Part of Appendix 8l:

i. Ofwat Proforma

Author: Yorkshire Water

YorkshireWater

Cost adjustment claim summary form

Name of claim	Wastewater Growth	
Name and identifier of related claim submitted in May 2018	Wastewater Growth – YKY WWN+04	
Business plan table lines where the totex value of this claim is reported.	WWN8 Lines 5-8 WWS1 (and 1a) lines 14-16 WWS2 (and 2a) lines 25 and 26	
Total value of claim for AMP7	£55.31 m	
Total opex of claim for AMP7	£0.0 m	
Total capex of claim for AMP7	£55.31 m	
Depreciation on capex in AMP7 (retail controls only)	N/A	
Remaining capex required after AMP7 to complete construction	£0.0 m	
Whole life totex of claim	£63.18 m (present value)	
Do you consider that part of the claim should be covered by our cost baselines? If yes, please provide an estimate	Yes. *We have estimated that £12.58 m might be covered within Ofwat cost baselines for incremental growth and may therefore be deducted from the gross value of this claim*	
Materiality of claim for AMP7 as percentage of business plan (5 year) totex for the relevant controls.	1.7% *Based on the assumed <u>net value</u> of the claim after deduction of the £12.58 m referred to above*	
Does the claim feature as a Direct Procurement for Customers (DPC) scheme? (please tick)	Yes	No
		X

	Brief summary of evidence to support claim against relevant test	**List of accompanying evidence, including document references, page or section numbers.**
Need for investment/ expenditure	The investment arises out of the need to accommodate exceptional localised growth in 4 new communities which cannot be accommodated through incremental changes to existing assets.	‘Appendix 8l: ii. Ofwat Evidence’ *Section 1.2*
Need for the adjustment (if relevant)	Whilst it is likely that incremental growth across our region would be captured in Ofwat’s modelled baselines, the nature of these developments and lack of proximity to suitable existing treatment assets with adequate headroom means that atypically large investment will be required to ensure this growth can be accommodated.	‘Appendix 8l: ii. Ofwat Evidence’ *Section 1.4*
Outside management control (if relevant)	The planned developments are outside of management control and we are required to enable regional growth in line with our obligations as a Sewerage Undertaker under Planning Legislation and the Water Industry Act 1991.	‘Appendix 8l: ii. Ofwat Evidence’ *Section 1.2*
Best option for customers (if relevant)	We have undertaken extensive option identification and evaluation and have selected the solution which provides confidence in delivery at lowest whole life cost.	‘Appendix 8l: ii. Ofwat Evidence’ *Section 1.5* *‘Appendix 8l: iii. AMP7 Growth Planning, Catterick (Arup)* *‘Appendix 8l: iv. AMP7 Growth Planning, Green Hammerton (Arup)* *‘Appendix 8l: v. AMP7 Growth Planning, Parlington (Arup)* *‘Appendix 8l: vi. AMP7 Growth Planning, York (Arup)*

Robustness and efficiency of claim’s costs	We have developed detailed solution scopes and used a combination of our own unit cost data base and other estimates provided by our consultants to derive a robust cost and have then applied stretching efficiency challenge to these costs.	‘Appendix 8l: ii. Ofwat Evidence’ *Section 1.5.1*
Customer protection (if relevant)	In order to protect customers in the event that investment is cancelled or postponed we propose to return the investment requirement to customers at end of the control period.	‘Appendix 8l: ii. Ofwat Evidence’ Section 1.6.2
Affordability (if relevant)	Overall customer support for our plan is that 86% of customers support our business plan. Of that 76% of our financially vulnerable customers are also supportive of our plan (with a sample of 487 customers classed as financially vulnerable in the survey).	‘Appendix 8l: ii. Ofwat Evidence’ Section 1.3.3 ‘Appendix 8p: Yorkshire Forum for Water Customer Statement of Support’
Board assurance (if relevant)	The Yorkshire Water Board has reviewed this cost adjustment claim. As part of this they have signed a board assurance statement which includes a statement relating to our use of cost adjustment claims.	‘Chapter 3, Board assurance statement’ section of the business plan. ‘Appendix 8l: ii. Ofwat Evidence’ Section 1.7

Part of Appendix 8I:
ii. Ofwat Evidence
Author: Yorkshire Water

Part of Appendix 8I:
ii. Ofwat Evidence

Author: Yorkshire Water

Contents

Wastewater Growth (YKY WWN+04)

1. Summary

- Claim: Wastewater Growth
- Reference: YKY WWN+04
- Type: Atypically large investment
- Totex value: £55.31m
- Materiality: 2.2% gross of estimated implicit allowance
  1.7% net of estimated implicit allowance
- Date: 03 September 2018

1.1. Overview of Claim

It is anticipated that commencing in AMP7, several new settlements/ urban extensions will be developed in our region. This will see new settlements / urban extensions created in:

- Green Hammerton
- Parlington
- Catterick
- York

A total of 21,553 new properties in these areas are anticipated by 2040, with an estimated total of 9,634 to be built by 2025.

