result, such developments will require residual risk management to minimise the consequences of potential flooding, e.g. following a breach or overtopping of local flood risk management structures.

Ensuring properties are defended to an appropriate design standard reduces flood risk. However, further options are also available should the residual risk to a development prove unacceptable. The following residual risk options should be considered as part of site specific flood risk assessments.

5.2.1 Identification of Potential Evacuation and Rescue Routes

In the event of a flood incident, it is essential that the evacuation and rescue routes to and from any proposed development remain safe. The EA deem evacuation routes safe if they fall within the white cells of Table 13.1 of the DEFRA/EA document FD2320 for a 1 in 100/200 year design event as a minimum, and the EA inform an LPA of the risk posed during the extreme event (1 in 1000 year). This allows the LPA to consult with the emergency services over the suitability of the access route. When considering plans for individual developments, emergency services should consider the potential for widespread flooding and the consequential impacts on their resources. If potential evacuation routes are likely to become inundated so that safe access/egress would not be possible, then the proposed development should be relocated. This may also be the case should the possible evacuation routes be particularly long or across difficult terrain.

A key consideration in relation to the presence and use of evacuation routes is the vulnerability and mobility of those in danger of being inundated. Development for vulnerable users e.g. disabled or the elderly should be located away from high-risk areas. The Sequential Test does not, however, differentiate between the vulnerability of the end users of the site, only the vulnerability of the intended use of the site. A proposed residential development for highly vulnerable end users will still fall under the 'More Vulnerable' classification in Table D.2 of PPS25 and the Sequential and Exception Tests will apply accordingly. Where development for highly vulnerable end users cannot be avoided, safe and easy evacuation routes are essential.

5.2.2 Time to Peak of Flood Hazard

Identification of the time to the peak of the flood hazard relates to the amount of time it takes for a flood event to reach its maximum level, flow or height. The greater the time to peak, the greater the time available for evacuation. The time to peak can, for residual flooding, be very short. Should a defence structure breach then inundation can be rapid, resulting in a short time to peak for the areas local to the breach. Typically, areas immediately adjacent to a breach location will have a shorter time to peak than areas setback from the flood defence.

5.2.3 Methods of Managing and Mitigating Residual Flood Risk

Many techniques are available to manage and mitigate against residual flood risk. These include:

- Setting aside higher risk land for recreation, amenity and ecology. These areas of open, undeveloped space can provide areas for flood water storage,
- Construction of secondary flood risk management structures which can relocate floodwaters away from certain areas or reduce the rate of flood inundation following a residual event. Examples of secondary flood risk management structures include embankments or raised areas behind flood

defence walls, raised infrastructure e.g. railways or roads and on a strategic level, canals, river and drainage networks. The latter are a form of secondary defence as they are able to convey or re-direct water away from flood prone areas even if this is not their primary function,

- Where development in flood risk areas is unavoidable, the most common method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water level. Finished Flood Levels (FFLs) should be considered at the same time as access and egress to ensure that residents are not trapped by flood water, and in close consultation with the EA.

Flood resilience is a damage limitation measure to reduce the consequence of flooding and should not be used as justification for inappropriate development in flood risk areas. The Association of British Insurers (ABI) in cooperation with the National Flood Forum has produced published guidance on how homeowners can improve the flood resilience of their properties (ABI, 2004). The guidance identifies the key flood resistant measures as being:

- Replace timber floors with concrete and cover with tiles,
- Replace chipboard/MDF kitchen and bathroom units with plastic equivalents,
- Replace gypsum plaster with more water-resistant material, such as lime plaster or cement render,
- Move service meters, boiler, and electrical points well above likely flood level,
- Put one-way valves into drainage pipes to prevent sewage backing up into the house.

Flood warning and emergency procedures are typically higher-level management strategies and should not be considered as a solution for flooding problems or a way of avoiding provision for safe and dry access and egress. In addition, when deriving flood warning and emergency procedures, the reluctance of residents to vacate premises upon receipt of a warning or during a flood event should not be under-estimated.

5.3 SUDS Utilisation

In order to reduce runoff rates from developed sites to that of existing (and where possible to achieve 'betterment'), PPS25 and its companion guidance recommend that Sustainable Drainage Systems (or techniques) known collectively as SUDS are used.

Surface water drainage from any new development within Bassetlaw should be designed in accordance with recommendations as set out PPS25 and the SUDS Manual (CIRIA C697) as a minimum and also in consultation with the EA and IDBs (where appropriate). Consideration should also be given to including porous paving (where permissible) and water recycling techniques such as rainwater harvesting and greywater recycling.

In general, there are advantages to be gained to developing drainage strategies for site wide developments such that strategic scale options such as utilising the existing attenuation lakes can be developed at lower overall cost (albeit with potential new linkages), but also to:

- Maximise green infrastructure linkage,
- Maximise ecological enhancement,
- Maximise water quality benefits from retention and filter type SUDS,
- Contribute towards the point system for Code for Sustainable Homes grading.

Considering the options now, is a key consideration for this strategic WCS. The following sections outline some of the key outline or strategic considerations for SUDS for the development areas, and it is recommended that any Detailed WCS, DPDs or AAPs develop site wide strategic drainage plans for the development scenarios and areas taken forward into the next planning stage. Property based SUDS should be provided in addition to strategic SUDS, and not instead of.

5.3.1 The SUDS Hierarchy

The EA and Defra currently suggest that the SUDS hierarchy (Figure 5-1) is adopted when considering SUDS techniques to be adopted for new development. This lists the order in which different SUDS techniques should be considered for a site in terms of their considered sustainability. SUDS techniques at the top of the hierarchy are preferable for their potential ecological and water quality benefits.

Figure 5-1: SUDS Hierarchy

Adapted from: SUDS - A Practical Guide, Environment Agency Thames Region

Most Sustainable	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape and Wildlife Benefit
	Basins and Ponds - Constructed Wetlands -Balancing Ponds -Detention Basins -Retention Ponds	✓	✓	✓
	Living Roofs	✓	✓	✓
	Filter Strips and Swales	✓	✓	✓
	Infiltration Devices -Soakaways -Infiltration Trenches and Basins	✓	✓	✓
	Permeable Surfaces and Filter Drains -Gravelled Areas -Solid Paving Blocks -Porous Paviors	✓	✓	
Least Sustainable	**Tanked Systems** -Oversized Pipes / Tanks -Storms Cells	✓		

5.3.2 Surface Water Attenuation

Once more is known about the likely layouts of the sites, it is recommended that the detailed requirement for different types of SUDS is undertaken. At this stage it can be assumed that a percentage of the development areas can be set aside as green space and notwithstanding other SUDS techniques. Therefore the remaining runoff generated from rainfall events will have to be attenuated or stored in surface water systems such as large scale strategic balancing lakes, or smaller site-specific ponds.

Once draft masterplans for each of the developments are available, then further work will be required to determine the increase in runoff due to development, allowing the required attenuation volumes to be calculated. Guidance in the Preliminary Rainfall Runoff Management for Developments or the Interim Code of Practice for SUDS should be referred to.

Once post development runoff rates and volumes have been determined (following masterplanning), surface water attenuation will need to be provided, utilising SUDS. Infiltration based SUDS are likely to be limited within Bassetlaw due to the nature of the underlying geology. Therefore, primary consideration should be given to the use of strategically located large-scale attenuation facilities, developed to attenuate water from a number of developments (rather than a number of individual disparate ponds, per development). In some instance, there may be a need to consider the use of smaller scale site-specific features such as rainwater harvesting, filter strips, swales and smaller balancing ponds.

5.3.3 Infiltration SUDS

Infiltration is a key factor in reducing runoff rates and volumes, as it reduces the reliance on surface or engineered storage systems such as balancing ponds or storage tanks. Figure 5-1 places some surface storage features near to the top of the hierarchy list on the basis of habitat creation and water quality benefits. Encouraging natural infiltration by creation of open grassland landscaping (where contamination is not an issue) should be encouraged first for large developments to maximise natural runoff rate reduction and to encourage natural recharge of groundwater systems.

Maximisation of green infrastructure and open space is recommended for large new development areas where the soil and geology is sufficiently permeable to make it a feasible option. Infiltration can also be encouraged via managed SUDS techniques such as soakaways, swales or infiltration trenches.

Infiltration based SUDS would be subject to site-specific ground investigation works by the developer.

Limitations

Given that much of the eastern (and far western) part of Bassetlaw is underlain by impermeable geology (typically mudstones), infiltration is not a key consideration for new development in these areas, without more detailed site by site analysis.

Due to the presence of a major aquifer under the western part of Bassetlaw, there are also extensive SPZs that would limit the possibility of discharging water to ground.

Groundwater Quality - Vulnerability

Groundwater resources are vulnerable to contamination from both direct sources (e.g. into groundwater) or indirect sources (e.g. infiltration of discharges onto land which in turn may feed down to the groundwater). Groundwater vulnerability within the study area has been determined by the EA, based on a review of aquifer characteristics, local geology and the leaching potential of soils. The vulnerability of the groundwater is important when advising on the suitability of SUDS. Aquifers close to, or outcropping at, the ground surface are more vulnerable to pollution or physical damage that could harm both the quality and flow of the groundwater. The flow of groundwater is slower than surface water, and the deeper into an aquifer the water is, the slower it moves. This means that if groundwater becomes polluted and the pollution moves deep into the aquifer, the water can potentially remain polluted for a very long time. This could subsequently led to a deterioration in the quality of drinking water supplied from a groundwater source or damage vulnerable groundwater dependent rivers and ecosystems.

EA groundwater vulnerability maps for the area (Figure 5-2) show that the western part of Bassetlaw is underlain by a major aquifer. A major aquifer usually provides a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Source Protection Zones

The EA creates groundwater SPZs around all major groundwater abstraction points. SPZs are created to protect areas of groundwater that are used for potable water supply, including both public and private supplies (including mineral and bottled water), or where the water is used in the production of commercial food and drinks.

SPZs are created on the basis that the time it takes for pollutants to reach an abstraction point from any point at the water table. It does not include the time taken for water to infiltrate from the surface down to the water table. This transmission time enables the EA to define 3 zones around a groundwater abstraction point.

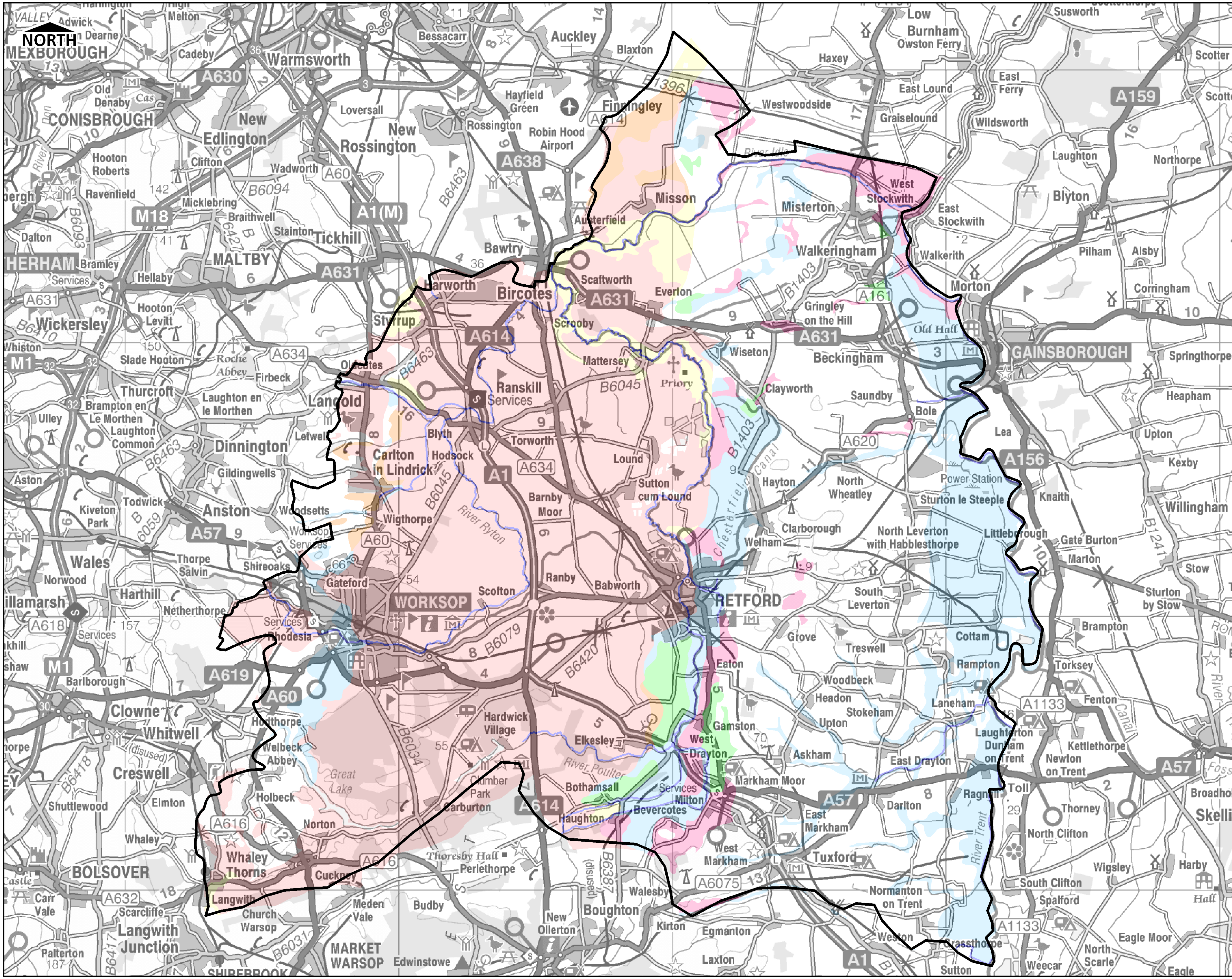
Zone 1 (Inner Protection Zone) – This is defined as 'any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1',

