treatment currently presents an overall constraint to growth and phasing in RPA4. Best case would allow development to take place but not until 2020 when process upgrades could be put in place. Worst case, an innovative site solution would be required.

Wastewater Transmission

Strategic Connection

7.18.6 Acle has a reasonably well connected wastewater network system with two main sewers feeding the WwTW. Both sewers have an approximate capacity sufficient to accept flow from the proposed additional dwellings without the need for strategic upgrades, although this would have to be confirmed on a development by development basis via network modelling checks with AWS.

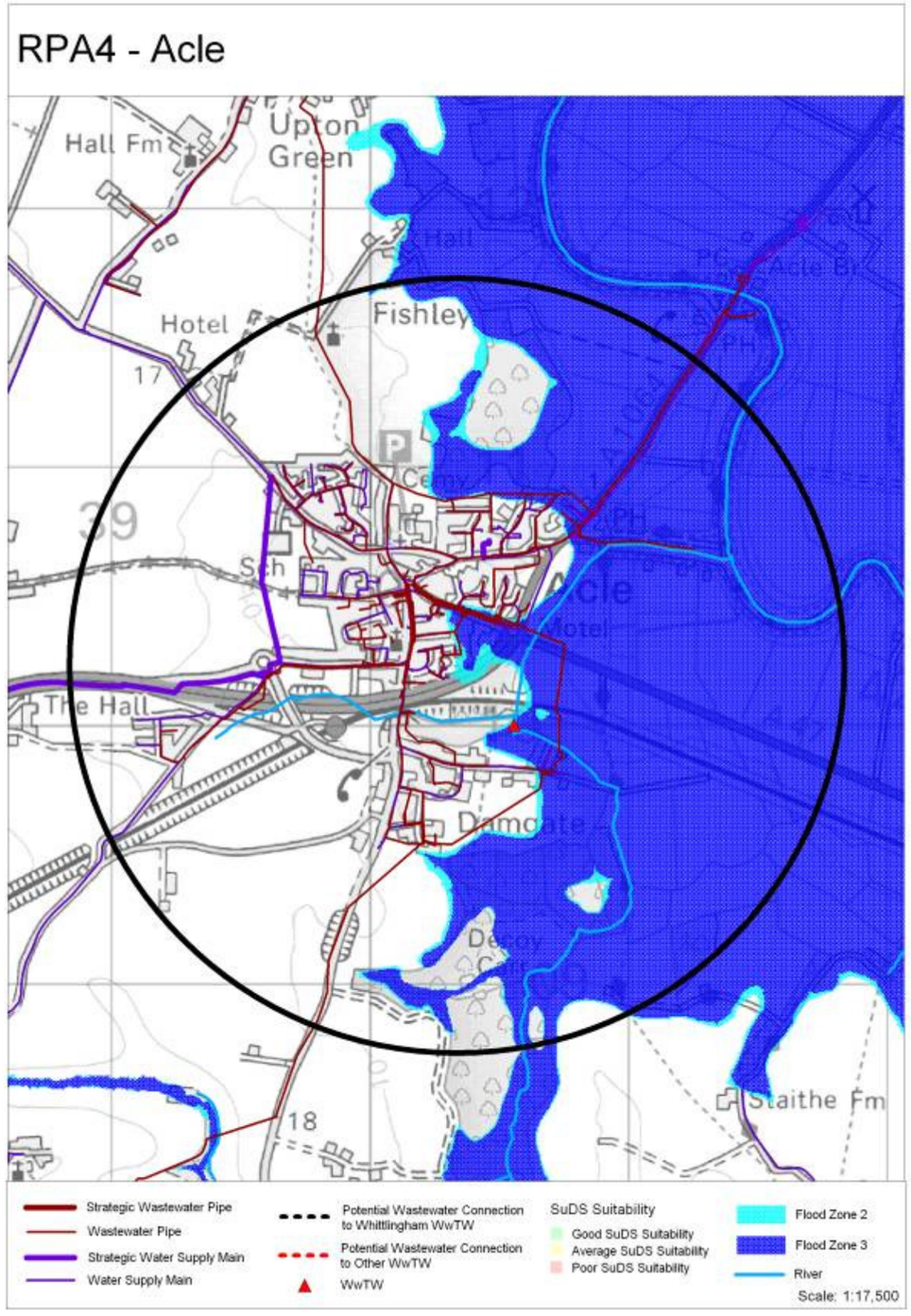
Local Connection

7.18.7 Extensive local connections will only be required at developer level if development is proposed at distance from the existing town.

Water Resources

Water Supply Infrastructure

7.18.8 The accompanying figure highlights that there is a single water main servicing the town coming in from the west and this main should be sufficient to supply water to the proposed development. However, local connections will be required.



Water Neutrality (WN)

7.18.9 Acle has been assessed for WN as a single town. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the town even with development at codes 1 & 2 on the CfSH, so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving WN for the town as a whole is a definite possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.

Flood Risk & Management

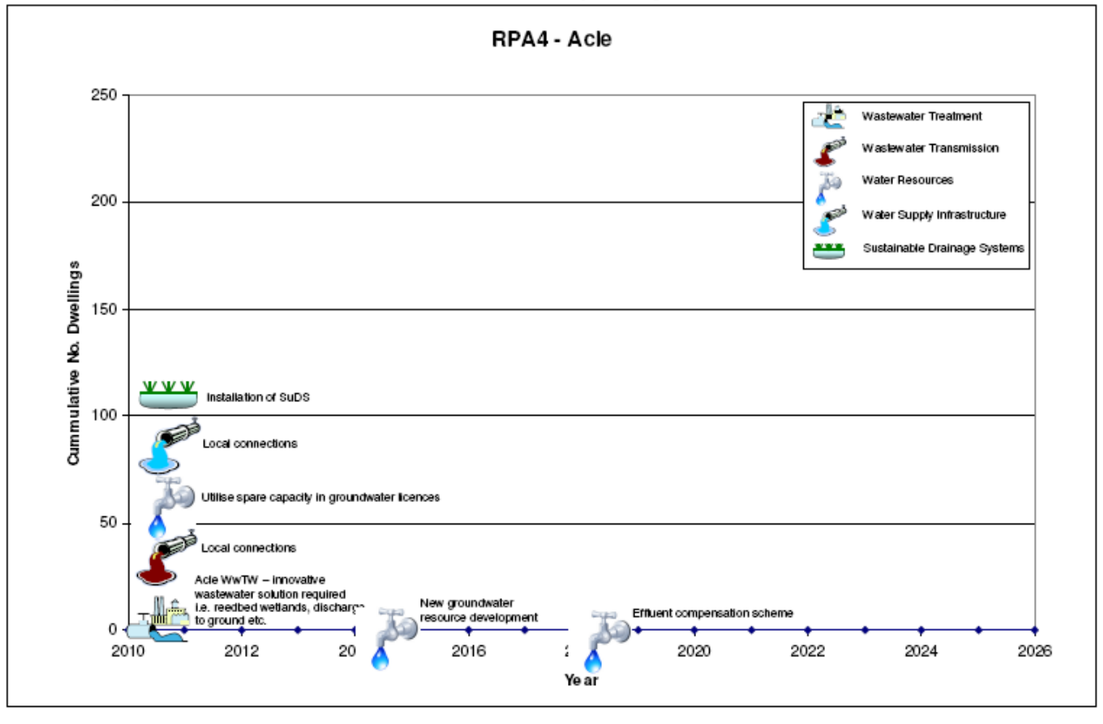
Flood Risk & the Sequential Test

7.18.10 The extent of Flood Zones 3 and 2 within this area is extensive with the eastern section of the proposed development area affected by Flood Zone 3. To meet with the Sequential Test requirements, development in this area will be required to be located to the west of the town. Specific flood mitigation will be required if development areas east of the town are proposed, including finished floor raising and flood compensation.

SuDS Suitability

7.18.11 The town is not located over an SPZ, hence there should be few restrictions on development type or infiltration of runoff (other than clean roof runoff) if infiltration SuDS are feasible.

Figure 7-16: RPA4 – Infrastructure timeline and phasing



7.19 RPA 5 – Hingham

Growth Summary

7.19.1 A small total of 148 new dwellings are proposed for Hingham.

Wastewater Treatment

7.19.2 Hingham has no significant WwTW within the village; hence it is proposed to transfer the flow to nearby Wymondham WwTW located to the east of the village which has volumetric capacity in its flow consent to accept the additional flow (along with NPA7).

7.19.3 Modelling has shown that Wymondham WwTW has sufficient capacity to accept growth from both Wymondham and Hingham without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required and no impact on phasing is anticipated as a result of wastewater treatment

Wastewater Transmission

Strategic Connection

7.19.4 Hingham has a reasonably well connected wastewater network system with a strategic sewer running from the centre of the village to Wymondham WwTW. All sewers connecting to the strategic sewer leaving the town have sufficient capacity to accept flow from the proposed new development and the strategic sewer downstream would appear to have sufficient capacity up to 1,200 new properties. Immediate connection and hence phasing is therefore possible in Hingham, although this would have to be confirmed on a development by development basis via network modelling checks with AWS.

Local Connection

7.19.5 Extensive local connections will be required at developer level if development is proposed at distance from the existing village, although development of any of the roads entering and leaving the village will have easier connection points.