These are atypically large growth-related investments as the growth is over and above that normally expected and is more localised. It is these localised factors that drive the atypically large investment requirements. It is therefore different in nature, as well as being over and above normal region wide incremental growth in connections which historically has averaged from 12,000 to 14,000 new connections per annum.

New infrastructure, potentially including new local sewage treatment works with the requisite capacities, will be required to meet the requirements of the new communities and to ensure that new and existing customers' levels of service aren't negatively impacted by this atypical growth.

The location of the new developments means it is not viable to utilise existing infrastructure and capacity to serve these communities. As such the investment required is larger than normal growth investment.

The investment requirement as part of this claim, adjusted for real price effects (RPE) is:

- 5-year capex to 2025 of £55.31m.

We estimate that Ofwat's cost assessment models would potentially recognise £12.58 million of totex for the 9,634 new properties anticipated in AMP7, as noted in the summary of this claim provided in the accompanying Ofwat proforma. We have estimated that there will be an incremental impact on opex of around £1.1m in AMP7, as a result of the operation of the new assets required to accommodate growth in the above development areas, however we have excluded this from our cost adjustment claim and will aim to mitigate this impact as part of our overall AMP7 operating efficiency challenge.

After deducting the £12.58m potentially implicitly allowed in any efficient baselines, the net value of the claim represents 1.7% of total wastewater totex for 2020-25, which is above the materiality threshold for cost adjustment claims.

We are not submitting a cost adjustment claim with respect to the water supply services to these new developments as the required expenditures were determined as being non-material when considered against the same threshold. The issue is mitigated somewhat by our ability to move water around our region through our grid system.

As our Long-Term Strategy document sets out, the Yorkshire population is expected to rise by 1 million by 2045. Combined with other demographic changes, such as an aging population, this means it is essential to plan for the long-term to ensure high quality wastewater services throughout the region, which includes maintaining and improving the levels of service we offer to our customers.

1.2. Need for Investment

The investment need reflects anticipated growth in the Yorkshire region and is driven by statutory obligations to supply. This need is outside of the management control as we have no ultimate control over the location of these new settlements and as such are in effect acting as an enabler of regional economic growth in line with our obligations as a

Sewerage Undertaker under Planning Legislation and the Water Industry Act 1991. Table 1 below summarises the expected profile and number of new properties from these new developments:

Table 1: Projected profile of new properties

Development	2020-25	2025-30	2030-35	2035-40	Total
Green Hammerton	859	750	750	450	2,809
Parlington	370	925	555		1,850
Catterick	1,808	2,235			4,043
York	6,597	3,298	1,478	1,478	12,851
Total	**9,634**	**7,208**	**2,783**	**1,928**	**21,553**

The investment required in AMP7 to ensure that the above development needs can be met is summarised in table 2 below, the costs are adjusted for real price effects (RPE).