Zone 2 (Outer Protection Zone) – This is defined as the area that 'covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest',

Zone 3 (Total Catchment) - The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Depending on the nature of the proposed development and the location of the development site with regards to the SPZs, restrictions may be placed on the types of SUDS appropriate to certain areas. Infiltration into SPZ1 is generally only permitted for clean roof runoff. Runoff from roads and car parks is not acceptable in SPZ1 and is only acceptable in SPZ2 if there are sufficient controls in sources of contamination (e.g. oil separators) and that there is sufficient depth between the unsaturated soil into which the water is drained and the saturated water table in the geology below.

The SPZ designations for Bassetlaw are shown in Figure 5-3.



Legend

- Bassetlaw Boundary
- Main River

Groundwater Vulnerability

- Minor Low
- Minor Intermediate
- Minor High
- Major Low
- Major Intermediate
- Major High

BASSETLAW DISTRICT COUNCIL
NORTH NOTTINGHAMSHIRE

Revision Details	By	Check	Date	Suffix

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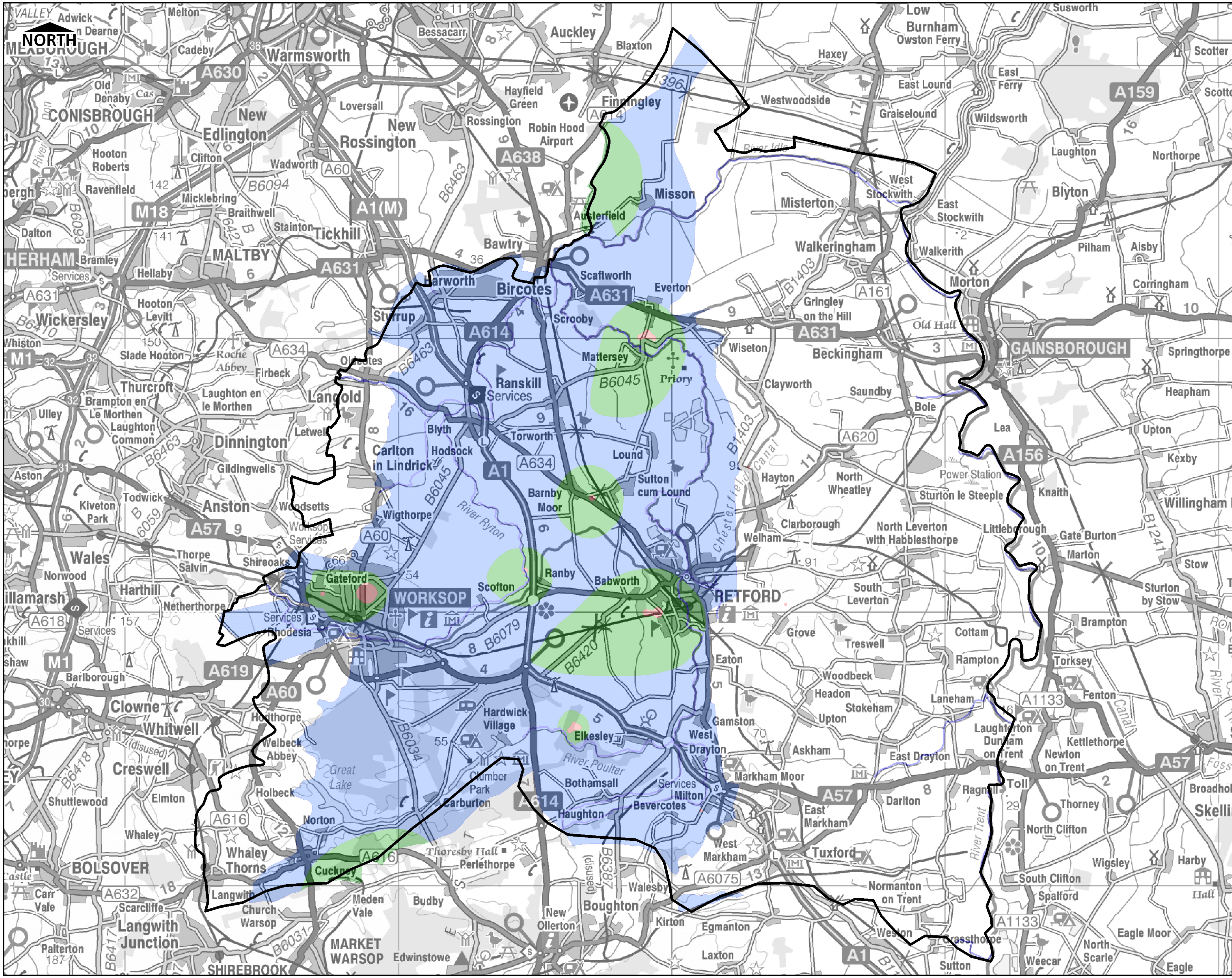
Drawing Number: FIGURE 5-2



Legend

Bassetlaw Boundary

Main River

Source Protection Zones

Zone 1 - Inner

Zone 2 - Outer

Zone 3 - Total Catchment

Revision Details	By	Check	Date	Suffix

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Drawing Number: FIGURE 5-3

6 Wastewater Treatment and Collection

6.1 Introduction

The wastewater treatment and collection section addresses two key areas for wastewater:

- Baseline assessment with respect to treatment of wastewater and how much 'spare' capacity is available in existing wastewater treatment facilities,
- Baseline assessment with respect to wastewater or sewer network and whether there is scope to use the existing network system[9] before upgrades are required.

It should be noted that ST have responsibility for wastewater collection in Bassetlaw. It is important to establish the baseline and hence spare capacity of wastewater treatment facilities and network because a basic assumption of the WCS is that it is preferable to maximise the use of existing infrastructure where feasible and also develop strategic upgrade solutions. By maximising existing infrastructure, costs may be minimised and potentially the most sustainable options would be encouraged (e.g. minimising initial carbon footprint of new development). Adopting such an approach may also reduce impact on existing neighbouring communities and allow the early phasing of some new development, which would not have to rely on longer lead in times associated with securing funding for new infrastructure through the statutory water company planning process.

An important aspect of the spare capacity of the existing wastewater treatment facilities is the assessment of the environmental capacity of the receiving watercourses. Discharge of additional treated wastewater from new development could have a detrimental impact on the water quality of receiving watercourses, the hydrological and hydraulic regime of receiving waters, associated habitats and the flood risk downstream of the discharge point. The assessment of the current water quality of the receiving watercourses within Bassetlaw is provided in Section 7 and should be read in conjunction with the wastewater capacity assessment undertaken in this section.

As part of any Detailed WCS, it will be important to fully assess (through network modelling) the performance of existing wastewater infrastructure and also determine any spare capacity of local wastewater treatment works (WwTW).

6.2 Data Availability

Information has been supplied by the EA, ST and BDC for the wastewater baseline assessment including:

- Proposed growth areas and indicative housing numbers for growth in Bassetlaw up to 2026,
- WwTW locations,

[9] the network of pipes and pumping stations which are used to transmit wastewater from buildings to treatment facilities

- Dry Weather Flow (DWF)[10] (measured flow consents) and quality consents for WwTW in Bassetlaw,
- Water quality information for receiving watercourses within the Bassetlaw study area,
- Sewer network records in GIS format. These show the layout of the sewer network and include information such as pipe sizes, gradient and sewer type.

The proposed growth areas, as supplied by BDC, show the potential areas that could accommodate further growth (either housing or employment) up to 2026. For each settlement, an indicative housing figure has been provided but employment information was only available in the form of total area of employment land.

The wastewater assessment uses an estimate of the wastewater generated from new development based on the amount of wastewater a person generates per day, for both domestic and employment uses. As employment growth was only available in terms of the area of employment land to be provided (identified by BDC as part of their Issues and Options consultation), the employment figures for use in the wastewater assessment were derived by calculating the likely population increase in Bassetlaw up to 2026. This was based on the proposed housing growth and estimating the percentage of that new population that would be of a working age, based on the current demographic profile in Bassetlaw as provided in the Annual Monitoring Report (BDC, 2009). This results in an estimated 7,765 jobs being created between 2010 and 2026.

Table 6-1 details the employment growth used for the wastewater assessment.

Table 6-1: Employment Growth for Wastewater Assessment

Area	Largest Employment Land Allocation		Estimated No. Jobs to be Assessed
	%	Ha	
Worksop	45%	36	3,494
Harworth	35%	28	2,718
Retford	20%	16	1,553
Total	**100%**	**80**	**7,765**

The calculations showing how the employment figures were derived are provided in Appendix A. The assessment makes a number of assumptions based on the proposed growth in the area and therefore the proposed jobs and wastewater generated from these jobs should be considered as indicative at this stage.

The housing and employment figures are subject to change based on the full public consultation on the BDC Core Strategy Issues and Options. When the housing and employment locations and level of growth are finalised, the wastewater assessment will need to be reviewed in light of the updated figures. In light of the available information, the wastewater assessment has been undertaken using the indicative housing numbers as provided by BDC and the derived employment numbers.

[10] DWF or Dry Weather Flow is a measure of baseflow in a sewerage system during dry weather, and is therefore meant to represent wastewater flow derived almost solely from human activity (trade and domestic) to separate out surface water drainage following rainfall events. It is used by the Environment Agency in a consent to describe the maximum daily volume ST can discharge from a WwTW.

6.3 Existing Wastewater Network

The first stage of the wastewater assessment is to assess the existing wastewater network and identify how and where wastewater from the proposed developments will be collected, whether the existing network is likely to be able to accommodate this additional flow, and which WwTW the wastewater will drain to and be treated at. Information has been provided by ST on the wastewater network serving Bassetlaw and potential sewerage infrastructure constraints as a result of proposed development.

There are twenty-four WwTWs located within and serving the Bassetlaw study area. Some of these works have the potential to be impacted by development within Bassetlaw itself and therefore a review of the wastewater network has been undertaken to identify those works likely to be impacted by growth up to 2026. All WwTWs within the study area are summarised in Table 6-2 and shown in Figure 6-1. Of the twenty-four WwTWs, eighteen have been identified as being likely to be impacted by growth in the study area and will therefore be assessed as part of this Outline WCS.

A high level assessment of the wastewater network serving each of the proposed growth areas has been undertaken based on the proposed housing and employment growth figures for each area. The assessment has been undertaken based on information provided by ST (Appendix B) and the main conclusions from their assessment are summarised in Table 6-3. A colour coding of green indicates that ST consider the potential impact of the proposed development on sewerage infrastructure to be low, whilst a colour coding of orange indicates that ST consider the potential impact of the proposed development on sewerage infrastructure to be medium.

At this stage it is not possible to provide an estimate of costings for infrastructure requirements. This can only be assessed following discussions with ST at the Detailed WCS stage. Outlined below however are some potential funding mechanisms and processes.

S106 Contributions

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.

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 adevelopment. 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.

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,
- reasonable in all other respects.

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,
- require a sum or sums to be paid to the authority on a specified date or dates.

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.

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 WCS has shown that the provision of SuDS and the relative costs will differ for different development areas according to the level of infiltration that is possible (according to geology) or acceptable (according to groundwater source protection zones).

Tariff System

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. However, the regulations introduced to accompany the Community Infrastructure Levy (CIL) make it clear that tariffs will no longer be used after 2014 by which time, infrastructure related to development will principally be secured by the CIL in combination with s106 agreements where applicable.