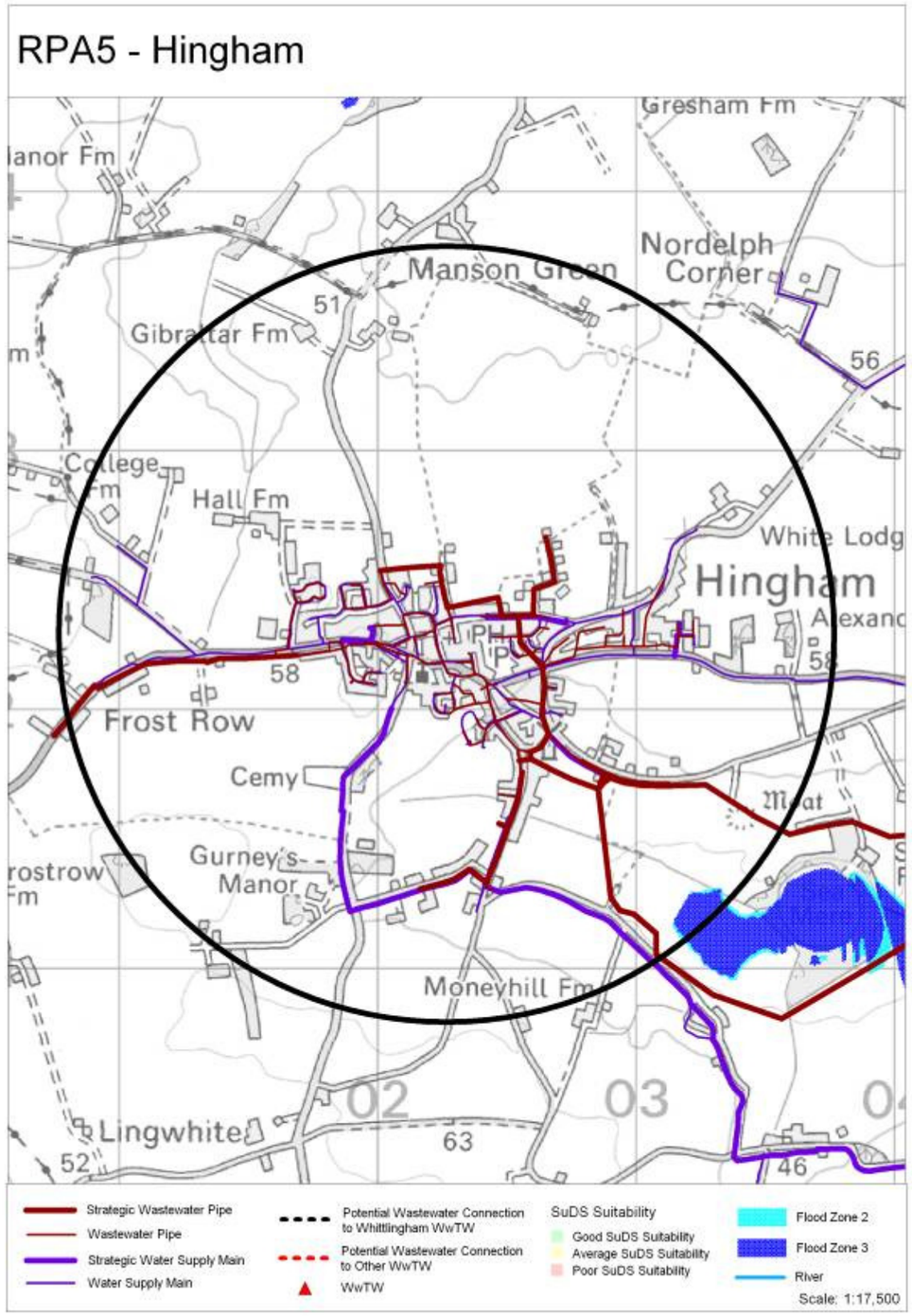
Water Resources

Water Supply Infrastructure

7.19.6 The accompanying figure highlights that there is a single water main servicing the village coming in from the south and this main should be sufficient to supply water to the proposed development. Local connections will be required with the potential for local pumping stations

Water Neutrality (WN)

7.19.7 Hingham has been assessed for WN as a single village. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the village even with new development using similar water demand as current homes so long as metering is introduced across the village for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving less water use overall (than current) for the village (after development) would be a possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.



Flood Risk & Management

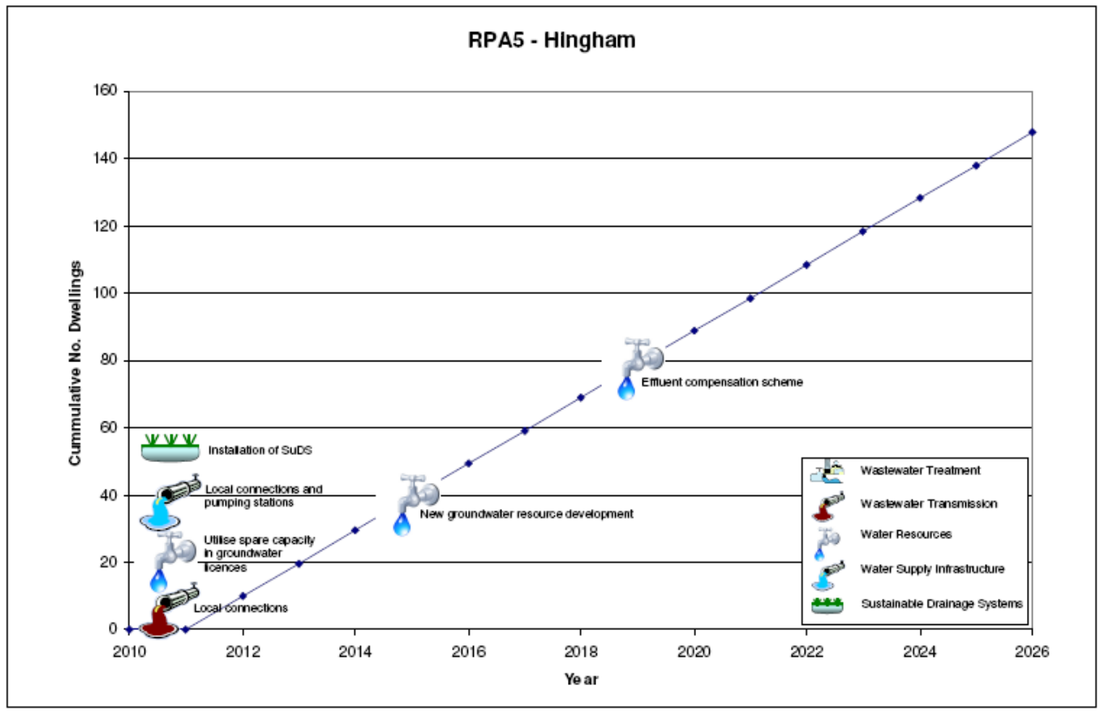
Flood Risk & the Sequential Test

7.19.8 The extent of Flood Zones 3 and 2 within this area is minimal; however a small section close to Hingham plantation is located within Flood Zones 2 & 3 and hence any development area proposed here would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.19.9 The village is not located over an SPZ, hence there should be few restrictions on development type or infiltration of runoff (other than clean roof runoff) if infiltration SuDS are feasible; however, pollution control measures may also be required outside of SPZs, depending upon the nature of development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-17: RPA5 – Infrastructure timeline and phasing



7.20 RPA 6 – Diss

Growth Summary

7.20.1 A total of 537 new dwellings are proposed for Diss.

Wastewater Treatment

7.20.2 To make use of existing capacity at the local WwTW and to reduce pumping and transmission costs, development in RPA6 will have wastewater treated at the existing WwTW in Diss.

7.20.3 Diss WwW has been shown to have sufficient capacity to accept growth from RPA without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required.

7.20.4 Wastewater Treatment will not present a limitation on phasing beyond 2010

Wastewater Transmission

Strategic Connection

7.20.5 Diss has a very well connected wastewater network system with two main sewers in the south east of the town feeding the WwTW. The sewer to the east of the town has an approximate capacity of 570 (sufficient to accept all growth) and the strategic main to the south has a very high spare capacity. Development located other than east or south of the town will need to consider network capacity through the town itself on a development by development basis via network modelling checks with AWS.

Local Connection

7.20.6 Extensive local connections will only be required at developer level if development is proposed at distance from the existing town.