Table 2: AMP7 Capex investment to address growth at the four strategic sites

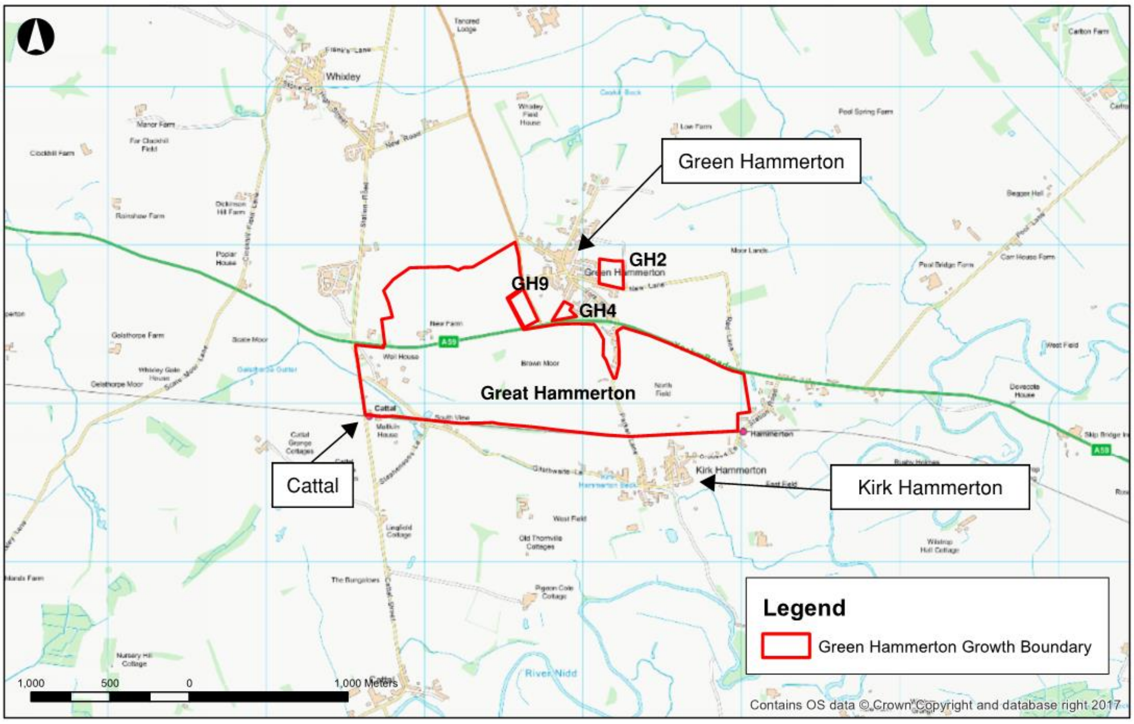
Development	AMP7 Capex
Green Hammerton	£9.19 m
Parlington	£3.08 m
Catterick	£13.34 m
York	£29.71 m
Total	£55.31 m

The investment will ensure that all quality standards are met in respect to the new developments, including final effluent and flow compliance. It will also ensure that no new or existing customer should experience a reduction in their levels of service because of this atypical new development. The characteristics and location of the new settlements means that compliance cannot be assured through connecting to existing infrastructure.

1.2.1. Green Hammerton

Green Hammerton (grid ref:SE3957NE) is the most likely new settlement/development to be promoted through the Harrogate Council Local Plan – See Figure 1. A total of 859 new properties are anticipated by 2025 with a projected total of 2,809 by 2035-40.

Figure 1: Green Hammerton growth locations



Discussions with the primary developer (Commercial Estates Group) have indicated that construction will commence in 2020-21 and the site currently is not served by wastewater or clean water infrastructure.[1]

Arup were commissioned on our behalf to undertake a review of infrastructure needs and solutions for the Green Hammerton development. The details of this review are presented in the document:

- 'Appendix 8I: iv. AMP7 Growth Planning, Green Hammerton' - issued 14 February 2018

The key wastewater service needs identified by Arup were:

- The nearest wastewater treatment works (WwTW) – Kirk Hammerton – is within 2km of the development. It has, however, insufficient capacity to meet the additional flows and would require a major rebuild.