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.

Unilateral Undertaking

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.

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

Community Infrastructure Levy

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 Spring 2010 (subject to Ministerial approval) and these are intended to ensure that costs incurred in providing infrastructure to support development can be funded.

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 likely mechanism.

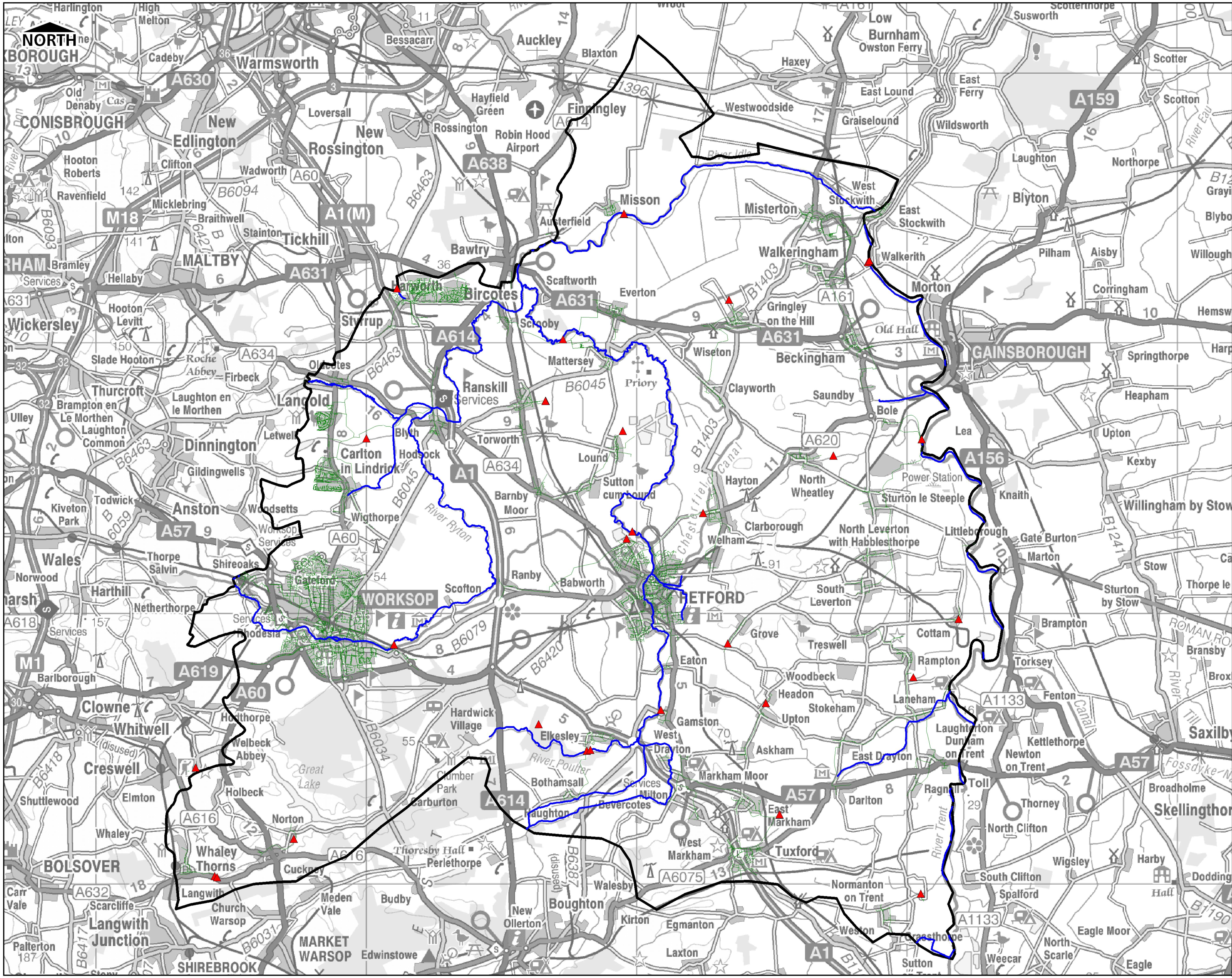
Minimisation of Cost

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.

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.

Table 6-2: Wastewater Treatment Works within the Bassetlaw Study Area

WwTW	NGR	Receiving Watercourse	Development Areas Draining to WwTW	Potential No. of Additional Dwellings	Maximum Employment Area (Ha)	Assessed in WCS
Askham & Headon Cum Upton	SK7478076690	Trib. of River Trent				✗
Clumber Park	SK6410075300	River Poulter				✗
Cottam	SK8192079810	Trib. of River Trent				✗
East Markham	SK7529072570	Tuxford Beck	Tuxford & East Markham	310		✓
Elkesley	SK6829074960	River Poulter	Elkesley	60		✓
Gamston	SK7090076440	River Idle bypass stream	Gamston	60		✓
Gringley-on-the-Hill	SK7342091620	Trib. of Chestfld. Canal	Gringley-on-the-Hill	60		✓
Grove	SK7337078900	Trib. of River Trent				✗
Harworth	SK6113092040	River Torne (via Harworth Bk)	Harworth / Bircotes	1,750	28	✓
Hodsock	SK6000086490	Langold Stream	Blyth, Carlton-in-Lindrick & Langold	420		✓
Lound	SK6949086760	Unnamed Trib of River Idle	Lound & Sutton (Cum Lound)	120		✓
Low Marnham	SK8052069650	Trib. of River Trent				✗
Markham Clinton	SK7090072700	Trib. of River Maun				✗
Mattersey Thorpe	SK6728090150	River Idle	Everton & Mattersey	120		✓
Misson	SK6953094810	River Idle	Misson	60		✓
Nether Langwith	SK5448070250	River Poulter	Nether Langwith	60		✓
North Wheatley	SK7728085850	Wheatley Beck	North/South Wheatley	60		✓
Norton	SK5731071670	River Poulter	Cuckney	60		✓
Rampton	SK8024077650	Seymour Drain	Rampton & Dunham	120		✓
Ranskill	SK6663087870	Trib. of Ranskill Brook	Ranskill	60		✓
Retford	SK6963082780	River Idle	Clarborough Hayton & Retford	1,560	16	✓
Walkeringham	SK7861093060	River Trent	Beckingham, Misterton & Walkeringham	370		✓
West Burton	SK8055086450	River Trent	North Leverton & Sturton-le-Steeple	120		✓
Worksop (Manton)	SK6102078860	River Ryton	Worksop	2,000	36	✓



Legend

- Bassetlaw Boundary
- Main River
- Wastewater Treatment Works
- Wastewater Network

BASSETLAW DISTRICT COUNCIL
NORTH NOTTINGHAMSHIRE

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: BASSETLAW OUTLINE WATER CYCLE STUDY

Drawing Title: WASTEWATER NETWORK

Scale at A3: NOT TO SCALE

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Stage 1 Check	Stage 2 Check	Originated	Date
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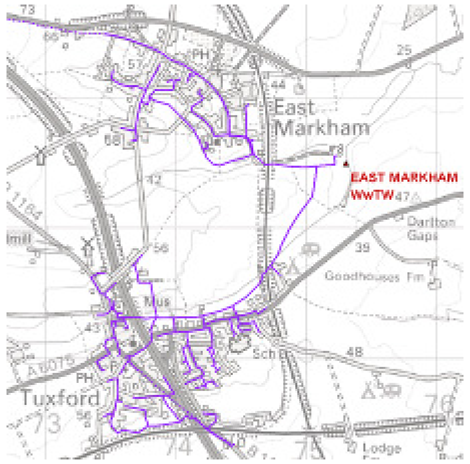
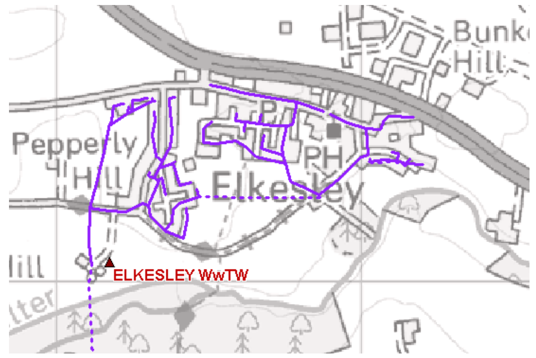
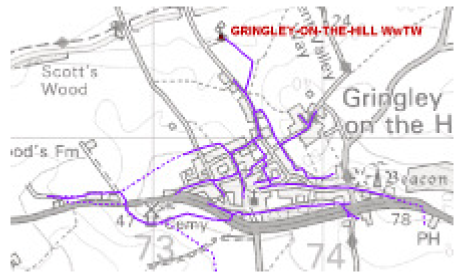
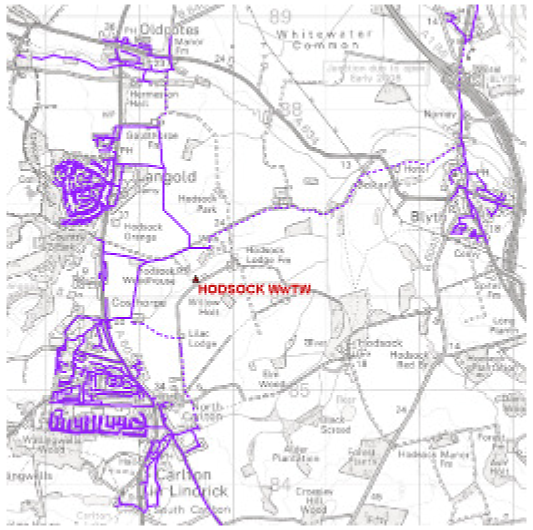
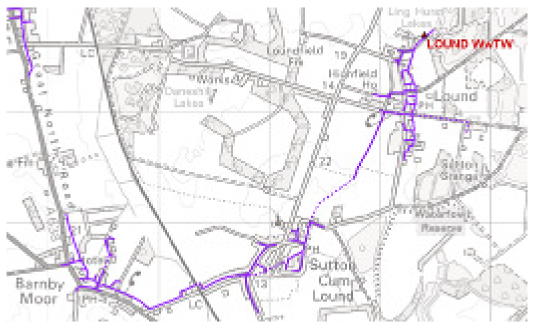
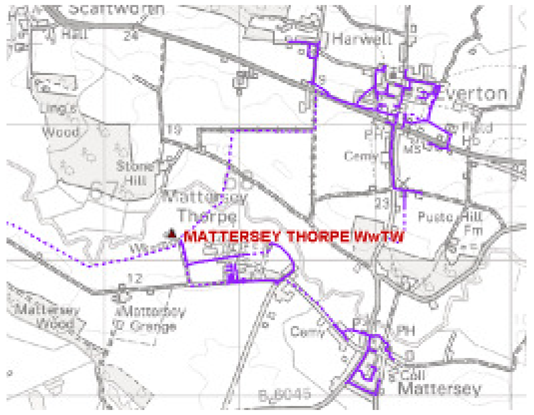
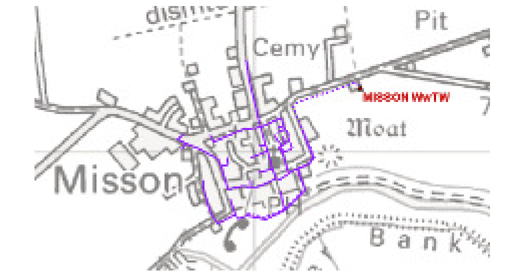
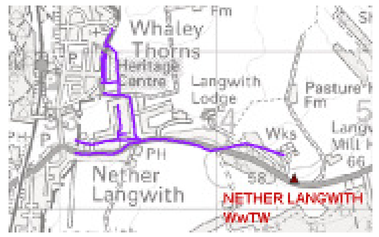
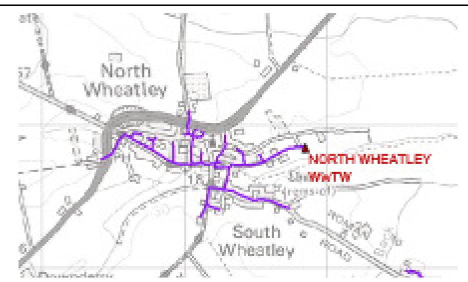
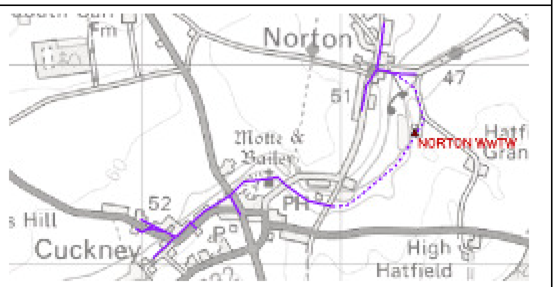
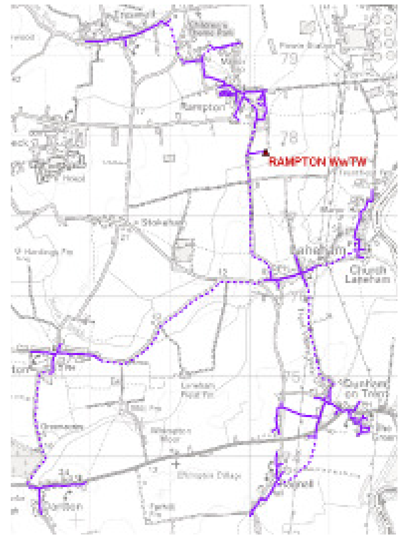
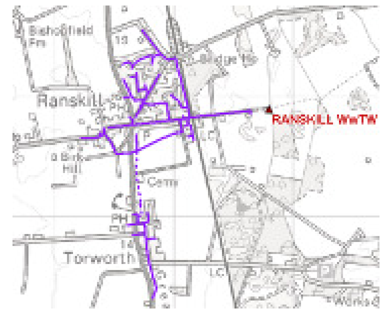
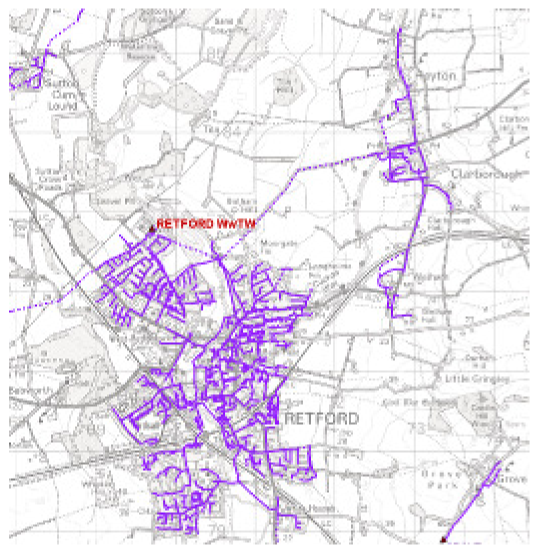
Drawing Number: FIGURE 6-1