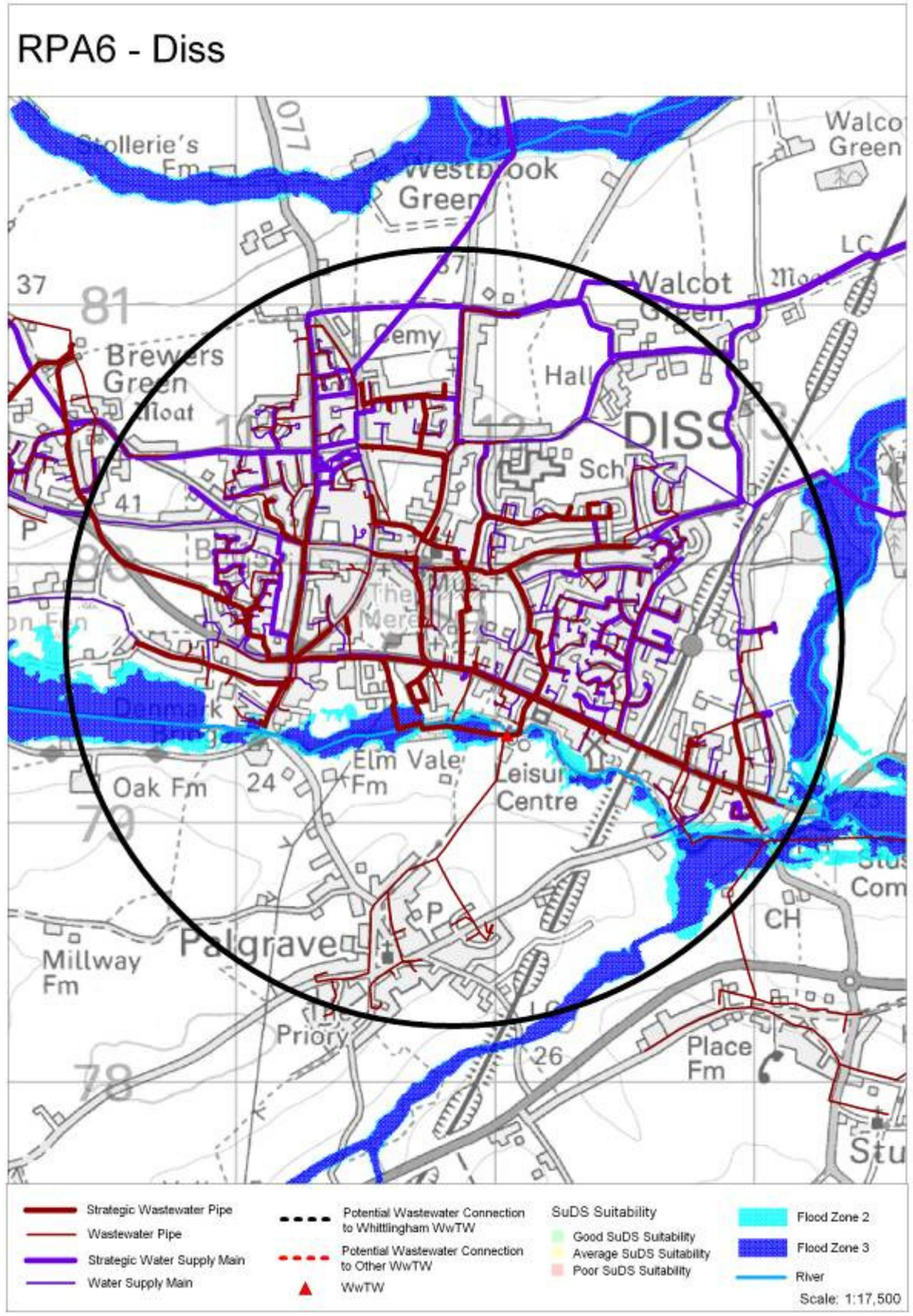
Water Resources

Water Supply Infrastructure

7.20.7 The accompanying figure highlights that there are several water mains servicing Diss largely coming in from the north and northeast. These mains should be sufficient to supply water to the proposed development. Local connections will be required if development is proposed south of the river, otherwise local connections are likely to be sufficient.

Water Neutrality (WN)

7.20.8 Diss has been assessed for WN as a single town. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the town even with new development using similar water demand as current homes so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving less water use overall (than current) for the town (after development) would be a possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.



Flood Risk & Management

Flood Risk & the Sequential Test

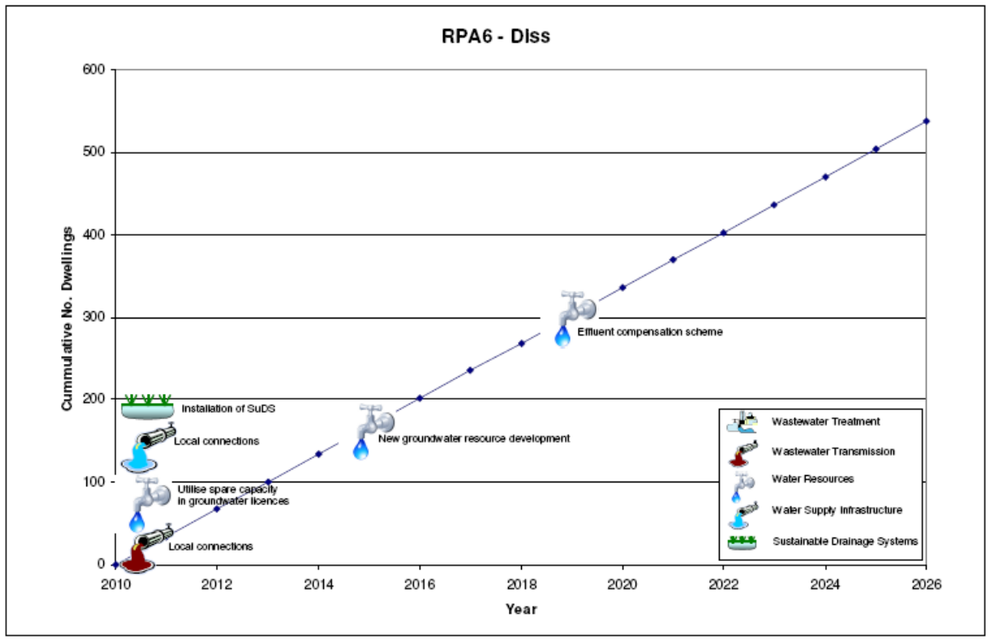
7.20.9 The extent of Flood Zones 3 and 2 within this area is fairly minimal; however a development immediately to the south of the town and the southeast of the area would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.20.10 Much of the town is covered by a SPZ, including a zone of SPZ 1 to the northwest of the town centre associated with a groundwater abstraction point. SPZ 2 and 'total catchment' areas are therefore located across most of the central, northern and western areas of the town and areas to the north and west of the main town itself. These SPZ designations would restrict development types here and will require some form of water quality control such as oil interceptors if infiltration of runoff (other than clean roof runoff) is proposed. Delivery of SuDS could therefore be problematic given space constraints within the town itself and careful designing and planning (including policy) will be required to ensure no increase in flood risk as a result of development) in the centre, north and west of the town.

7.20.11 Restrictions to the far east of the main town are unlikely to be onerous if suitable for infiltration; however, pollution control measures may also be required outside of SPZs, depending upon the nature of development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-18: RPA6 – Infrastructure timeline and phasing



7.21 RPA 7 – Harleston

Growth Summary

7.21.1 A total of 779 new dwellings are proposed for Harleston.

Wastewater Treatment

7.21.2 Harleston WwW has been shown to have sufficient capacity to accept growth from RPA7 without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required.

7.21.3 Wastewater Treatment will not present a limitation on phasing beyond 2010

Wastewater Transmission

Strategic Connection

7.21.4 Harleston has a very well connected wastewater network system with a strategic sewer running through the centre of the town to the WwTW to the north and two strategic sewers draining the north east and north west fringes of the town. The northwest sewer has capacity for approximately 1,000 dwellings, whereas the northeastern sewer has capacity for approximately 500; therefore, development should be able to be accommodated in these sewers if located around the town. Development located other than northeast or northwest of the town will need to consider network capacity through the town itself on a development by development basis via network modelling checks with AWS.

Local Connection

7.21.5 Extensive local connections will only be required at developer level if development is proposed at distance from the existing town.

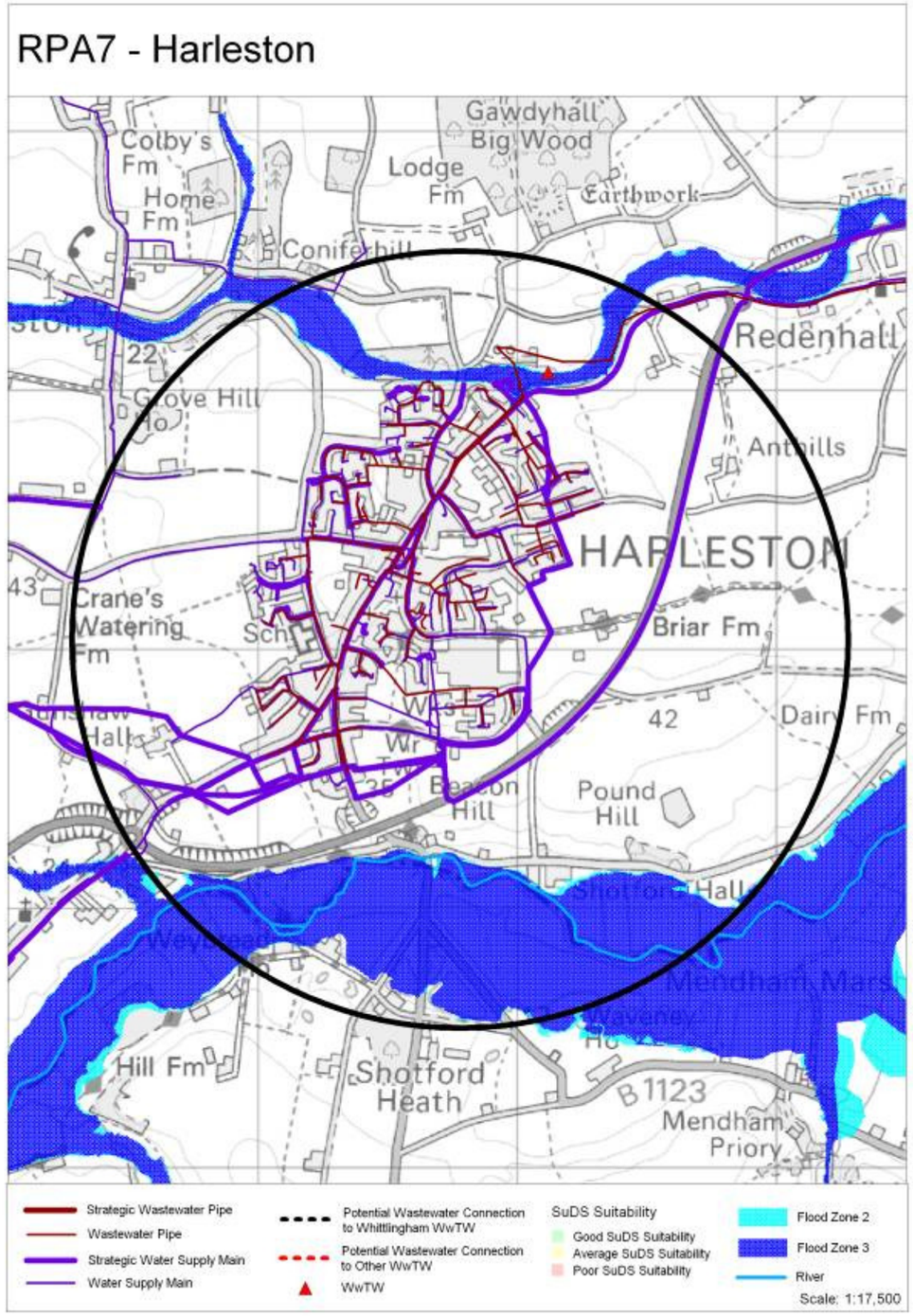
Water Resources

Water Supply Infrastructure

7.21.6 The accompanying figure highlights that there are several water mains servicing Harleston from the northwest and southwest. These mains should be sufficient to supply water to the proposed development. Local connections will only be required at developer level if development is proposed at distance from the existing town.