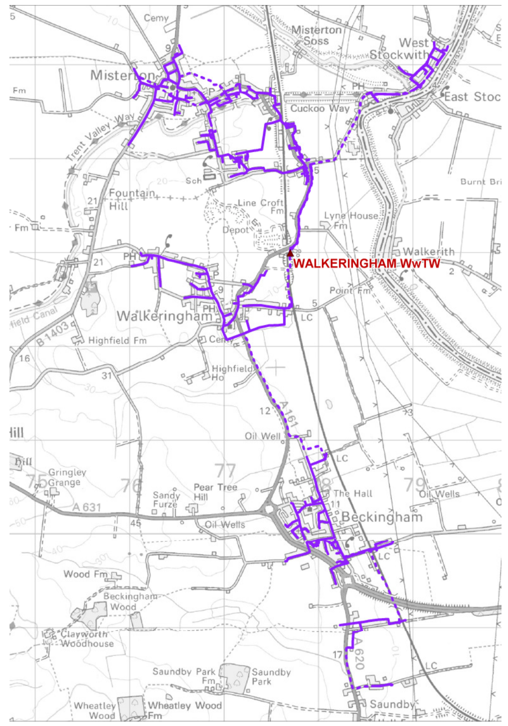
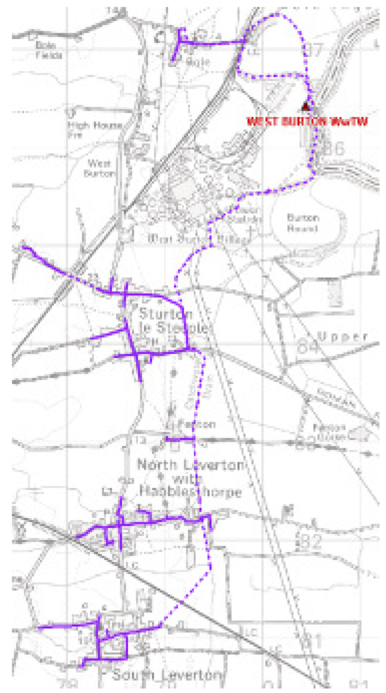
Table 6-3: Wastewater Network Assessment

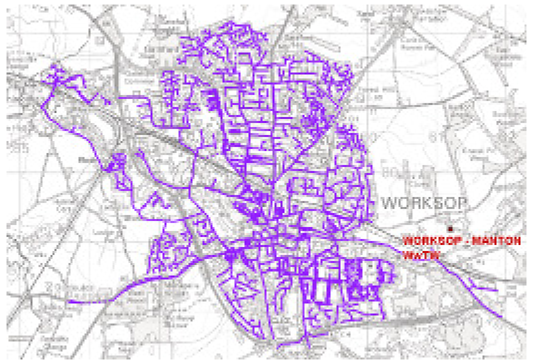
WwTW	Growth Area (and Impact Assessment)	Additional Dwellings (and Employment)	Comments on Existing Wastewater Network and Possible Restrictions	Network Schematic
East Markham	East Markham	60	• Wastewater in East Markham drains southeast to East Markham WwTW via a 300mm pipe. • There is a known isolated external sewer flooding problem in the village indicating localised capacity constraints. • ST has confirmed that the potential impact on sewerage infrastructure from new development is low but further hydraulic modelling would be required to assess spare capacity and any improvement needs. Provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant.	
	Tuxford	250	• Wastewater in Tuxford drains from the south to the northeast before being drained 1.5 km northeast to East Markham WwTW via a 300mm pipe. • The south of Tuxford is located in a sub-catchment which drains to a small sewage pumping station at Ashvale Road. There are no known sewer flooding problems in the catchment. • The west of Tuxford drains by gravity directly to East Markham STW (located to the east of the village). There are no known sewer flooding problems in this part of the network. • ST has confirmed that the potential impact on sewerage infrastructure from new development is low and subject to hydraulic modelling no capacity issues are envisaged provided surface water is managed sustainably and not connected to the foul/combined sewer.	
Elkesley	Elkesley	60	• Wastewater from Elkesley is drained from west to east through the village and then drains south to Elkesley WwTW via a 225mm pipe. • Any development located to the west of Elkesley will be located immediately upstream of Elkesley WwTW and would drain to the works via an existing 150mm outfall sewer which ST have confirmed has no known capacity issues. • Development to the southeast of Elkesley is likely to drain to Brough Lane sewage pumping station which then pumps flows a gravity sewer in Lawnwood Ave and then by gravity to Elkesley STW. There are no known problems with Brough Lane SAPS although there is a known highway flooding problem upstream of Brough Lane SAPS. Further hydraulic assessment would be required to confirm capacity availability. • ST has confirmed that the potential impact of development from all sites on sewerage infrastructure is low but further hydraulic assessment would be required to confirm capacity availability for development to the centre and southeast of Tuxford.	
Gamston	Gamston	60	• Gamston is served by a small 225mm diameter foul sewerage system draining to a small sewage pumping station pumping to Gamston WwTW. • There are no known sewer flooding problems in the village. • ST has confirmed that the potential impact on sewerage infrastructure from new development is low. • Provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant.	
Gringley-on-the-Hill	Gringley-on-the-Hill	60	• Wastewater from Gringley-on-the-Hill drains to the north of the town via a 150mm to Gringley-on-the-Hill WwTW. • There are no known sewer flooding problems in the village. • ST has confirmed that the potential impact on sewerage infrastructure from new development is low. • Provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant	

Harworth	Harworth / Bircotes	1,750 + 28 ha employment land	• Wastewater from Harworth / Bircotes is drained from east to west to Harworth WwTW via a 450 mm pipe. • A substantial growth of 1,745 dwellings coupled with a large allocation of employment land and uncertainties at present as to the location and level of development throughout the town means that further hydraulic capacity modelling will be required to confirm capacity in the existing sewerage network. • Development located to the east of the town is likely to require detailed hydraulic modelling to confirm hydraulic capacity and assessment regarding pumping requirements (potentially due to topography) and existing external flooding/capacity problems i.e. in the vicinity of Snipe Wood Park/Brookside Road. Additional storm flows are likely to require attenuation to avoid flooding to receiving watercourses. • Development to the west of the town (immediately upstream of Harworth WwTW) will be able to drain by gravity to the works but may require localised upsizing to accommodate the additional wastewater. There is a known highway flooding problem in Beech Road which (subject to detailed hydraulic modelling) may need localised upsizing if additional wastewater was to be drained through this part of the network. There are existing surface water sewers in the western area and whilst hydraulic modelling would be required to assess spare capacity it is unlikely that there is sufficient capacity to accept a development of this size without use of SUDS or other measures to reduce surface water run-off. • Any development in West Harworth which is likely to drain to Church Entrance swage pumping station/combined sewer overflow off Church Walk, would require hydraulic modelling/pumping capacity checks to ensure the additional developments do not have a detrimental impact on the pumping station or sewer overflow performance. • ST considers that the potential impact of development in the town on sewerage infrastructure to be **medium** (particularly where development is located to the east of the town). • Once the growth figures and locations have been confirmed, it is recommended that detailed modelling of the sewer network is undertaken in conjunction with ST to ensure that there is adequate capacity in the network to accommodate the proposed additional wastewater and to consider the options for development.	
Hodsock	Blyth	60	• Wastewater within Blyth drains north to a small sewage pumping station off Bawtry Road which then pumps flows via a 200mm diameter 3.2 km rising main directly to Hodsock WwTW (to the west of the village). • There is a known garden flooding problem downstream of the north, south and west of network serving the village which may need some localised upsizing works although acceptance of an additional 60 properties in the village is not expected to be have any capacity issues providing storm water is not connected to the foul sewers. • There are some limited surface water sewers located to the south of the village. • ST has confirmed that the potential impact on sewerage infrastructure as a result of the proposed development is **low**.	
	Carlton-in-Lindrick	300	• Wastewater from Carlton-in-Lindrick drains 1.5 km northeast to Hodsock WwTW along a 450 mm pipe. Within the village itself, wastewater drains north-easterly to the 450 mm pipe. • A relatively small amount of residential development (a peak flow increase of approximately 1 l/s) is planned for the village across four proposed sites in total, one to the east as discussed above, two to the north of the village and one to the south west. • Development to the north of the village will be upstream of the main outfall sewer to Hodsock WwTW. There are no known sewer flooding problems downstream of this area. • Development to the south of the village will be located at the upstream end of the network draining to Hodsock WwTW. ST have reported that there are several known internal flooding problems on Doncaster Road where the main sewer runs through the centre of the town. This sewer would be affected by the development to the south (and potentially west) of the village.. This could increase base flows which will exacerbate flooding along Doncaster Road and as such further hydraulic modelling will be required to assess the capacity issues and identify the scope of any improvements. • Development to the east of the village may also be impacted by/exacerbate the known internal flooding events in Doncaster Road and therefore hydraulic modelling would be required to assess the impact of any proposed development in this vicinity. • ST considers that the potential impact of development in the town on sewerage infrastructure to be **medium** (particularly where development is located to the west, south or east of the town).	
	Langold	60	• Wastewater from Langold is drained through the village from west to east and then southeast to Hodsock WwTW via a 450 mm pipe. • Development to the east of the village will be located upstream of the main outfall sewer to Hodstock STW and there are no known sewer flooding problems downstream of this area. • Development to the west of the town will also be located upstream of the main outfall sewer to Hodstock STW and there is a no known external flooding problems downstream of this area. However, there may need to be localised upsizing to provide additional capacity to ensure the flooding does not deteriorate. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
Lound	Lound	60	• Wastewater from Lound drains north through the village to Lound WwTW. • There are several external flooding problems in the centre of the village which would be exacerbated by any development to the south or east of the village. • Consequently depending on the location of development localised capacity improvements are envisaged although further hydraulic modelling will be required to confirm the extent of capacity improvements. • ST considers that the potential impact of development in the town on sewerage infrastructure to be **medium.**	
	Sutton (Cum Lound)	60	• Wastewater from Sutton (Cum Lound) is pumped north to the village of Lound and then drains to Lound WwTW. • Lound has several known external sewer flooding problems and the discharge point from the rising main (transferring flows from Sutton (Cum Lound) to Lound) is upstream of the flooding problems in the centre of the village which would be exacerbated by any development in Sutton which could increase pumping rates. • Consequently depending on the location of development localised capacity improvements are envisaged although further hydraulic modelling will be required to confirm the extent of capacity improvements. • ST considers that the potential impact of development in the town on sewerage infrastructure to be **medium.**	

Mattersey Thorpe	Everton	60	• This village is served by two pumping stations; one pumps the east of the village to the sewerage system serving the west whereby all flows are then pumped directly to Mattersey Thorpe WwTW. • There is a known infrequent internal sewer flooding problem in the village indicating localised capacity constraints. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs but provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • Any development to the east of the village would be less preferable due to potential capacity issues on the small sewage pumping station and the known flooding. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
	Mattersey	60	• Wastewater from Mattersey is drained to Mattersey Thorpe WwTW, • There are no known sewer flooding problems in the village and therefore provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
Misson	Misson	60	• Wastewater from Misson drains to a small pumping station located to the south west of the village. This then pumps 920m via a 100mm diameter rising main to Misson WwTW which is located to the north east of the village. • There are no known sewer flooding problems in the village and so subject to hydraulic modelling an additional 60 dwellings is not expected to have a detrimental impact on capacity. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
Nether Langwith	Nether Langwith	60	• Wastewater from Nether Langwith drains west to east to Nether Langwith WwTW via a 300 mm pipe. • There are no known sewer flooding problems in Nether Langwith and so subject to hydraulic modelling no capacity issues are expected to cater for an additional 60 dwellings in the catchment. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
North Wheatley	North/South Wheatley	60	• Wastewater from North Wheatley drains from west to east through the village to North Wheatley WwTW. • Development to the east of the village will be located close to North Wheatley STW and subject to hydraulic confirmation development in this location is not expected to have any capacity issues. • Development to the south or west of the village may exacerbate a known garden flooding problem downstream and therefore further hydraulic analysis would be required to assess the impact of any development in this area on the flooding problem. • ST considers the potential impact of the proposed development at these sites on the sewerage infrastructure as **medium**.	
Norton	Cuckney	60	• All flows in the village drain to a terminal sewage pumping station to the northeast of the village which pumps flows to Norton WwTW. • There is a known isolated external sewer flooding problem located at the top of the catchment (south-west of the village) indicating localised capacity constraints. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs but provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	

Rampton	Dunham	60	• All flows in the village drain to a terminal sewage pumping station which pumps flows to the village of Laneham where flows are then pumped on to Rampton WwTW. • There is an known infrequent internal and external sewer flooding problem located at the top of the catchment (south-west of the village) indicating localised capacity constraints. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs but provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
	Rampton	60	• Wastewater from Rampton is drained from northwest to southeast through the village and pumped to Rampton WwTW via a 150 mm pipe. • All development is likely to drain to a terminal sewage pumping station off The Pastures which pumps all flows from the village directly to Rampton WwTW. There are known internal flooding problems in the vicinity of the pumping station but these are currently being assessed as part of ST's sewer flooding investment programme. Subject to completion of these sewer flooding improvements ST do not envisage any capacity issues associated with an additional 60 dwellings in the village • ST considers the potential impact of the proposed development in the village on the sewerage infrastructure as **medium**.	
Ranskill	Ranskill	60	• Wastewater from Ranskill drains to the east of the village to Ranskill WwTW. • There are no known sewer flooding problems in the village and so provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
Retford	Clarborough Hayton	60	• Clarborough Hayton lies to the northeast of Retford and wastewater from the village is drained to a terminal sewage pumping station on Smeath Lane which pumps flows 3.5 km southwest to Retford WwTW, via the sewer network serving the north of Retford. Capacity within the sewer system draining to Retford WwTW should be considered in conjunction with growth in northeast Retford as they will both drain via the same pipe to Retford WwTW. • There are three isolated external flooding locations across the village indicating limited capacity. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs. • ST considers the potential impact of the proposed development in the village on the sewerage infrastructure as **medium**.	
	Retford	1,500 + 16 ha employment land	• Wastewater in Retford drains from south to north through the town to Retford WwTW. The majority of wastewater from Retford is pumped to the works via a 375 mm pipe to the northeast of the town. • The substantial growth of 1,163 dwellings coupled with a large allocation of employment land and uncertainties at present as to the level and location of development throughout the town, means that further hydraulic capacity modelling will be required to confirm capacity in the existing sewerage network. • There are known internal and external flooding problems downstream of south Retford. An internal flooding problem is currently being assessed as part of ST's sewer flooding capital investment programme. Further hydraulic analysis would be required to assess capacity availability for all developments to the south of the railway. • Development to the north of Retford (particularly in the vicinity of Bolham Lane sewage pumping station) may impact the storm sewer overflow on Bolham Lane, and as such this may need to be assessed to ensure its performance is not unduly affected. However subject to hydraulic modelling it is not envisaged that development in this area would have any major capacity implications. • ST considers the potential impact of the proposed development at these sites on the sewerage infrastructure as **medium**.	

Walkeringham	Beckingham	60	• Wastewater within Beckingham is drained from the south to the north of the village and is then pumped 3 km north to Walkeringham WwTW. • Development to the south of the village will be located upstream of Station Road sewage pumping station which also has a combined sewer overflow. This pumping station then pumps to Low Street. ST have reported that there are known internal flooding issues on Low Street which is currently being assessed as part of ST's sewer flooding investment programme. • Development to the north and west of the village would drain to sewers downstream of the known sewer flooding problems in Low Street and so additional flows are likely to have negligible impact on the current flooding. • ST has confirmed that the overall potential impact of development on sewerage infrastructure is **medium**.	
	Misterton	250	• Wastewater from Misterton drains from the northwest to the southeast and is pumped from Marsh Lane pumping station 1.5 km south to Walkeringham WwTW along a 120 mm pipe. • Development to the northwest of the village would drain to Cornley Road sewage pumping station and are then pumped to Station Street and then gravity drained to the terminal pumping station at Marsh Lane. There is a known highway flooding problem off March Lane so hydraulic modelling would be required to ensure this problem is not unduly exacerbated. • Development to the south of the village would drain to a sewer serving the south of the village which drain by gravity to the terminal pumping station at Marsh Lane which pumps all of Misterton to the sewage works at Walkeringham. There are no known sewer flooding problems on this 225mm sewer • Due to the proposed number of dwellings being proposed in the village there it is envisaged that some capacity improvements may be required at the sewage pumping stations depending on the location of the development sites. However provided surface water is managed sustainably and is not connected to the foul/combined sewers then this impact will be reduced. • ST has confirmed that the overall potential impact of development on sewerage infrastructure is **medium**.	
	Walkeringham	60	• All flows in the village drain to a terminal sewage pumping station which pumps flows to Walkeringham WwTW. • There is an isolated external sewer flooding problem located near to the terminal pumping station indicating localised capacity constraints. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs but provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
West Burton	North Leverton	60	• Wastewater from North Leverton drains from west to east through the village and connects to sewer that pumps the wastewater 6 km north to West Burton WwTW, through the town of Sturton-le-Steeple, via a 150 mm pipe. • Development to the west of the village would be upstream of a known low frequency internal flooding problem on Main Street (in the vicinity of Southgore Lane). The additional flows from a further 60 dwellings in not expected to have a major impact on this flooding problem but detailed hydraulic modelling would be require to confirm if any localised capacity improvements are required. • All flows in North Leverton are pumped to West Burton sewage pumping station but there are no capacity issues at this pumping station. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	
	Sturton-le-Steeple	60	• All flows in the village drain to a terminal sewage pumping station which pumps flows to West Burton WwTW. • There is a known isolated external sewer flooding problem located at the top of the catchment (north of the village) indicating localised capacity constraints. • Further hydraulic modelling would be required to assess spare capacity and any improvement needs but provided surface water is managed sustainably and not connected to the foul/combined sewer then (subject to hydraulic confirmation) capacity improvements are not envisaged to be significant to accommodate foul only flows from 60 properties. • ST considers that the potential impact of the development on sewerage infrastructure will be **low.**	

Worksop-Manton	Worksop	2,000 + 36 ha employment land	• Worksop is targeted with providing the largest level of growth in Bassetlaw. There is already a substantial sewer network serving the area which drains wastewater from northeast Worksop to Worksop WwTW to the southwest of the town via 1200 mm pipe. There are several larger strategic sewers through the town that transmit the wastewater from the southwest, west and north of the town to the large strategic sewer serving the works. • The substantial growth of 2,326 dwellings coupled with a large allocation of employment land and uncertainties at present as to the level of development in each of the growth areas, means that further hydraulic capacity modelling will be required to confirm capacity in the existing sewerage network. • Development to the east of the town is likely to provide less impact and potential upgrades to the existing sewer network as wastewater from here will be able to connect to the larger strategic main to the southeast of the town that drains directly to Worksop WwTW. • Once the growth figures and locations have been confirmed, it is recommended that detailed modelling of the sewer network is undertaken in conjunction with ST to ensure that there is adequate capacity in the network to accommodate the proposed additional wastewater. • ST has confirmed that the potential impact of the proposed development on sewerage infrastructure is low, but this will need to be confirmed by hydraulic modelling and pumping station capacity checks.	

A summary of the main points of the wastewater network capacity assessment are as follows:

- There is a good coverage of existing strategic sewers across the three main towns in the study area of Worksop, Harworth / Bircotes and Retford where the majority of growth within Bassetlaw is planned,
- A detailed modelling exercise should be undertaken (at Detailed WCS) for the three main towns of Worksop, Harworth / Bircotes and Retford when the proposed dwelling and employment numbers for each area are known to assess the current capacity within the existing sewer network and capacity for the proposed development. This is crucial in these areas as significant growth is planned which could require upgrades to the existing sewer network, particularly if growth is planned at the upstream end of the network,
- Where minor development is planned, outside of the main three towns, it is unlikely that upgrades to the existing sewer network will be required and local connections to the existing network will be possible. However, modelling exercises to determine the capacity of the existing sewer network in these towns and the capacity to accommodate the planned growth may need to be undertaken on a village-by-village or area-by-area basis in conjunction with ST to confirm this – this is something that could be done by developers in support of their planning applications or at the Detailed WCS level,
- Where possible, for all towns and villages, it is advised that growth is maximised in those sites to the downstream end of the network, nearer the WwTW, as this is likely to minimise the need and investment for sewer upgrades further upstream in the network and as such mean that growth can be delivered earlier in the planning timescale as there will not be the lead in time associated with planning for sewer upgrades,
- Development on the urban fringe of the towns and/or villages offers the potential to provide local connections from the proposed growth areas to the existing sewer network and negate the need the building of new strategic sewers.

Given the current uncertainties associated with levels and location of housing (and employment) development in Bassetlaw, a key component of any Detailed WCS should be the modelling of the sewer network for the three main towns of Worksop, Harworth / Bircotes and Retford (and where deemed necessary the smaller villages) to confirm the capacity within the existing sewer network once the housing and employment locations and levels have been confirmed. The modelling exercise and wastewater capacity assessment will need to be undertaken in conjunction, and agreed, with ST.

6.4 Wastewater Treatment Baseline and Capacity

The wastewater treatment and baseline capacity assessment assesses the current and future potential volumetric (headroom), process and wastewater quality consent capacity for those works identified as being impacted by future growth in Bassetlaw.

For the purposes of the Outline WCS the wastewater treatment capacity has been assessed in three stages:

- Volumetric Consent Capacity - difference between the maximum DWF that ST are permitted to discharge under the discharge consent and the current DWF that is treated from the existing population,
- Process Capacity - amount of flow that can be physically treated to the required quality standards as set under the discharge consent,
- Quality Consent Capacity - the amount of flow that can be discharged at the existing quality consents without deteriorating the downstream watercourse (under the WFD).

Whilst the assumptions used within these assessments are acceptable for the Outline WCS to determine the outline feasibility of accommodating the proposed growth, the Detailed WCS will need to revisit these assumptions in conjunction with ST. The review process should take into account finalised housing figures, occupancy rates and consumption (based on water efficiency targets). As a final output, the detailed review should also provide information on if, and when, funding is required to upgrade the process capacity at the WwTWs. Any new upgrades or infrastructure requires funding to be sought by ST and as such, there is an associated lead in time for the upgrade works which would limit the amount of development that could take place before the upgrades are in place.