Water Neutrality (WN)

7.21.7 Harleston has been assessed for WN as a single town. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the town even with development at codes 1 & 2 on the CfSH, so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving WN for the town as a whole is a definite possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.



Flood Risk & Management

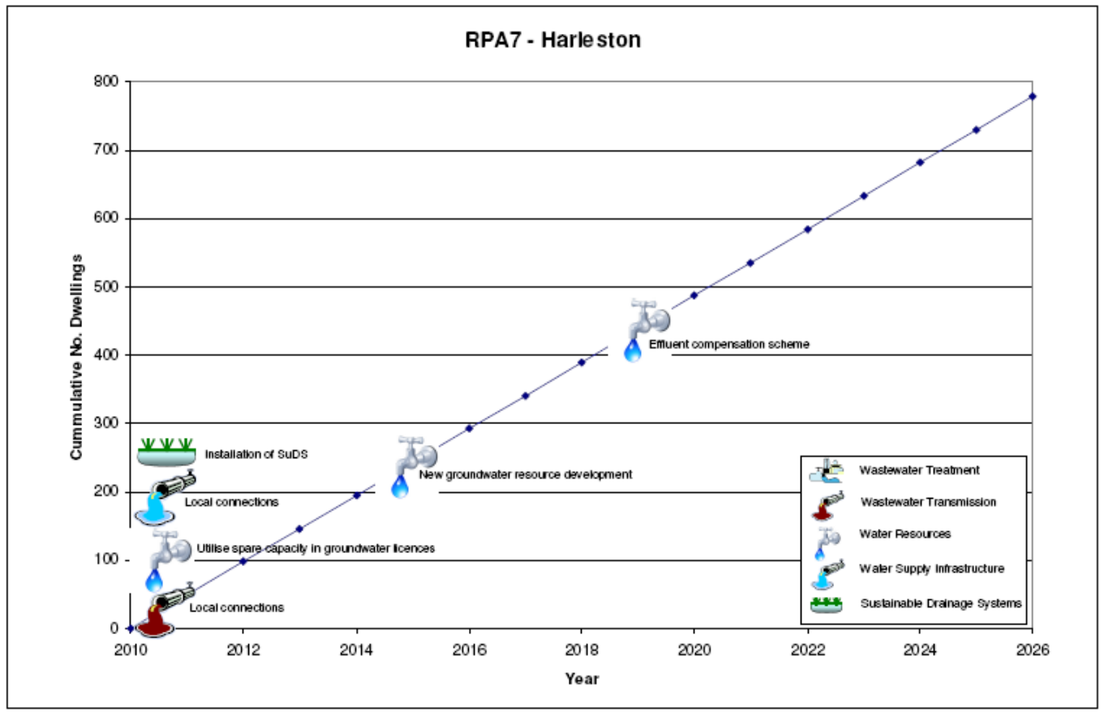
Flood Risk & the Sequential Test

7.21.8 The extent of Flood Zones 3 and 2 within this area is fairly minimal except for the far south and north of the area. Development to the south of the main town and the A143 would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation

SuDS Suitability

7.21.9 The town is not located over an SPZ, hence there should be few restrictions on development type or infiltration of runoff (other than clean roof runoff) if infiltration SuDS are feasible; however, pollution control measures may also be required outside of SPZs, depending upon the nature of development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-19: RPA7 – Infrastructure timeline and phasing



7.22 RPA 8 – Loddon

Growth Summary

7.22.1 A total of 323 new dwellings are proposed for Loddon.

Wastewater Treatment

7.22.2 There is no significant WwTW serving Loddon, hence wastewater flows from new development would be transferred to Sisland WwTW to the west of the town to make use of existing capacity at the WwTW.

7.22.3 Sisland WwW has been shown to have sufficient capacity to accept growth from the RPA without requiring an increase in consented flow conditions. Therefore, no changes to the quality consent are required.

7.22.4 Wastewater Treatment will not present a limitation on phasing beyond 2010

Wastewater Transmission

Strategic Connection

7.22.5 Loddon has a reasonably well connected wastewater network system with strategic sewers serving the southern and northern sections of the town (north and south of the River Chet). A strategic sewer transfers flows from the town centre west to Sisland WwTW. This sewer has been estimated to have a capacity for over 4,000 dwellings which is more than sufficient to accommodate the proposed growth. Development located other to the south of the town will need to consider network capacity through the town itself on a development by development basis via network modelling checks with AWS.

Local Connection

7.22.6 Extensive local connections will only be required at developer level if development is proposed at distance from the existing town.

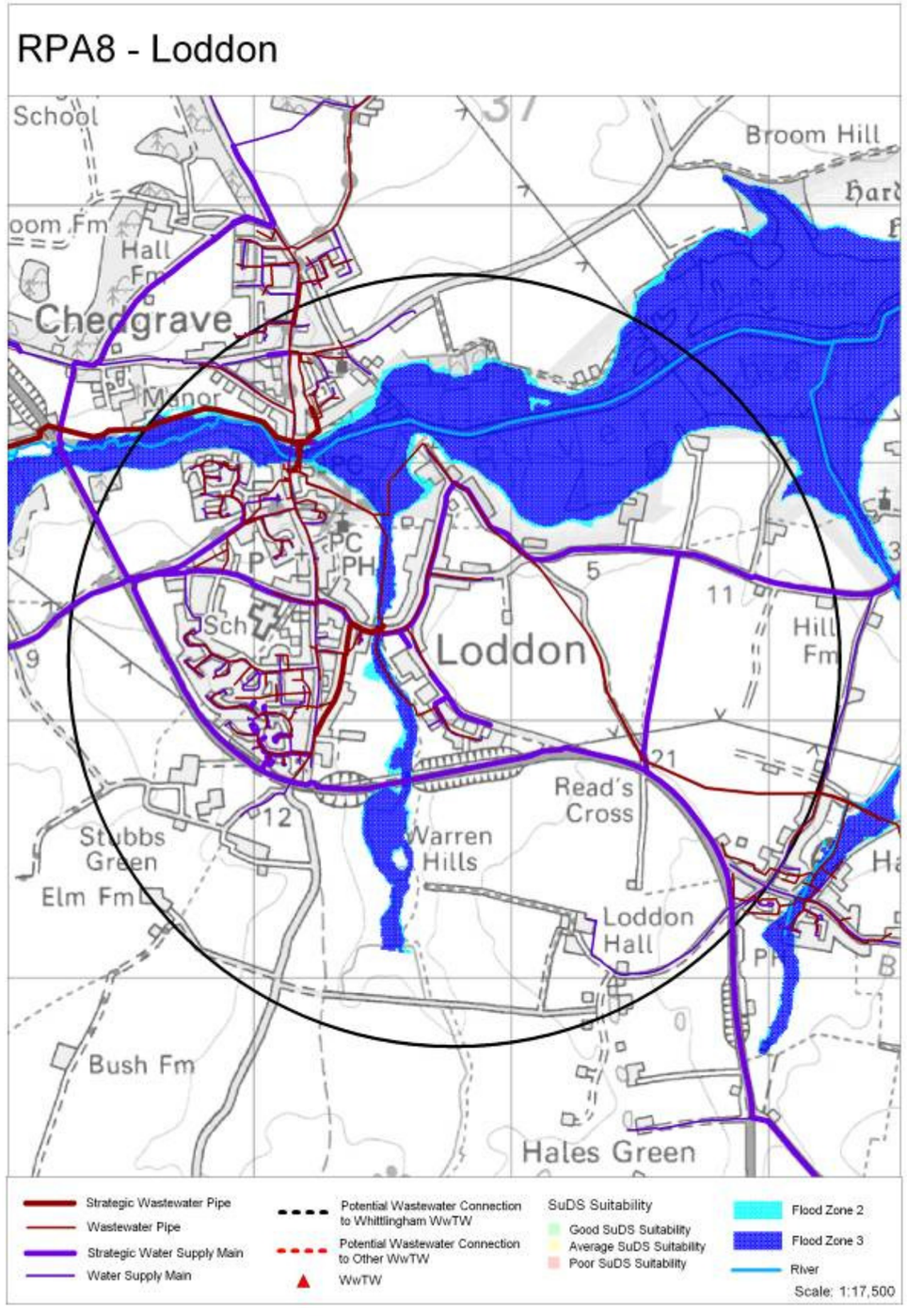
Water Resources

Water Supply Infrastructure

7.22.7 The accompanying figure highlights that there are several water mains servicing the town running from northwest to southeast along the line of the A146. This main and others coming in from the east and west should be sufficient to supply water to the proposed development. Local connections will only be required at developer level if development is proposed at distance from the existing town.

Water Neutrality (WN)

7.22.8 Loddon has been assessed for WN as a single town. As the amount of proposed growth for the town is fairly small, WN is theoretically feasible for the town even with new development using similar water demand as current homes so long as metering is introduced across the town for existing homes and low use fittings (including toilet flushing) are included for existing homes. Achieving less water use overall (than current) for the town (after development) would be a possibility with retrofitting and even higher achievement of codes 5 & 6 under the CfSH for new homes.



Flood Risk & Management

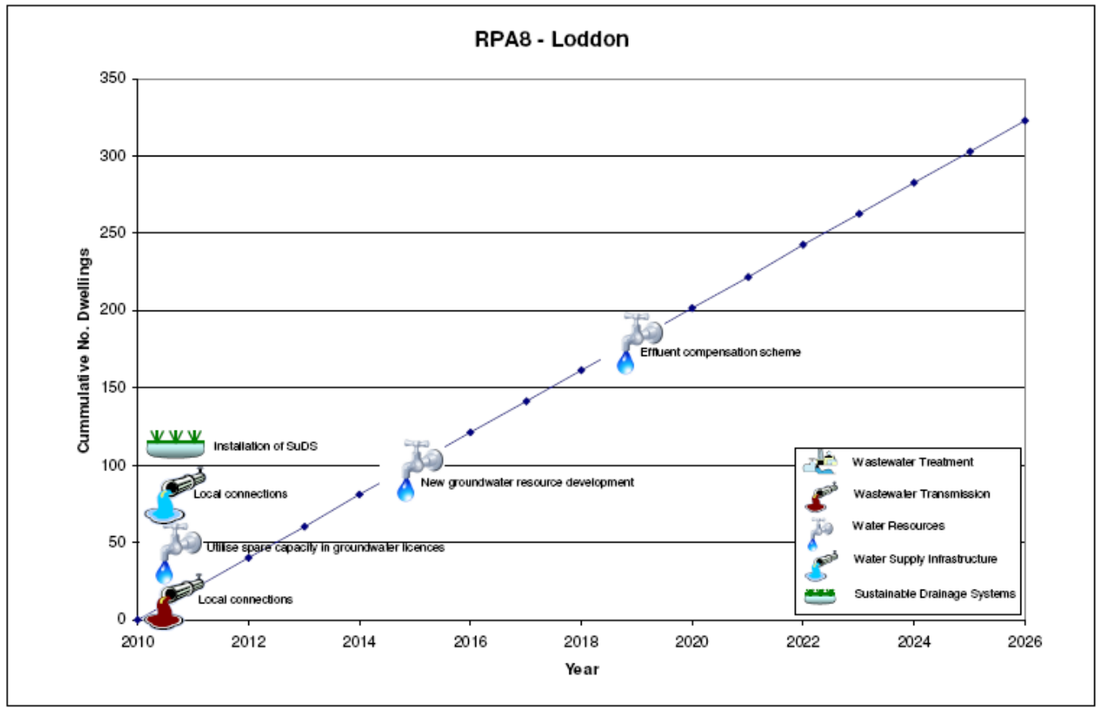
Flood Risk & the Sequential Test

7.22.9 The extent of Flood Zones 3 and 2 within this area is fairly extensive through the town centre, to the north east of the town centre (River Chet) and between the east of the southern section of the town. To meet with the Sequential Test requirements, development in these areas would need to be carefully planned to enable the area to meet the PPS25 Sequential Test and Exception Test and support the proposed development without the need for specific flood risk mitigation.

SuDS suitability

7.22.10 The town is not located over an SPZ, hence there should be few restrictions on development type or infiltration SuDS (assuming infiltration is feasible); ; however, pollution control measures may also be required outside of SPZs, depending upon the nature of development proposed and the risk posed by the runoff type. The absence of a SPZ does not necessary indicate that there will be no restrictions and no pollution control measures will be required. Decisions on SuDS types should be made on a site by site basis depending upon a risk assessment and in accordance with the Environment Agency's Groundwater Protection Policy.

Figure 7-20: RPA8 – Infrastructure timeline and phasing



8 Infrastructure Costing

8.1 Introduction

8.1.1 This GNWCS has highlighted that there is a need for expenditure on new infrastructure in the following areas:

- Water supply and water resources;
- Wastewater treatment and sewerage; and
- Flood risk management (surface water attenuation).

8.1.2 It was agreed at the inception of Stage 2b, that costing of strategic infrastructure to be provided solely by AWS would not be costed as part of this WCS for the following reasons:

- because of the strategic nature of the study, it is not possible to be prescriptive about the exact type of infrastructure and solution that AWS would eventually implement. This study has identified the most feasible and achievable options for meeting new demand for water services from growth at the time of completion in order to demonstrate that a solution to the provision of water supply and wastewater is feasible. AWS may consider that other alternatives are progressed in preparation of future business plans, and hence costing the strategic infrastructure at this stage is likely to be premature. This position is supported by AWS; and
- both water supply (treatment) and wastewater treatment are the responsibility of AWS within the GNDP study area. At present, the Water Industry Act 1991, and agreements between Ofwat and water companies prevent developers contributing towards the provision of water resource schemes, water treatment and wastewater treatment facilities. These elements of the WCS will be funded by customer charges which are set by Ofwat over the 5 year AMP periods through the Periodic Review process. Customer charges are set across a company's supply area and the same charges apply for all customers equally (i.e. customers in one area will not pay more than in another area even if costs for new infrastructure to service that area are higher). Hence there is no possibility for seeking contributions to this infrastructure.

8.1.3 Despite this, the provision of strategic level wastewater mains as part of the wastewater strategy has been highlighted as infrastructure that is required specifically to deliver new development, and there are mechanisms that would allow developer contributions to be made towards the funding of water supply and wastewater networks or mains infrastructure on a scale commensurate with the number of housing proposed by each developer. If investment is required to local water or wastewater networks, Ofwat takes the view that water and wastewater companies should seek to part finance this work through contributions from developers. This reduces the financing burden on existing customers, who would otherwise have to pay through increases in general charges. Developer contributions can be sought for this infrastructure and the options for it are detailed section 9.

8.1.4 In addition, flood risk infrastructure required to service a development can be entirely funded from developer contributions. Although the generic nature of the proposed PGAs has meant that it has not been possible to identify specific flood risk infrastructure such as flood defences, it has highlighted that the provision of SuDS and surface water attenuation will be required for

development areas to minimise flood risk elsewhere and comply with PPS25. Developer contributions can be sought for this infrastructure and the options for it are detailed in section 9.

8.2 Wastewater Network Infrastructure

8.2.1 Site specific connection costs for developers will be similar across all development scenarios, regardless of whether new strategic infrastructure (serving more than one site) is required or not. This section therefore provides costs specifically for strategic new mains which are required to connect PGAs to either existing network or to a WwTW.

8.2.2 The costs included do not account for additional costs that might be incurred as a result of the requirement for crossings of roads, railways, environmental studies or ecological mitigation. The costs are indicative in order to give an idea of the potential cost of providing the strategic network mains identified as required in this WCS and are based on distance and pipe size. The costs have been based on those developed (and described in detail) in the Stage 2a WCS report and are based on gravity sewers or pumped sewers dependent on the topography. The key assumption is that pipe routes would follow main roads wherever possible for ease of construction.

8.2.3 The Interceptor Sewers (see figure 2) have been costed separately (see Table 8-2) and the costs apportioned to each PGA dependent on how many dwellings would need to connect to them.

8.2.4 Where an NPA is connecting to a WwTW other than Whitlingham, and where there is insufficient capacity in the existing network, an approximate cost has been provided for this link.

8.2.5 It has been considered that there is sufficient capacity within the RPAs existing network to service the relatively low levels of growth proposed; hence no costs are provided for the RPAs.

8.2.6 It is important to note that these costs would not be borne solely by the developer, but would be required to contribute towards it via Ofwat regulations. This process, and the residual funding options available are discussed in section 9.

Table 8-1: Costs for Interceptor Sewers

Sewer	Estimated dwellings to service	Estimated pipe size (mm)	Distance of Gravity (m)	Unit cost Gravity (£/m)	Approx. Gravity cost (£)	Distance of pumped	Unit cost Pumped (£/m)	Pumped cost (£)	Total cost (£)
North Link	8,500	350 - 525	12,500	637	7,900,000	2,000	519	1,030,000	8,930,000
Southern Link	13,400	450 - 600	17,250	681	11,800,000	0	0	0	11,800,000
TOTAL	21,900	-	29,750	-	19,700,000	2,000	-	1,030,000	20,730,000

Table 8-2: Costs for Strategic Wastewater Mains

NPA	Link Required	Approx. No. of dwellings to link	Gravity / pumped	Pipe size(mm)	Unit cost (£/m)	Distance (m)	Link cost (£)	% of interceptor capacity used by NPA	Interceptor apportioned cost (£)	Total Network cost for NPA (£)	Notes
1 – North Sector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Small dwelling numbers and employment can utilise existing network.
2 – North East Sector	N/A	9,100 (approx 4,000 using existing network)	N/A	N/A	N/A	N/A	N/A	60%	£5,358,000	£5,358,000	
3a – North East Sector	Yes - to Belaugh WwTW	2195 to Belaugh, 1986 to Whitlingham	pumped	150	292	2,500	£730,000	23%	£2,050,000	£2,780,000	Link to Belaugh as well as Interceptor required

NPA	Link Required	Approx. No. of dwellings to link	Gravity / pumped	Pipe size(mm)	Unit cost (£/m)	Distance (m)	Link cost (£)	% of interceptor capacity used by NPA	Interceptor apportioned cost (£)	Total Network cost for NPA (£)	Notes
3b – East Sector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Small dwelling numbers and employment can utilise existing network.
4 – South East Sector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Small dwelling numbers can utilise existing network to local WwTW
5 – South Sector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Small dwelling numbers can utilise existing network to local WwTW
6 – Long Stratton	Yes – to Long Stratton WwTW	1,927	Gravity	300	452	500	£220,000	N/A	N/A	£220,000	Dwelling numbers significant, so strategic new main
7 - Wymondham	Yes – to Wymondham WwTW	2,750	Gravity	300	452	1,250	£560,000	N/A	N/A	£560,000	Existing sewer capacity issues, new mains considered required
8 – South West Sector	N/A	3215	N/A	N/A	N/A	N/A	N/A	24%	£2,800,000	£2,800,000	
9 – West Sector	N/A	3106	N/A	N/A	N/A	N/A	N/A	23%	£2,700,000	£2,700,000	
10 – North West Sector	N/A	1480	N/A	N/A	N/A	N/A	N/A	17%	£1,500,000	£1,500,000	
11 – Norwich City	N/A	7,100 (approx 1,800 using existing)	N/A	N/A	N/A	N/A	N/A	60%	£7,000,000	£7,000,000	

8.3 Surface Water Attenuation

8.3.1 As described, it has not been possible to be specific regarding the type and size of SuDS due to the size of the assessment areas provided for the PGAs. However, as an indication, generic costs for surface water management features per m^3 of storage required have been provided to inform more site specific studies. This information is taken from the SuDS Manual (C697) as published by CIRIA.