6.4.1 Assumptions

The following assumptions based on latest available data, have been used for the wastewater treatment baseline and capacity assessment:

- The measured DWF, as provided by ST, represents the current wastewater being treated at the WwTWs,
- The per capita consumption for the future domestic residential population (G – water used per head, per day) is taken as 125 $lh^{-1}d^{-1}$. This is based on the Part G of the Building Regulations, which states that from April 2010 all new dwellings have to be built to a consumption of 125 $lh^{-1}d^{-1}$,
- The infiltration (I) rate[11] will be calculated as 25% of the domestic population multiplied by the stated per capita consumptions (PG = Domestic Population (Pd) x Domestic Consumption (G)),
- DWF is calculated as PG + I + E where E is the volume of trade effluent discharged in the catchment ($m3d^{-1}$),
- Flow to Full Treatment[12] (FtFT) is calculated as 3PG + I + 3E,
- The occupancy rate is 2.4 per dwelling – confirmed by ST,
- Proposed employment in Bassetlaw is assumed to be predominantly ‘commercial’ and has a per capita consumption of 28 $lh^{-1}d^{-1}$.

[11] Infiltration in this sense is defined as the amount of water that enters the drainage system from other sources such as ingress of groundwater through defective pipes or joints in either public sewers or private sewers and drains.
[12] Flow to Full Treatment (FtFT) is the maximum rate of flow that can be treated at a WwTW.

6.4.2 Wastewater Volumetric Consent Capacity

Current Volumetric Consent Capacity

Headroom is calculated by determining the difference between the consented upper limit on DWF and the DWF that the WwTW currently treats. Using the assumptions defined in Section 6.4.1, the number of future homes and population equivalent that could be accommodated in the future can be estimated and when new infrastructure upgrades to the WwTW may be required. Dependent on the number of new housing being assessed, the spare capacity will vary because infiltration allowance (calculated as 25% of the population multiplied by the per capita consumption) increases with population increases which further reduces the capacity.

The discharge consent information supplied by ST has been compared to the measured DWF at each of the works to derive the volumetric (headroom) capacity for the eighteen WwTWs. This information has been used to calculate the number of new dwellings that can be served at each of the works (using information provided by ST and confirmed using the assumptions provided in Section 6.4.1). A summary in terms of current volumetric capacity each of the works is provided in Table 6-4.

Table 6-4: Current WwTW Volumetric Consent Capacity Assessment

WwTW	DWF Consent (m^3d^{-1})	Measured DWF[13] (m^3d^{-1})	Headroom		
			%	DWF (m^3d^{-1})	Dwellings
East Markham	1,160	961	17%	199	520
Elkesley	250	126	50%	124	320
Gamston	60	52	13%	8	20
Gringley-on-the-Hill	226	181	20%	45	120
Harworth	2,050	1,517	26%	533	620
Hodsock	2,158	1,991	8%	167	440
Lound	325	206	37%	119	30
Mattersey Thorpe	1,631	1,114	32%	517	1,350
Misson	161	95	41%	66	170
Nether Langwith	1,000	623	38%	377	980
North Wheatley	120	124	-3%	-4	0
Norton	92	92	0%	0	0
Rampton	345	388	-12%	-43	0
Ranskill	358	187	48%	171	450
Retford	6,593	4,945	25%	1,648	4,395
Walkeringham	2,090	1,503	28%	587	1,140
West Burton	582	375	36%	207	540
Worksop-Manton	10,227	11,783	-15%	-1,556	570

Currently, North Wheatley and Rampton WwTWs are exceeding their volumetric consents and therefore have no capacity to treat further flows from new development in the area unless they apply for, and are granted an

[13] Based on information provided by ST – see Appendix C – Severn Trent Wastewater Treatment Assessment..

increase to their flow consent by the EA. Additionally, upgrades to the respective works may be required to treat the additional flow; this would need to be confirmed by ST. Worksop WwTW is reported as exceeding its current DWF consent but ST have indicated that it has capacity to accommodate an additional 570 dwellings before capacity is reached; this may require further investigation as part of the Detailed WCS. Norton WwTW is at its DWF consent and Hodsock WwTW is close to its DWF consent limit (8% capacity) and it is therefore possible that these works may require new flow consents to treat any additional wastewater.

Under the proposed measures for the Humber River Basin Management Plan (RBMP) and the EA National Environment Programme (NEP) Rampton WwTW has been identified for a new flow consent. The new DWF consent of 425 m^3d^{-1}, would mean that the consent is increased to the current measured level (and includes no headroom allowance for future growth). It is therefore considered to have no additional capacity for treatment of further effluent. As such the works would need to seek a new flow consent to treat the additional wastewater generated by any proposed growth and invest in upgrades to the works where required.

Future Volumetric Consent Capacity

As an indication of where potential future capacity constraints may exist, a calculation of future volumetric capacity at the eighteen WwTWs has been undertaken using the proposed housing and employment figures and assuming that growth in the settlements will drain to the WwTWs as identified in Table 6-2. The results of the capacity assessment are provided in Table 6-5 and Appendix D.

Table 6-5: Potential Future WwTW Volumetric Consent Capacity Assessment

WwTW	Development Areas Draining to WwTW	Potential No. of Additional Dwellings	Estimated maximum No. of new jobs	Future (2026) Headroom		
				%	DWF (m^3d^{-1})	Dwellings
East Markham	Tuxford & East Markham	310		7%	83	210
Elkesley	Elkesley	60		41%	102	260
Gamston	Gamston	60		-24%	-15	-40
Gringley-on-the-Hill	Gringley-on-the-Hill	60		10%	23	60
Harworth	Harworth / Bircotes	1,750	2,718	-10%	-199	-1,330
Hodsock	Blyth, Carlton-in-Lindrick & Langold	420		0%	10	20
Lound	Lound & Sutton (Cum Lound)	120		23%	74	195
Mattersey Thorpe	Everton & Mattersey	120		19%	472	1,230
Misson	Misson	60		27%	44	110
Nether Langwith	Nether Langwith	60		35%	355	920
North Wheatley	North/South Wheatley	60		-22%	-27	-60
Norton	Cuckney	60		-24%	-23	-60
Rampton[1]	Rampton & Dunham	120		-26%[1]	-45	-120
Ranskill	Ranskill	60		41%	149	390
Retford	Clarborough Hayton & Retford	1,500	1,553	15%	1,020	2,720
Walkeringham	Beckingham, Misterton & Walkeringham	370		21%	448	770
West Burton	North Leverton & Sturton-le-Steeple	120		28%	162	420
Worksop-Manton	Worksop	2,000	3,494	-24%	-2,404	-1,545

Note: 1. Rampton WwTW is assessed against its proposed consent of 425 m^3d^{-1} which is assumed to have no volumetric headroom

It is important to note that the future capacity assessment is only provided as an indication of potential future constraints at present and will need to be revisited at an early stage of the Detailed WCS once housing and employment levels and locations have been confirmed.

The assessment shows that in addition to those works identified in the current volumetric capacity assessment (i.e. as having no capacity for future growth without increases to the flow consents and / or upgrades to the works to treat the additional flow), Harworth WwTW is predicted to exceed its DWF consents by 10% under future growth conditions. Due to the nature of the assessment and the assumptions used the exceedence could be considered to be within the sensitivity of the calculations, and as such, it is suggested that the results are discussed with ST and the EA and reviewed when the finalised housing and employment information is made available as part of the Detailed WCS.

Rampton WwTW which has been assessed against its proposed DWF consent of 425 m^3d^{-1}, would need to seek a new consent to treat an additional 45m^3d^{-1} of wastewater.

Table 6-6 provides a summary of the proposed growth horizons and predicted wastewater capacity under each of these for those works estimated to exceed their DWF consent under future growth conditions. This shows that out of the six WwTWs, only Gamston WwTW has capacity to accommodate any of the proposed growth. All other works will require an increase to the DWF consent prior to development.

Table 6-6: Potential Future WwTW Volumetric Consent Capacity vs. Growth Horizons

WwTW	Development Areas Draining to WwTW	Growth Horizons (dwellings) and Wastewater Capacity[1]			
Gamston	Gamston	15	30	45	60
Harworth	Harworth / Bircotes	1,000	1,250	1,500	1,750
North Wheatley	North/South Wheatley	15	30	45	60
Norton	Cuckney	15	30	45	60
Rampton	Rampton & Dunham	30	60	90	120
Worksop-Manton	Worksop	1,250	1,500	1,750	2,000

[1]. Green indicates capacity to accommodate growth. Red indicates no capacity to accommodate growth under existing wastewater DWF consent.

The future volumetric headroom capacity assessment shows that until new DWF flow consents are sought and granted from the EA and potentially upgrades to the WwTWs are undertaken to treat that additional flow, it will not be possible to treat any wastewater from growth in Cuckney, Dunham, North/South Wheatley and Rampton. Similarly, only a limited number of dwellings can built and the wastewater from these treated at Gamston, Harworth and Worksop WwTW before a new flow consent and potential upgrades to the works are required, excluding the implications of employment growth in the area. All other works should have the volumetric capacity to treat the wastewater generated from the proposed residential and employment development within Bassetlaw.

Assumption Sensitivity

The conclusions for the assessment of housing that can be accommodated by the existing capacity of the WwTW are sensitive to assumptions applied to the calculations and in particular to the assumption applied to the per capita consumption and infiltration (which is calculated as 25% of the population consumption). With the publication of the Code for Sustainable Homes this is a considerable drive to move towards more water efficient developments where water consumption is reduced by a number of measures. A reduction in water usage would significantly reduce the wastewater generated from new properties which could result in more properties being able to be treated at the WwTWs using any existing headroom capacity. However, whilst water efficiency will reduce the volume of sewage produced from new housing, this will tend to increase the strength of the sewage. Consequently, as the volumetric capacity is increased, the biological capacity is reduced, and therefore the capacity at the works is not necessarily released for more housing as result of these measures.

The assumptions used to calculate the additional wastewater generated from the proposed housing and employment development will need to be revisited and assessed as part of the Detailed WCS in conjunction with ST once the finalised housing and employment figures and locations have been made available to confirm the current capacity at each of the works and the future capacity.

An assessment of the sensitivity of water consumption is included in Section 4 of this report.

6.4.3 Wastewater Process Capacity

Process capacity refers to the amount of flow that can be treated to the required quality standards as set under the discharge consent. ST have undertaken an assessment based on the proposed dwelling and employment growth to identify those works that are likely to require process upgrades to treat the additional wastewater generated by the proposed growth. These are highlighted in Table 6-7 and the full assessment is provided in Appendix C as provided by ST.

Whilst WwTWs may not have sufficient spare capacity to accept the levels of development being proposed in its catchment area this does not necessarily mean that development cannot take place. Under Section 94 of the Water Industry Act 1991 sewerage undertakers have an obligation to provide additional treatment capacity as and when required. Where necessary ST will discuss any discharge consent implications with the EA. It is assumed that ST would seek the funding required to upgrade the processes in the works (if necessary) to treat the additional flow to the standard required under the existing licence.

Table 6-7: Wastewater Treatment Process Capacity

WwTW	Current Quality Performance (RAG)	Future Quality Performance (RAG)	Physical Constraints Regarding Provision of Additional Treatment Capacity (RAG)	Comments
East Markham	Marginal	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is likely to be sufficient hydraulic capacity to accommodate 310 dwellings in the catchment. Should additional treatment capacity be required ST do not envisage any issues in dealing with future growth demand.
Elkesley	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is likely to be sufficient hydraulic capacity to accommodate an additional 60 dwellings in the catchment. Should additional treatment capacity be required ST do not envisage any issues in dealing with future growth demand.
Gamston	Marginal	None expected to be an issue	No land or other constraints preventing expansion	This is a small rural sewage treatment works where the provision of an additional 60 dwellings (equivalent to around 144PE based on 2.4 people per dwelling) would represent a significant increase in current flows. Consequently the works is likely to required complete replacement although at present ST do not envisage any physical constraints that would prevent additional capacity being provided
Gringley-on-the-Hill	Good	None expected to be an issue	No land or other constraints preventing expansion	This is a small rural sewage treatment works. Comparison of current measured DWF against the consented DWF consent indicates that there is hydraulic capacity at this site to accommodate an additional 60 dwellings.
Harworth	Marginal	Marginal concern	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is limited hydraulic capacity and additional treatment capacity will be required to accommodate the levels of development being proposed in Harworth. Provision of additional capacity is likely to take 2-3 years to provide but this would only be initiated once planned development proposals have been confirmed by Bassetlaw DC. Notwithstanding this we ST not envisage any issues with the provision of additional treatment capacity (subject to a revised discharge consent being agreed with the Environment Agency).
Hodsock	Marginal	Marginal concern	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is some hydraulic capacity at this site, however the current sizing biological filters indicated there could be stress from a load perspective. Based on the growth projections for Carlton-in-Lindrick and Langold it is marginal whether there is sufficient spare headroom to accommodate an additional 420 dwellings without provision of additional treatment capacity. Should additional capacity be required ST do not envisage any physical constraints that would prevent additional capacity being provided.
Lound	Good	None expected to be an issue	No land or other constraints preventing expansion	This is a small rural sewage treatment works where the provision of an additional 120 dwellings (equivalent to around 288PE based on 2.4 people per dwelling) would represent a large increase in current flows. Consequently the works is likely to required upsizing/replacement in order to accommodate the additional flows although at present ST do not envisage any physical constraints that would prevent additional capacity being provided