Table 8-3: Estimated SuDS construction and maintenance costs per m^3 of storage (*Source – the SuDS Manual, CIRIA C697 – 2007*)

Component	Annual cost (for regular maintenance only)	Unit
Filter drain/infiltration trench	£0.2–£1	/m^2 of filter surface area
Swale	£0.10	/m^2 of swale surface area
Filter strip	£0.10	/m^2 of filter surface area
Soakaway	£0.10	/m^2 of treated area
Permeable pavement	£0.5–£1	/m^3 of storage volume
Detention/infiltration basin	£0.1–£0.3	/m^2 of detention basin area
Wetland	£0.10	/m^2 of wetland surface area
Retention pond	£0.5–£1.5	/m^2 of retention pond surface area

9 Infrastructure Funding Options

9.1 Introduction

9.1.1 It is important that the GNWCS considers mechanisms for obtaining and securing funding toward water infrastructure that the developers can contribute to. The following sections describe possible options in relation to limitations placed on developer contribution to water services under the Water Resources Act 1991, which the GNDP should consider as part of producing the Joint Core Strategy and their LDFs.

9.2 Suggested Developer Contribution Options

S106 Contributions

9.2.1 Under Section 106 of the Town and Country Planning Act 1990, developer contributions, also known as planning obligations may be sought when planning conditions are inappropriate to enhance the quality of development and to enable proposals that might otherwise have been refused to go ahead in a sustainable manner.

9.2.2 Developer contributions are intended to ensure that developers make appropriate provision for any losses or supply additional facilities and services that are required to mitigate the impact of a development. For example affordable housing, school places, roads, pedestrian crossings and other transport facilities, open spaces or equipped playgrounds or new long term maintenance of open space, travel plans, residents parking schemes, public art, libraries and other community buildings.

9.2.3 Government Circular 05/2005 includes a necessity test that ensures that all developer contributions are directly linked to a specific impact of the development and that the funds acquired are to be used for that purpose. The circular states that the obligations will be:

- necessary;
- relevant to planning;
- directly related to the proposed development;
- fairly and reasonably related in scale and kind to the proposed development; and
- reasonable in all other respects.

9.2.4 Planning permission cannot be granted without a completed agreement in place. Developer contributions may be used to:

- restrict development or use of the land in a specified way;
- require specified operations or activities to be carried out on the land;
- require land to be used in any specified way; and
- require a sum or sums to be paid to the authority on a specified date or dates.

9.2.5 Section 106 agreements are very frequently used in the strategic planning process for provision of key infrastructure requirements. However, in general the charge levied is required to be commensurate with the developer's impact.

9.2.6 Therefore, in the case of wastewater network, water supply network and surface water attenuation provision, a single section 106 levy cannot be applied to all new development and a cost apportionment mechanism would have to be derived dependent on the level of impact each development is likely to have and this is not always a straightforward process. For instance, the GNWCS has shown that the provision of SuDS and the relative costs will differ for different PGAs according to the level of infiltration that is possible (according to geology) or acceptable (according to groundwater source protection zones).

Tariff System

9.2.7 Similar to a section 106 agreement and used successfully by the Milton Keynes Partnership, a tariff system charges a single per dwelling fee to a developer to contribute towards the strategic infrastructure required to service it.

9.2.8 Generally, this does not include for water infrastructure but several WCSs are considering this as a potential option for providing a pot of funds to pay for strategic flood risk management infrastructure such as strategic SuDS and greywater recycling systems on a community level. In addition, it is considered that tariffs will become inoperable by April 2012.

Community Infrastructure Levy

9.2.9 There is now provision in legislation (under the Planning Act 2008) for introducing a Community Infrastructure Levy. Regulations under this act are expected to come into effect in April 2010 (subject to Ministerial approval) and these are intended to ensure that costs incurred in providing infrastructure to support development can be funded.

9.2.10 It is currently unclear precisely how this will apply to water infrastructure, and it will be up to local planning authorities to bring forward charging schedules; however, it does provide a potential mechanism. .

Unilateral Undertaking

9.2.11 A Unilateral Undertaking is an offer of specific undertaking from a developer. It is usually considered to be quicker, less costly and advantageous to the applicant/owner, as the council does not need to be a party to such a deed. It is preferable to use this rather than Section 106 Agreement when:

- There is a straightforward contribution required;
- There is no requirement for the Council to covenant to do something;
- No payback requirement is necessary;
- No affordable housing is required;

9.2.12 This system could work well for providing developer sums towards strategic wastewater and water supply network infrastructure as the GNDP councils do not necessarily need to covenant to provide the funding mechanism for water company infrastructure.

9.3 Proposed Funding Process

9.3.1 Section 106 or tariff systems are likely to be the best mechanism for providing funding to pay for strategic level flood risk management infrastructure such as SuDS. However, for funding the strategic wastewater mains, the situation is not so straightforward.

9.3.2 Under the Water Industry Act 1991, an Infrastructure charge may be levied on new and existing property connected to the public sewerage system for the first time. In cases where this is required in the GNDP area, this charge will be applied directly by AWS for new development that does not need new offsite infrastructure.

9.3.3 However, if the existing network infrastructure (water supply or wastewater) is not adjacent to a proposed site, the developer will be required to fund or at least contribute to this infrastructure through the requisition process under the Water Industry Act. The formal requisition procedures as set out in the Act (sections 41 and 98) a legal mechanism for developers to provide the necessary infrastructure to service their site.

9.3.4 How this process is ultimately undertaken for the proposed development in the Norwich Study area cannot be decided by this WCS i.e. a decision could be taken that developers pay for new mains through a requisition process directly with AWS or the developer pays for the infrastructure to be built and it is taken on, or requisitioned by AWS. However, because the wastewater main upgrades are strategic in nature, the conclusion of the funding element of this study is that a formal developer contribution mechanism should be set out for development which is dependent on the construction of new strategic wastewater before they can be built and serviced with wastewater collection. The WCS has shown that wastewater treatment requirements of all proposed growth in the GNDP area cannot be met without investment in strategic wastewater mains and as a result, developers should be required to contribute towards the provision of this infrastructure commensurate with the size of the development proposed. Ultimately, the new strategic interceptor wastewater main could be used by AWS to relieve sewer flooding and wastewater capacity issues in Norwich city; hence it is not appropriate for developers to solely fund the interceptor sewer.

9.4 Further Cost Considerations

Minimisation of Cost

9.4.1 Even where direct funding of infrastructure is not an option, developers can at least contribute to minimising the capital cost of water infrastructure and policy can be developed to ensure that this is achieved.

9.4.2 It can be seen from this WCS that a key variable to provision of water services infrastructure is water consumption. To a large extent, developers can be encouraged to reduce this through initiatives such as grey water recycling, having developments with less impermeable surfaces, specifying higher quality materials for pipework etc. By way of example, if the percentage return to sewer can be reduced from 90% to 75%, the number of additional properties that can be accommodated per 1 m3/d headroom at an existing sewage treatment works is 0.8. If reducing the infiltration of ground water into drains supports the reduction in percentage return to drain by using higher quality drain pipes, the number of additional properties that can be supported per 1 m3/d headroom at the same WwTW can be further increased.

Water Resource Provision - Employment

9.4.3 Since December 2005, non-household customers who are likely to be supplied with at least 50 mega litres of water per year at their premises are now able to benefit from a new Water Supply Licensing mechanism. If eligible, they may be able to choose their water supplier from a range of new companies entering the market. The Water Supply Licensing mechanism enables new companies to supply water once Ofwat has granted them a licence. These companies can compete in two ways:

- by developing their own water source and using the supply systems of appointed water companies (such as AWS) to supply water to customers' premises. This would be carried out under the combined water supply licence; or
- by buying water 'wholesale' from appointed water companies (such as AWS) and selling it on to customers. This would be done under a retail water supply licence.

10 Policy and Recommendations

10.1.1 Following the completion of the Stage 2b WCS, the following recommendations are made to ensure that the overall water cycle strategy proposed is adhered to (through recommended policy) and that the study findings remain as current as possible based on best available information (through making the WCS a live document that is reviewed upon release of certain key water cycle related documents and information).

10.2 Water Cycle Policy

10.2.1 This section draws on the various assessments undertaken in this Stage 2b study as well as previous WCS stages. It summarises the key issues and suggests direction for policies to be included in the Joint Core Strategy, future Area Action Plans and suggested Supplementary Planning Documents to ensure that the aims of this WCS and a sustainable water environment are achieved.

General

Policy Recommendation 1: Development Phasing

10.2.2 New homes should not be built until agreement has been reached with the water and wastewater provider that sufficient capacity in existing or future water services infrastructure is available in accordance with the GNWCS.