Mattersey Thorpe	Marginal	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured dry weather flow against the consented dry weather flow consent indicates that there is significant hydraulic capacity at this site. An additional 120 dwellings proposed in this catchment is not envisaged to be an issue
Misson	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is hydraulic capacity at this site to accommodate an additional 60 dwellings.
Nether Langwith	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is significant hydraulic capacity at this site. An additional 60 dwellings proposed in this catchment is not envisaged to be an issue
North Wheatley	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is no spare hydraulic capacity at this site. However asset sizing data indicates there is capacity within the secondary treatment process but capacity improvements may be required to other processes. Should additional capacity be required to accommodate an additional 60 dwellings ST do not envisage any physical constraints that would prevent additional capacity being provided.
Norton	Good	None expected to be an issue	No land or other constraints preventing expansion	This is a small rural sewage treatment works where the provision of an additional 60 dwellings (equivalent to around 144PE based on 2.4 people per dwelling) would represent a significant increase in current flows. Consequently the works is likely to required complete replacement although at present ST do not envisage any physical constraints that would prevent additional capacity being provided
Rampton[1]	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is no spare hydraulic capacity at this site. To accommodate additional flows from a further 120 dwellings a revised discharge consent will need to be obtained from the Environment Agency but should additional treatment capacity be required to meet tighter quality parameters it is not envisaged that there are any physical constraints that would prevent additional capacity being provided.
Ranskill	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured dry weather flow against the consented dry weather flow consent indicates that there is significant hydraulic capacity at this site. An additional 60 dwellings proposed in this catchment is not envisaged to be an issue
Retford	Good	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is sufficient spare hydraulic capacity to accommodate the growth projections of 1560 dwellings and 16Ha of employment, however there are concerns relating to the capacity of the Biological Filters. Further process analysis will be required to confirm actual capacity but should additional capacity be required ST do not envisage any physical constraints that would prevent additional capacity being provided.

Walkeringham	Marginal	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is significant hydraulic capacity at this site to accommodate the revised growth projections of 370 dwellings. Further process analysis will be required to confirm actual capacity but should additional capacity be required ST do not envisage any physical constraints that would prevent additional capacity being provided.
West Burton	Marginal	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured dry weather flow against the consented dry weather flow consent indicates that there is significant hydraulic capacity at this site to accommodate the revised growth projections of 120 dwellings. Further process analysis will be required to confirm actual capacity but should additional capacity be required ST do not envisage any physical constraints that would prevent additional capacity being provided.
Worksop-Manton	Marginal	None expected to be an issue	No land or other constraints preventing expansion	Comparison of current measured DWF against the consented DWF consent indicates that there is limited spare hydraulic capacity at this site. Notwithstanding this ST do not envisage any physical constraints that would prevent additional capacity being provided to meet future development being proposed in Worksop. Provision of additional capacity is likely to take 2-3 years to provide but this would only be initiated once planned development proposals have been confirmed by Bassetlaw DC.

6.4.4 Wastewater Quality Consent Capacity

Urban Wastewater Treatment Directive

There are several pieces of legislation which are relevant to WwTWs, of these the Urban Wastewater Treatment Directive (UWwTD) is particularly important in terms of the setting of quality consents for WwTWs.

The UWwTD is designed to make sure all wastewater in the EU is treated to the appropriate standard. An essential element of the Directive is that quality standards for effluent fall into categories depending on size of the WwTW and the sensitivity of the receiving water. As populations grow in each sewerage catchment, some WwTWs may exceed the UWwTD threshold that requires nutrient removal.

For works discharging into a Sensitive Area (Eutrophic) a population equivalent exceeding 10,000 will require phosphate removal to a standard of 2 mgl^{-1} (as an annual average). If however the population equivalent is increased to exceed 100,000, then a tighter standard of 1 mgl^{-1} (as an annual average) phosphorous is required. It is clear that growth in some areas could result in tighter limits on the quality of the effluent and this could have implications for investment in new sewage treatment infrastructure.

Implications of new water classifications and standards under the Water Framework Directive (WFD) are discussed in Section 7.4.

Current Quality Consents

The current quality consents for the eighteen WwTWs principally serving Bassetlaw have been provided by ST (Table 6-8). Best Available Technology (BAT) limits for WwTW are 5 mgl^{-1} (95%ile) for BOD, 1 mgl^{-1} (95%ile) for Ammonia and 1 mgl^{-1} (Mean) for Phosphorus. The current consents for the WwTWs within Bassetlaw are not close to BAT (except for the 3mgl^{-1} Ammonia consent for Worksop-Manton WwTW and 2mgl^{-1} Phosphorus consents at Hodsock, Nether Langwith, Retford and Worksop-Manton WwTWs) and therefore tightening of these consents under future growth conditions and the WFD should theoretically be possible within the confines of BAT, though upgrades may be required to the works to treat the effluent to the required quality.

Table 6-8: Current Quality Consents

WwTW	BOD (mgl^{-1})	Ammonia (mgl^{-1})	SS (mgl^{-1})	P (mgl^{-1})
East Markham	20	10	30	-
Elkesley	25	15	45	-
Gamston	25	-	45	-
Gringley-on-the-Hill	20	10	40	-
Harworth	25	10	45	-
Hodsock	15	5	40	2
Lound	60	-	70	-
Mattersey Thorpe	25	-	45	-
Misson	25	-	45	-
Nether Langwith	25	5 (Summer)/10 (Winter)	45	2
North Wheatley	20	10	40	-
Norton	25	15	45	-
Rampton	25	10	40	-
Ranskill	30	10	50	-
Retford	30	10 (Summer)/15 (Winter)	50	2
Walkeringham	25	15	45	-
West Burton	25	-	45	-
Worksop-Manton	15	3	30	2

Future Quality Consents

The proposed growth in Bassetlaw is likely to require a tightening of consents to ensure that 'good ecological status' is achieved and there is no deterioration in water quality downstream of the works as a result of increased effluent discharges.

A high level Monte Carlo modelling exercise has been undertaken for this Outline assessment based on information available at the time of the study to provide indicative future quality consents for those WwTWs identified as exceeding their current flow consent under future growth conditions (namely, Harworth, North Wheatley, Rampton and Worksop-Manton). Additionally, Retford WwTW, which is expected to treat and discharge wastewater from significant growth (an additional 1,208 dwellings and 2,970 jobs) has been assessed against WFD requirements. For all other WwTW where a small volume of growth is planned and where the associated WwTWs will not exceed their current flow consent (and therefore under current EA policy will not require a tightening of water quality consents), the future quality consent capacity has not be calculated.

The assessment will need to be revisited during the Detailed WCS once the housing and employment figures have been finalised to calculate the required consents. The results from the detailed modelling exercise will need to be discussed with ST and the EA to determine whether wastewater from future proposed growth in Bassetlaw can be adequately treated and discharged at the existing works without causing deterioration in the downstream water environment. The costs and timings associated with any associated upgrades or treatment options will need to be assessed to help guide the decision of where and when future growth can be accommodated within Bassetlaw.

Water Quality Requirements Downstream of Wastewater Treatment Works

Based on the water quality analysis undertaken in Section 7, the proposed WFD standards required to be achieved downstream of the WwTWs under future discharge conditions have been identified (Figure 6-8). Downstream water quality standards are based on the current WFD assessment. Where a water body is currently achieving 'high' status for an individual determinand, it must continue to meet this in the future. Where a determinand is currently achieving less than 'good' status, it should aim to achieve at least 'good' status in the future. The majority of water bodies are currently achieving 'poor' status for phosphorus upstream and downstream of the WwTWs and as such in the future, they must achieve 'good' status. As no specific information pertaining to BOD was available for the assessment, the BOD targets have been assumed to be the same as those for Ammonia (i.e. where Ammonia must achieve 'high' status, BOD must also achieve 'high' status).

Table 6-9: WFD Water Quality Objectives Downstream of WwTW

WwTW	Receiving Watercourse	BOD	Ammonia	Phosphorus
		(90%ile)		
East Markham	Tuxford Beck	Good – 5mgl^{-1}	Good – 0.6mgl^{-1}	Good – 0.12 mgl^{-1}
Elkesley	River Poulter	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Gamston	River Idle bypass stream	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Gringley-on-the-Hill	Trib. of Chestfld. Canal	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Harworth	River Torne (via Harworth	Good – 5mgl^{-1}	Good – 0.6mgl^{-1}	Good – 0.12 mgl^{-1}
Hodsock	Langold Stream	Good – 5mgl^{-1}	Good – 0.6mgl^{-1}	Good – 0.12 mgl^{-1}
Lound	Unnamed Trib of River Idle	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Mattersey Thorpe	River Idle	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Misson	River Idle	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Nether Langwith	River Poulter	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
North Wheatley	Wheatley Beck	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Norton	River Poulter	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Rampton	Seymour Drain	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Ranskill	Trib. of Ranskill Brook	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Retford	River Idle	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Walkeringham	River Trent	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
West Burton	River Trent	High – 4mgl^{-1}	High – 0.3mgl^{-1}	Good – 0.12 mgl^{-1}
Worksop-Manton	River Ryton	Good – 5mgl^{-1}	Good – 0.6mgl^{-1}	Good – 0.12 mgl^{-1}

Determination of Future Wastewater Treatment Work Quality Consents

In line with EA advice and agreement from other WCS Scott Wilson have undertaken, the wastewater consent assessment under future discharge conditions has been undertaken to provide indicative future quality consents for the works, assuming that were upstream water quality currently achieves less than 'good', it should assumed that the upstream water quality achieves WFD Status 'Good' and the midpoint values from this class should be used in modelling the required consents. This assumes that all measures have been taken upstream of the works to achieve 'good ecological status' or 'potential' so as not to unduly penalise the water company through potentially poor upstream quality. In reality, in some catchments there may be little opportunity to reduce other inputs in order to meet 'good' status, in which case further modelling may be needed to be undertaken and the assumptions used within this assessment reviewed. As such, the consent standards derived from this process should be regarded as indicative only.

Simple mass balance 'Monte Carlo' simulations have been undertaken using the EA River Quality Planning (RQP) tool (v2.5). This provides an indication of the degree of change required in consent standards in order to achieve compliance within WFD standards and legislation assuming the full planned growth within Bassetlaw. This has been undertaken for Retford and Worksop-Manton WwTW as upstream flow information which is used in the assessment was only available at these sites. The mid-class estimates for the upstream water quality have been used in the modelling where upstream water quality information was not available. The model parameters have been provided in Appendix E. The results from the assessment are summarised in Table 6-10. The indicative consents show that there will be a required tightening of consents at the two WwTW to meet WFD standards under future growth conditions but, except for the Phosphorus consent at Worksop-Manton, all required consents will be within BAT.

The Monte-Carlo modelling of the required Phosphorus consent at Worksop-Manton indicates that a consent in the region of 0.1mgl^{-1} (Mean) will be required to treat the additional wastewater generated from development and achieve WFD 'good' ecological status downstream (0.12mgl^{-1} (Mean)). The impact of the additional Phosphate load is greater than that at Retford WwTW due to the relatively small dilution offered by the River Ryton, compared to the sizeable discharge from Worksop WwTW, which is located towards the headwaters of the river. The future DWF from the works accounts for around 40% of the downstream river flow. If a load standstill approach was applied to the future discharge, i.e. there was no overall increase in the Phosphorus load being discharged to the River Ryton, the Phosphorus consent would only need to be tightened to 1.9mgl^{-1} (Mean), which is within the BAT limit of 1mgl^{-1} (Mean). The required consents and approach to consenting future discharges will need to be discussed and agreed with the EA and ST as part of the Detailed Study.

Harworth, North Wheatley and Rampton WwTWs are located in the headwaters of small rivers or becks and as such, flow within these watercourses are not monitored by the EA. As no flow information was available for these watercourses, it was not possible to undertake the Monte Carlo analysis to assess the requirements for future discharges to meet the WFD standards downstream of the works. Therefore, the future consents have been calculated based on a no-load increase principle (load standstill), i.e. future loads to the watercourse must not exceed those currently being discharged. Therefore, by applying this principle, there should be no deterioration in the downstream water quality as a result of the proposed growth as future flows will need to be treated to a higher quality to ensure that the loads remain the same. However, it should be noted that the future consents do not ensure compliance with the WFD standard downstream of the WwTW; this would need to be assessed following discussions with the EA as part of the Detailed WCS. Appendix E provides the results from the load standstill modelling exercise.

Whilst indicative, the assessments highlight the need for further assessment of the future discharge consents and in particular the requirements to treat (and process) the additional wastewater flow at Worksop WwTW to the required standards. This should be investigated at an early stage of the Detailed WCS to identify if significant investment is required at the WwTWs that could potentially impact upon the phasing of development in Worksop.

Table 6-10: Future Indicative Quality Consents

WwTW	BOD (mgl^{-1})	Ammonia (mgl^{-1})	Phosphorus (mgl^{-1})
Gamston	17.0	6.5	3.5
Harworth	17.0	6.5	3.0
North Wheatley	17.0	8.0	4.0
Norton	25.0	15.0	-
Rampton	22.0	9.0	4.5
Retford	7.5	5.0	1.0
Worksop -Manton	10.0	1.2	0.15

Future Consent Risk Assessment			Colour coding definition
BOD (95%ile)	Ammonia (95%ile)	Phosphorus (95%ile)	
No Change	No Change	No Change	No change required to existing consent
$> 10mgl^{-1}$	$> 3mgl^{-1}$	No consent or $\geq 2mgl^{-1}$	Consent Achievable (within BAT)
$> 5mgl^{-1}$ and $\leq 10mgl^{-1}$	$> 1mgl^{-1}$ and $\leq 3mgl^{-1}$	$>1mgl^{-1}$ and $< 2mgl^{-1}$	Consent within BAT but difficult to achieve
$\leq 5 mgl^{-1}$	$\leq 1mgl^{-1}$	$\leq 1mgl^{-1}$	Consent Unachievable with current technology

7 Water Quality

7.1 Introduction

A review of water-related environment baseline is essential to ensure that:

- The water related environment has the capacity to absorb further discharges (from WwTW and / or surface water) to the receiving watercourse(s),
- There is no unacceptable deterioration in the quality of the water related environment as a result of the proposed development.

The water quality capacity of the receiving watercourses, i.e. how much more waste products (albeit treated) and / or surface water can be discharged to the receiving watercourse before water quality standards imposed to protect the integrity and ecology of a watercourse are reached, has been assessed and constraints identified. This has identified where constraints are already present prior to the proposed development and any proposed mitigation measures.

The water quality assessment focuses on those watercourses likely to be directly impacted by the proposed growth within Bassetlaw.

7.2 Water Quality Legislation

Historically the EA have used River Quality Objectives (RQOs) - planned targets for water quality, to help protect and improve the quality of the water in watercourses. The principal non-statutory RQO system is the River Ecosystem (RE) Classification scheme which comprises five hierarchical classes in order of decreasing quality, ranging from 'very good quality' to 'poor quality'. Each stretch of river is given a RE target such that if the river achieves this target it means that the river will be of adequate quality to support the required ecosystem.

Whereas the EA use RQOs for planning purposes (i.e. for setting water quality targets and assessing compliance with those targets), the General Quality Assessment (GQA) scheme is designed to provide an assessment of the general state of water quality and changes in this state over time. The GQA scheme comprises several separate aspects of water quality falling under chemical (including nutrients) and biological monitoring and assessment. A monitoring programme at a set number of sites has been undertaken on a monthly basis to assess the quality of individual stretches of river.

However, over the next two to three years the existing statutory targets and legislation relating to water quality will be replaced with a new set of water quality standards under the umbrella of the WFD which was passed into United Kingdom Law in 2003[14]. The competent authority responsible for its implementation is the EA in England and Wales. The overall requirement of the directive is that all water bodies in the United Kingdom must achieve "good ecological and good chemical status" by 2015 unless there are grounds for derogation.

[14] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008. UK Technical Advisory Group on the Water Framework Directive.

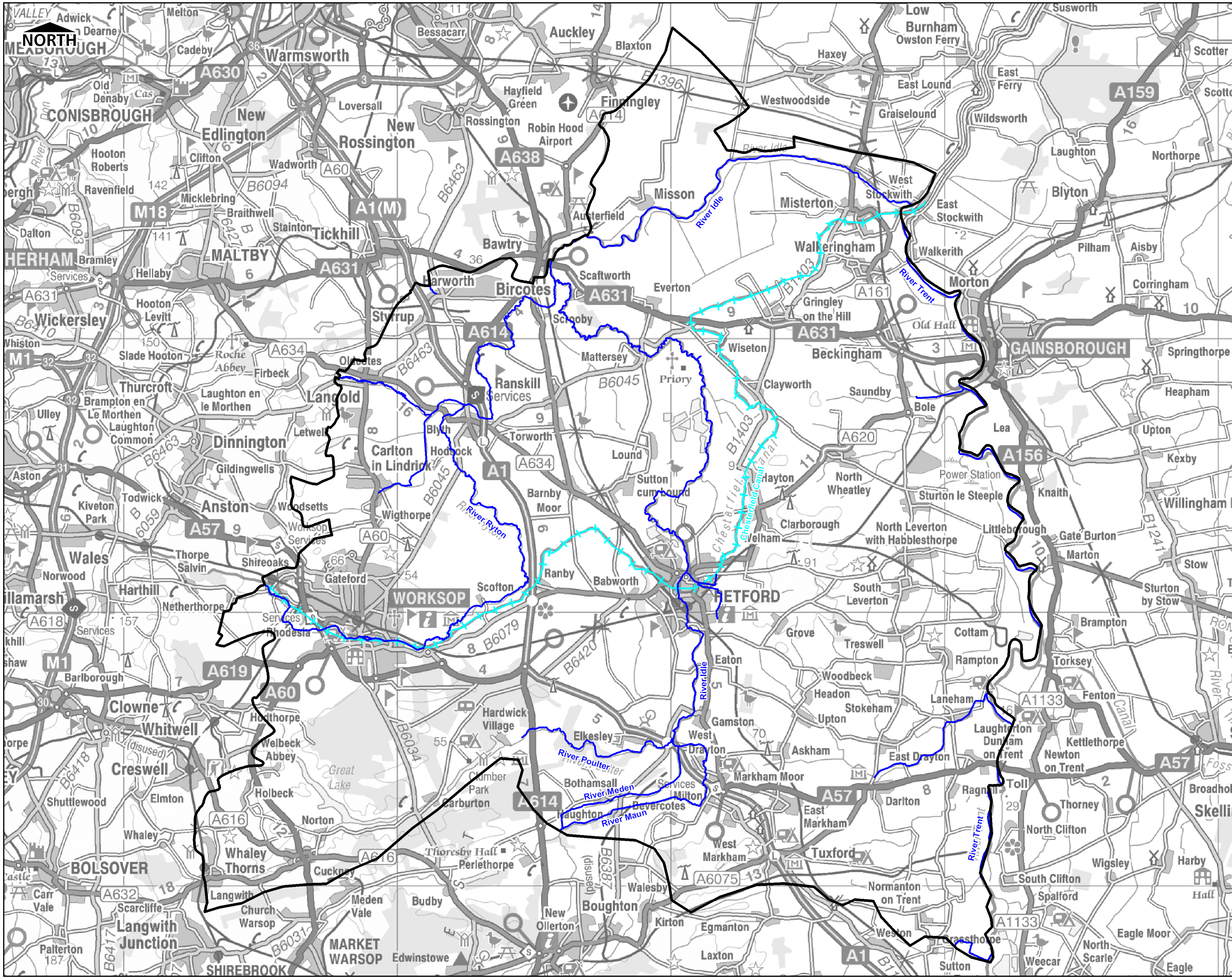
Water quality within Bassetlaw has been assessed against both current and future water quality legislation. Further information on both the EAs current water quality classification system and the WFD is provided in Appendix F. This should be read in conjunction with the results presented within this section.

7.3 Historical Water Quality

There are several watercourses located within Bassetlaw that have the potential to be impacted by increased discharges from the eighteen identified WwTWs as a result of development within Bassetlaw up to 2026. However, several of these discharges are to small watercourses, drains or the headwaters of main rivers that are not routinely monitored by the EA. As such, water quality monitoring records are only available for some of the receiving watercourses in Bassetlaw (Table 7-1). The EA provided water quality monitoring information for the period 2004 – 2009 where available. The main watercourses within Bassetlaw are illustrated in Figure 7-1.

Table 7-1: Water Quality Monitoring Sites in Bassetlaw

WwTW	Receiving Watercourse	Water Quality Monitoring Information Available	
		upstream	downstream
East Markham	Tuxford Beck	✓	✓
Elkesley	River Poulter	✗	✓
Gamston	River Idle bypass stream	✗	✗
Gringley-on-the-Hill	Trib. of Chestfld. Canal	✗	✗
Harworth	Harworth Beck	✓	✓
Hodsock	Langold Stream	✓	✓
Lound	Unnamed Trib of River Idle	✗	✗
Mattersey Thorpe	River Idle	✓	✓
Misson	Rive Idle	✓	✗
Nether Langwith	River Poulter	✓	✓
North Wheatley	Wheatley Beck	✗	✓
Norton	River Poulter		
Rampton	Seymour Drain	✗	✓
Ranskill	Trib. of Ranskill Brook	✗	✗
Retford	River Idle	✓	✓
Walkeringham	Trib. of River Trent	✗	✗
West Burton	River Trent	✓	✗
Worksop (Manton)	River Ryton	✓	✓



BASSETLAW DISTRICT COUNCIL
NORTH NOTTINGHAMSHIRE

Legend

- Bassetlaw Boundary
- Main River
- Canal

Revision Details	By	Check	Date	Suffix

Drawing Status: FINAL

Job Title: BASSETLAW OUTLINE WATER CYCLE STUDY

Drawing Title: WATERCOURSES

Scale at A3: NOT TO SCALE

Drawn	Approved
GC	AW

Stage 1 Check	Stage 2 Check	Originated	Date
			NOV 2010

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Drawing Number: FIGURE 7-1

Table 7-2 details the water quality monitoring information for the three watercourses likely to be the greatest impacted by development (in terms of additional volume of wastewater being discharged). This shows that in general, chemical and biological water quality in watercourses in Bassetlaw are of 'very good' or 'good' quality, whereas nitrate and phosphate concentrations are 'high' or 'very high', particularly within River Idle and River Ryton.

Where information was available both upstream and downstream of the WwTWs, the results show that apart from an increase in phosphate levels, which in the majority of works were already high upstream, the works do not seem to have any significant impact on the receiving watercourses.

It should also be noted that several of the WwTWs discharge to the same watercourses downstream meaning that there is a cumulative impact of the discharges downstream in the catchment.

Table 7-2: Historical Water Quality Monitoring Information for Watercourses in Bassetlaw

Reach	River	Year	Chemistry	Biology	Nitrate	Phosphate	RQO Compliant
Styrrup Lane To Conf. Harworth Dyke (*u/s Harworth WwTW*)	River Torne	2007	A	B	6	3	-
		2006	A	B	5	3	✓
		2005	A	B	5	4	✓
		2005	A	B	6	5	✓
B6387 Rd Br Gamston To Retford (*u/s Retford WwTW*)	River Idle	2007	A	B	6	5	-
		2006	B	B	6	5	✓
		2005	B	B	6	5	✓
Retford To Chainbridge Rd (*d/s Retford WwTW*)	River Idle	2007	A	B	6	5	-
		2006	A	B	6	5	✓
		2005	A	B	6	5	✓
Ford At Shireoaks To Worksop Stw (*u/s Worksop WwTW*)	River Ryton	2007	B	B	6	5	-
		2006	B	C	6	5	✓
		2005	B	C	6	5	✓
Worksop Stw To Chequer Br Ranby (*d/s Worksop WwTW*)	River Ryton	2007	B	B	6	5	-
		2006	A	C	6	5	✓
		2005	B	C	6	6	✓

Notes: 1. Significant Failure (BOD), 2. Marginal Pass (BOD)

Very Good or Good/ Very Low and Low	Fairly Good or Fair/ Moderately Low and Moderate	Poor or Bad/ High and Very High

7.4 Water Framework Directive

Bassetlaw's river systems are included in the Humber River Basin District (RBD) as described in the Bassetlaw WCS Scoping Study.

Several watercourses within the Humber RBD have a historical legacy of physical modification (a major issue under the WFD) as a result of urbanisation and land drainage. As such these waterbodies as recognised as being unable to achieve natural conditions. As such, designated as 'artificial' or 'heavily modified' waterbodies have a target to achieve Good Ecological Potential (GEP) as opposed to Good Ecological Status (GES), which recognises their important uses, whilst making sure that ecology is protected as far as possible. Within Bassetlaw, stretches of the River Torne and River Idle have been designated as Heavily Modified Water Bodies (HMWB) due to urbanisation and flood protection whilst some stretches of the River Idle and River