10.2.3 *Reason: The WCS has demonstrated some capacity within existing infrastructure; however this capacity is limited and upgrades (or new) infrastructure is required to deliver full housing requirements up to 2026. Development must not be permitted to develop until the water services infrastructure is in place to service it.*

10.2.4 Policy Recommendation 2: Developer Contribution

10.2.5 As well as connection fees required under the Water Industry Act, where it is determined that new wastewater infrastructure is required specifically to service a development area, those developers will be required to contribute this infrastructure.

10.2.6 *Reason: The WCS has shown that in general, contributions directly to treatment and water supply infrastructure is not possible under the Water Resources Act 1991. However, AWS are able to requisition or adopt infrastructure funded by developers which is required solely for new development. This position is encouraged by Ofwat and hence developer contribution will be required towards the proposed interceptor sewer wastewater strategy solution for the GNDP study area.*

Wastewater treatment and transmission

Policy Recommendation 3: Strategic Wastewater Network

10.2.7 Recognition is made that the provision of a new strategic wastewater interceptor main will be required around the north and south of Norwich to connect new development areas and transfer much of the wastewater generated to Whitlingham WwTW for treatment.

10.2.8 Reason: The WCS has demonstrated that sufficient wastewater treatment capacity exists within the combined WwTW capacity in the study area; however, in order to utilise all the spare capacity without building more costly extension, the wastewater network needs to be flexibly designed to ensure that the existing capacity can be utilised. The WCS has shown that the best means of achieving this is to build an interceptor wastewater main which transfers much of the wastewater flow to Whitlingham. The Joint Core Strategy needs to ensure that the provision of this wastewater interceptor main is fully supported.

Policy Recommendation 4: Strategic Wastewater Treatment

10.2.9 Recognition is made that the provision of upgrades to wastewater treatment facilities within the study area is required in order for demands of future growth to be met without causing a failure in statutory WFD or standards or HD standards. Expansion of some works may be required.

10.2.10 Reason: The WCS has demonstrated that sufficient wastewater treatment capacity exists within the combined WwTW capacity in the study area as a whole; however, some of the WwTW will need to add process streams or expand the capacity of processes in order to treat to a higher standards to meet current and future water legislation (WFD and HD standards). The Joint Core Strategy needs to ensure that the expansion of some WwTW sites is fully supported.

Policy Recommendation 5: Protection of Amenity

10.2.11 Development will only be permitted adjacent to WwTW only if the distance between the works is sufficient to allow adequate odour dispersion.

10.2.12 Reason: The WCS has demonstrated that NPAs 5 & 6 currently have WwTW within the generic growth area extent. Therefore, development close to the WwTW in these areas would need to be managed so as to prevent nuisance from odour associated with the treatment process.

Water Resources & Supply

Policy Recommendation 6: Water Efficiency

10.2.13 All new houses within developments of less than 500 homes should be designed to have a water demand in keeping with levels 3 & 4 in the Code for Sustainable Homes. For developments of greater than 500 homes, houses will be expected to have a water demand in keeping with levels 5 & 6 of the Code for Sustainable Homes.

10.2.14 Reason: The WCS has highlighted that water resources are 'seriously stressed' in the study area and that, although new resources have been planned by AWS, potential sustainability changes in existing abstraction licences will potentially further exacerbate the lack of available water for supply. New houses and non residential units must minimise water use to ensure that water demand by the end of plan period is as low as possible. The study has also shown that combining investment in measures to reduce water use in existing homes with new homes built to high levels of water efficiency targets under the code for sustainable homes, it is theoretically possible to attain close to water neutrality[11] at the end of the plan period. This level of weater use reduction will also reduce the burden on wastewater flows that need to be treated, reducing the reliance on new consents in key growth locations

[11] Water neutrality refers total water use of all homes in the study area after new development is complete (2026) is no greater than the base year (2009).

Policy Recommendation 7: Protection of Water Resources

10.2.15 New development will not be permitted in source protection zones unless the Environment Agency is satisfied that the risk is acceptable.

10.2.16 Reason: The WCS has highlighted that water supply in the GNDP study area is highly dependent on groundwater abstraction and as such, it is important to continue to protect the areas that recharge the groundwater through suitable management of surface activities. Several PGAs are over or close to source protection zones around abstraction boreholes and hence Environment Agency agreement will need to be achieved for some development types in these areas.

Flood risk and drainage

Policy Recommendation 8: Site drainage

10.2.17 All new development, including that on brownfield development, should be served by separate surface water and wastewater drainage. No new development will be permitted to discharge runoff to foul drainage connections.

10.2.18 *Reason: The WCS has highlighted that sewer flooding and Combined Sewer Overflows are an existing concern in Norwich and that with climate change, capacity will be limited. Therefore further discharges of surface water to foul or combined drainage should not be permitted to prevent exacerbation of existing problems.*

Policy Recommendation 9: Surface Water Management

10.2.19 All new development, including that on brownfield development, should not be constructed until sufficient surface water management and attenuation has been provided to ensure that flood risk from the development as a result of surface water runoff can be managed in line with PPS25 both during construction and the design life of the development.

10.2.20 *Reason: The WCS has determined that management of surface water is key to preventing downstream flood risk as a result of development. Therefore, design of runoff attenuation (through SuDS design) needs to be built into developments as part of the masterplan and as part of the Environmental Management Plan for construction for major developments. The WCS has provided outline advice on the type of SuDS that could be suitable in each PGA; but this will need to be confirmed via a site specific FRA and on a case by case basis with the Environment Agency.*

Policy Recommendation 10: Site Specific Water Cycle Studies

10.2.21 All new development proposals with a footprint greater than 1 Hectare will need to consult with both the Environment Agency and the relevant Planning Authority to determine whether a site specific Water Cycle Study should be undertaken to confirm capacity in water infrastructure prior to commencement of construction.

10.2.22 *Reason: The WCS has determined that strategic capacity in water supply and wastewater infrastructure is available in most cases, to allow growth to proceed. However, there are several key constraints that will take time to overcome and need to be assessed at a site level once it is known when and where development will take place within each PGA. This is particularly pertinent for wastewater transmission (sewerage capacity) where developers will need to check with AWS (via a pre-development enquiry) as to whether there is capacity to connect to existing networks, or whether upgrades or new sewers are required.*

10.3 Developer checklist

10.3.1 In addition to the high level policy suggestions included in the previous section, a developer checklist has been provided. The checklist includes for all the necessary steps that a developer would need to take to meet with the key water based legislative and policy requirements.

10.3.2 The overall intention is that all developers would be asked to use the water cycle developer checklist as part of the planning application process and to submit a completed version with their planning applications. The Environment Agency is a statutory consultee with regards to flood risk and the water environment and as such, will need to sign up to the checklist as will the partner authorities, Natural England and the water and wastewater undertaker. The checklist provided in this Stage 2b WCS has been developed from examples used in previous WCS as well as the Environment Agency's national standard checklist available on their website. The checklist refers to different levels of policy to make it clearer to the developer as to which are driven by mandatory national policy, which are driven by Environment Agency requirements and which are driven by local policy.

10.3.3 The Detailed Study checklist has been provided as a 'working document' which should be revised as development scenarios and housing numbers are updated. More relevant site specific details can then be included to make it a document which can be used as part of the planning process for developers once Area Action Plans or other LDDs are being developed.

10.3.4 The checklist is provided in Appendix B: Developer Checklist.

10.4 Further Work Suggestions

10.4.1 It is recommended that the Stage 2b Water Cycle Study remains a live document and its recommendations and findings are reviewed and reassessed as updates are made to key inputs and legislation such as the WFD, the Habitats Directive RoC process and AWS's final Water Resources Management Plan (WRMP).

10.4.2 A timeline of when the WCS may have to be updated in line with the changes in legislation and drivers is included in Appendix C: Timeline of Likely WCS .

10.4.3 A more detailed technical SIMCAT (or other catchment model) assessment of the P consent requirements is recommended as a collaboration between the Environment Agency and AWS to determine most suitable limits on P discharge at each WwTWs. This should be aligned with modelling future improvements in catchment (diffuse) sources as a result of implementation of the POMs as to be recommended in the final RBMPs.

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Appendix A: Figures

Figure 1: PGA Locations and Growth Figures

Figure 2: Wastewater Strategy

Figure 3: WFD current Ecological status classifications

Figure 4: Stage 2b WCS Methodology

Figure 5a: Quality Consent Details: Planned consented

Figure 5b: Quality Consent Details: WFD Compliance

Figure 5c: Quality Consent Details: Best Case Recommended

Figure 6: Environmental Designations

Appendix B: Developer Checklist

Key	
	Water Cycle Strategy Recommended Policy
	Environment Agency and Natural England Policy and Recommendations
	Local Policy
	National Policy or Legislation

	Flood Risk Assessment requirement checklist		Policy or Legislation
1	Is the Development within Flood Zones 2 or 3 as defined by the flood zone mapping in the SFRA, or where SFRA coverage is not available, the published Environment Agency flood risk maps?	Y - go to 5 N - go to 2	
2	Development is within Flood Zone 1: Site larger than 1 Ha? Site smaller than 1 Ha?	 go to 5 go to 3	
3	Is the development residential with 10 or more dwellings or is the site between 0.5Ha and 1Ha?	Y - go to 6 N - go to 4	
4	Is the development non-residential where new floor space is 1,000m2 or the site is 1 Ha or more	Y - go to 6 N - go to 7	
5	The development either constitutes major development or is considered to be in a high risk flood zone and requires a Flood Risk Assessment (in accordance with PPS25 and the relevant SFRA) and the Environment Agency are required to be consulted.	Go to 8	PPS25
6	The development constitutes major development and is likely to require a Flood Risk Assessment (in accordance with PPS25 and the relevant SFRA) but the Environment Agency may not be required to be consulted.	Go to 8	
7	An FRA is unlikely to be required for this development, although a check should be made against the SFRA and with the LPA to ensure that there is no requirement for a FRA on the grounds of critical drainage issues. Does the SFRA or does the LPA consider a Flood Risk Assessment (FRA) is required?	Y – go to 8 N – go to 9	
8	Has an FRA been produced in accordance with PPS25 and the relevant SFRA?	Y/N or N/A	
	Surface water runoff		**Policy or Legislation**
9	A) What was the previous use of the site? B) What was the extent of impermeable areas both before and after development?	% before % after	Environment Agency Requirement for FRA.

10	If development is on a Greenfield site, have you provided evidence that post development run-off will not be increased above the Greenfield runoff rates and volumes using SuDS attenuation features where feasible (see also 18 onwards). If development is on a brownfield site, have you provided evidence that the post development run-off rate has not been increased, and as far as practical, will be decreased below existing site runoff rates using SuDS attenuation features where feasible (see also 17 onwards).	Y/N or N/A Y/N or N/A	PPS25
11	Is the discharged water only surface water (e.g. not foul or from highways)? If no, has a discharge consent been applied for?	Y/N Y/N	Water Resources Act 1991
12	A) Does your site increase run-off to other sites? B) Which method to calculate run-off have you used?	Y/N	PPS 25
12	Have you confirmed that any surface water storage measures are designed for varying rainfall events, up to and including, a 1 in 100 year + climate change event (see PPS25 Annex B, table B.2)?	Y/N	PPS25
13	For rainfall events greater than the 1 in 100 year + climate change, have you considered the layout of the development to ensure that there are suitable routes for conveyance of surface flows that exceed the drainage design?	Y/N	PPS25 Guidance Notes
14	Have you provided layout plans, cross section details and long section drawings of attenuation measures, where applicable?	Y/N	
15	If you are proposing to work within 8 m of a watercourse have you applied, and received Flood Defence Consent from the Environment Agency?	Y/N or N/A	Water Resources Act 1991 Land Drainage Act 1991
16	The number of outfalls from the site should be minimised. Any new or replacement outfall designs should adhere to standard guidance form SD13, available from the local area Environment Agency office. Has the guidance been followed?	Y/N	Guidance Driven by the Water Resources Act 1991
	Sustainable Drainage Systems (SuDS)		**Policy or Legislation**
17	A) Has the SuDS hierarchy been considered during the design of the attenuation and site drainage? Provide evidence for reasons why SuDS near the top of the hierarchy have been disregarded. B) Have you provided detail of any SuDS proposed with supporting information, for example, calculations for sizing of features, ground investigation results and soakage tests? See CIRIA guidance for more information. http://www.ciria.org.uk/suds/697.htm	Y/N	PPS25 Guidance
18	A) Are Infiltration SuDS to be promoted as part of the development? If Yes, the base of the system should be set at least 1m above the groundwater level and the depth of the unsaturated soil zones between the base of the SuDS and the groundwater should be maximised. B) If Yes – has Infiltration testing been undertaken to confirm the effective drainage rate of the SuDS?	Y/N Y/N	
19	A) Are there proposals to discharge clean roof water direct to ground (aquifer strata)? B) If Yes, have all water down-pipes been sealed against pollutants entering the system form surface runoff or other forms of discharge?	Y/N Y/N	

20	Is the development area above a Source Protection Zone (SPZ)?	If Y go to 22 If N go to 23	Groundwater Regulations 1998
21	A) Is the development area above an inner zone (SPZ1)? B) If yes, discharge of Infiltration of runoff from car parks, roads and public amenity areas is likely to be restricted – has there been discussion with the Environment Agency as to suitability of proposed infiltration SuDS?	Y/N Y/N	Groundwater Regulations 1998
22	A) For infill development, has the previous use of the land been considered? B) Is there the possibility of contamination? C) If yes, infiltration SuDS may not be appropriate and remediation required to be undertaken. A groundwater Risk Assessment is likely to be required (Under PPS23) Has this been undertaken before the drainage design is considered in detail?	Y/N Y/N Y/N	PPS23
23	Have oil separators been designed into the highway and car parking drainage? PPG23: http://publications.environment-agency.gov.uk/pdf/PMHO0406BIYL-e-e.pdf	Y/N	PPG23
24	Have you confirmed whether the proposed SuDS are to be adopted as part of public open space, or by a wastewater undertaker and provide supporting evidence? Alternatively, have you provide details of the maintenance contributions to be provided over the life of the development.	Y/N Y/N	
25	Have you provided details of any proposed measures to encourage public awareness of SuDS and increase community participation?	Y/N	
	Water Consumption		**Policy or Legislation**
26	A) Have you provided the expected level of water consumption and hence the level to be attained in the Code for Sustainable Homes http://www.planningportal.gov.uk/england/professionals/buildingregs/sustainablehomes/ B) Have you considered whether the development can achieve a water consumption lower than 120 l/h/d (105 l/h/d for Levels 3 & 4 in the Code for Sustainable Homes, 80l/h/d as required for Levels 5 & 6)	Y/N	
27	Is the proposed development likely to achieve a water consumption of less than or equal to 125 l/h/d as consistent with the Communities and Local Government Building Regulations Part G (2009)? http://www.communities.gov.uk/publications/planningandbuilding/partg2009divisionalletter and http://www.planningportal.gov.uk/uploads/br/BR_PDF_draftADG_2009.pdf	Y/N	
28	Have you Provided details of water efficiency methods to be installed in houses?	Y/N	
29	Have you confirmed whether the development will utilise rainwater harvesting and/or required tank sizes (see http://www.environment-agency.gov.uk/homeandleisure/drought/38559.aspx and http://publications.environment-agency.gov.uk/pdf/GEHO0108BNPN-E-E.pdf)	Y/N	
30	Has a practicable alternative strategy been included for the supply of water for fire fighting?	Y/N	
31	Have you confirmed whether grey water recycling is to be utilised and provided details?	Y/N	

32	Have you provided details of any proposed measures to increase public awareness and community participation in water efficiency?	Y/N	
	Pollution prevention		**Policy or Legislation**
33	Have you provided details of construction phase works method statement, outlining pollution control and waste management measures? See PPG2, PPG5, PPG6, PPG21(http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx) and DTI Site Waste Management Plan, (SWMP, http://www.constructingexcellence.org.uk/resources/publications/view.jsp?id=2568)	Y/N	PPG2, PPG5, PPG6, PPG21
34	A) Have you provided details of pollution prevention measures for the life of the development, such as oil and silt interceptors? B) Have you considered whether permeable pavement areas are protected from siltation? C) Have you provided details of maintenance – as with the SuDS?	Y/N Y/N Y/N	
	Water Supply and Sewage Treatment		**Policy or Legislation**
35	Have you provided evidence to confirm that water supply capacity is available, and that demand can be met in accordance with the Greater Norwich Water Cycle Strategy?	Y/N	
36	Have you provided evidence to confirm that sewerage and wastewater treatment capacity is available, and that demand can be met in accordance with the Greater Norwich Water Cycle Strategy?	Y/N	
	Conservation / Enhancement of Ecological Interest		**Policy or Legislation**
37	Have you confirmed that any green infrastructure, such as the surface water system, links to the neighbouring green infrastructure (River Corridors) to assist the creation and maintenance of green corridors?	Y/N	Green Infrastructure Study
38	Have you confirmed that at least 25% of flood attenuation ponds/wetlands will be designed for multifunctional uses, such as providing access, footpaths, cycleways, recreational uses, and submit outline details as suggested under Natural England guidelines?	Y/N	
39	A) Have you shown the impacts your development may have on the water environment? B) Is there the potential for beneficial impacts?	Y/N Y/N	Town and Country Planning Regulations 1999
40	Have you confirmed all ponds within 500m of the site boundary have been surveyed for presence of great-crested newt populations?	Y/N	Habitats Directive

Further information can be found in the Environment Agency's guide for developers: http://www.environment-agency.gov.uk/business/sectors/32695.aspx

Appendix C: Timeline of Likely WCS Changes

As documented throughout the Stage 2b WCS, several key sources of information from statutory processes have not been made available in time to inform the study within the timeframe permitted by the GNDP Joint Core Strategy publication. Because there are several key water resource elements to the unavailable information the agreement of the GNWCS steering group is therefore that the WCS remains a live document and is reviewed if and when all the information is made available. A best estimate of when the information should be made available and hence used in a review of the GNWCS is presented in table J1 below.

Table J1: Suggested Review dates for the WCS pertaining to key uncompleted inputs

Document / Study	Reason not available	Key relevance to the GNWCS	Likely date of availability
AWS final Water Resources Management Plan	Defra has asked (August 2009) for AWS to submit further information to allow the SoS to agree to finalisation of the plan. It is not known what further information has been requested but it is likely that the potential sustainability change at Costessey is one of the key issues	The proposed water resources strategy for supplying additional homes cannot be known until the plan is finalised. The water resources strategy proposed in this Stage 2b report will need to be revisited	Early 2010
Stage 4 RoC – Site Action Plans and decision on sustainability change	RoC process not due to finish until 2010	Full information on the extent of the sustainability change at the Costessey surface water abstraction point is not known. This will alter the current water resource availability in the study area and hence the water resources strategy proposed in this Stage 2b report will need to be revisited	March 2010
Hydrualic Model of Norwich Sewer Network	During production of the Stage 2b WCS, AWS was in the process of rebuilding the sewer model and is undertaking sewer flow surveys to verify the model. The final model (and reports) will not be available until summer 2010	Modelling of the network is required to determine capacities for connections for PGAs. The Stage 2b WCS currently uses broad scale calculations undertaken by Scott Wilson using spreadsheet analysis and this has been used to determine how much early phasing of development can take place before strategic new mains are required	June 2010