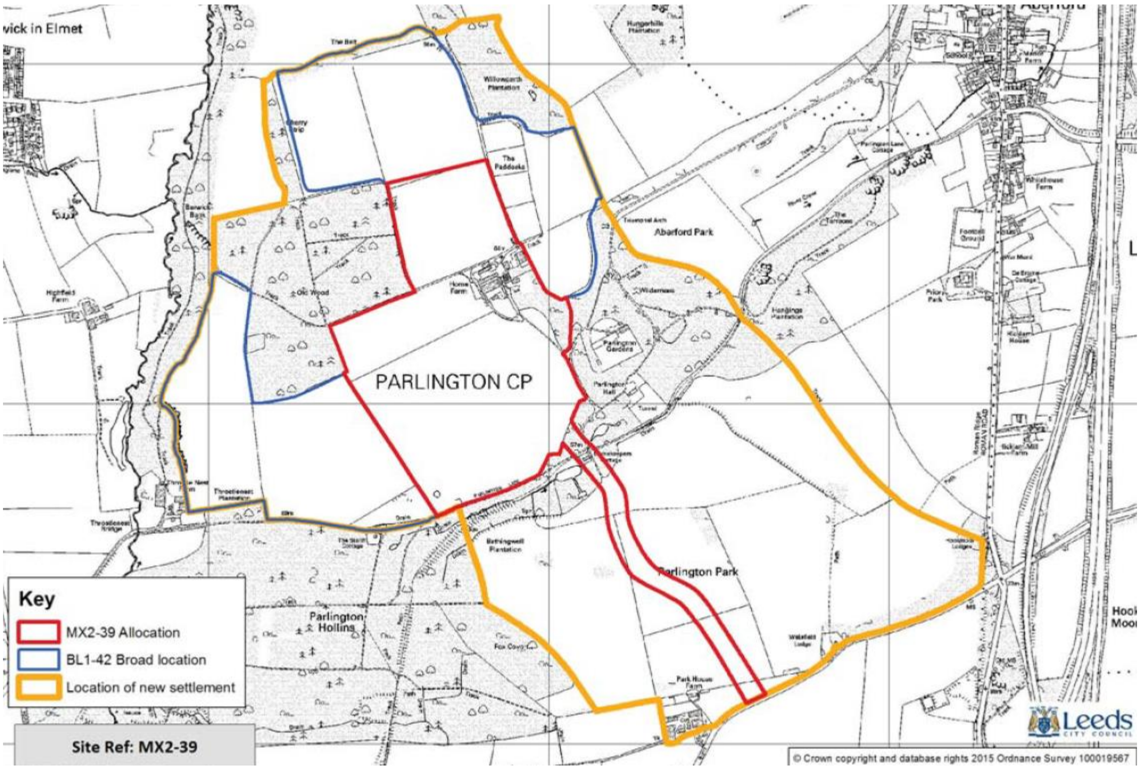
[1] Details of the Local Plans are available at: Harrogate Borough Council (2016) Harrogate District Draft Local Plan. Available from: http://consult.harrogate.gov.uk/portal/pp/lp/dlp?pointId=s1472544211526 and Harrogate Borough Council (2016) Strategic Housing and Economic Land Availability Assessment. Available from: http://consult.harrogate.gov.uk/portal/pp/so/shelaa/shelaa

- The larger WwTW at Knaresborough is about 10km away and does not have the required spare capacity to meet the new demands.
- New and separate sewerage network capacity would be required as the current pipe capacity at Kirk Hammerton is not sufficient.
- The proposed development sites are constrained by statutory environmental designations, heritage sites and flood risk (Zone 2 and Zone 3). The entire Phase 1 development is with Flood Zone 1.[2]

1.2.2. Parlington

A new settlement on the Parlington Estate (grid ref:SE4236) located east of Leeds has been proposed, it will have a significant impact on our assets and operations (wastewater infrastructure and treatment and clean water infrastructure) in the area. A total of 370 new properties are anticipated by 2025 with a projected total of 1,850 by 2030-35.

Figure 2: Parlington development location



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[2] Flood zones refer to the probability of river and sea flooding without the presence of defences. Zone 1 is the lowest probability and Zone 3 is the highest probability (1 in 100 or greater for river flooding and 1 in 200 or greater for sea flooding).

Discussions with the developer's agent (AECOM) have suggested that development will commence in mid to late 2022, with the first properties being occupied in early 2024. An indicative delivery of 185 properties per annum is envisaged (resulting in the delivery of 1,850 properties by the end of 2033).[3]

Arup were commissioned on our behalf to undertake a review of infrastructure needs and solutions for the Parlington development. The details of this review are presented in the document:

- 'Appendix 8I: v. AMP7 Growth Planning, Parlington' - issued 16 March 2018

The key wastewater service needs identified by Arup were:

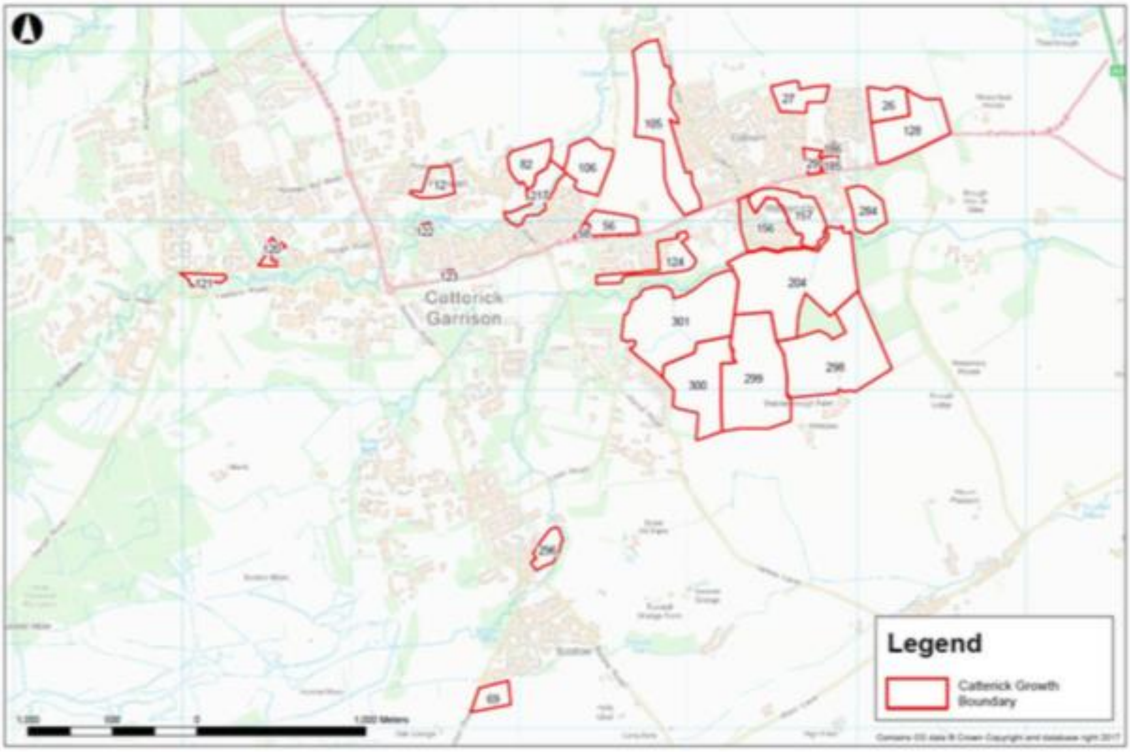
- Three existing WwTWs (Aberford, Barwick-in-Elmet and Micklefield) are located within 4.0 km of the Parlington development. These works are small relative to the size of the Parlington development and Arup's assessments of available capacity at these works indicates no significant space capacity. A near complete rebuild of existing works would be required to accommodate the new flows from Parlington.
- The Parlington site is not currently served by a Yorkshire Water (YW) sewerage network. The available networks at the nearby villages of Barwick-in-Elmet and Aberford are respectively upstream of the Parlington development and known to be already operating at capacity and therefore connection to existing sewerage infrastructure is not recommended.
- The proposed development sites are constrained by statutory environmental designations, heritage sites and flood risk (Zone 2 and Zone 3). The entire Phase 1 development is with Flood Zone 1.

1.2.3. Catterick

Figure 3 shows the locations and boundaries of the new settlements in Catterick as identified in the Richmondshire District Council Strategic Housing Land Availability Assessment. A total of 1,808 new properties are anticipated by 2025 with a projected total of 4,043 by 2025-30.

[3] Details of the Local Plans are available through: AECOM (2016) Parlington Masterplan Studies. Available from: http://www.parlingtonvillage.co.uk/submission/; AECOM (2016) Parlington: a submission to the Leeds Site Allocation Plan. Available from: http://www.parlingtonvillage.co.uk/submission/ http://www.leeds.gov.uk/council/Pages/Site-Allocations-Plan-Publication-Draft-Representations.aspx

Figure 3: Catterick growth locations



The Ministry of Defence (MoD) has indicated that approximately 2,900 military personnel will be relocated to Catterick Garrison near Colburn, with estimated additional dependants (related civilians) of 1,900 giving an estimated total population increase of 4,800 people. The expansion is scheduled to take place between 2019 to 2031 with indications that the bulk of the relocation will take place in the early years (2019-2025). It should be noted that the number is dependent on MoD policy and could increase (or decrease).

We are a member of a Garrison infrastructure working group formed to ensure that all infrastructure providers are made aware of MoD proposals. Additionally, Richmondshire District Council is proposing to allocate up to 1,000 new homes to be built in the period up to 2028. The distribution of these properties is partly dependent on where/if the MOD releases land for open market housing.[4]

[4] Details of the Catterick developments are provided in: Richmondshire district Council (2015) Richmondshire Plan Area Strategic Housing Land Availability Assessment. Available from: http://www.richmondshire.gov.uk/planning/local- plan/1045-strategic-land-availability-assessment

A review of infrastructure needs and solutions for the Catterick development was undertaken by Arup. The details of this review are presented in the document:

- ‘Appendix 8l: iii. AMP7 Growth Planning, Catterick’ - issued 13 April 2018

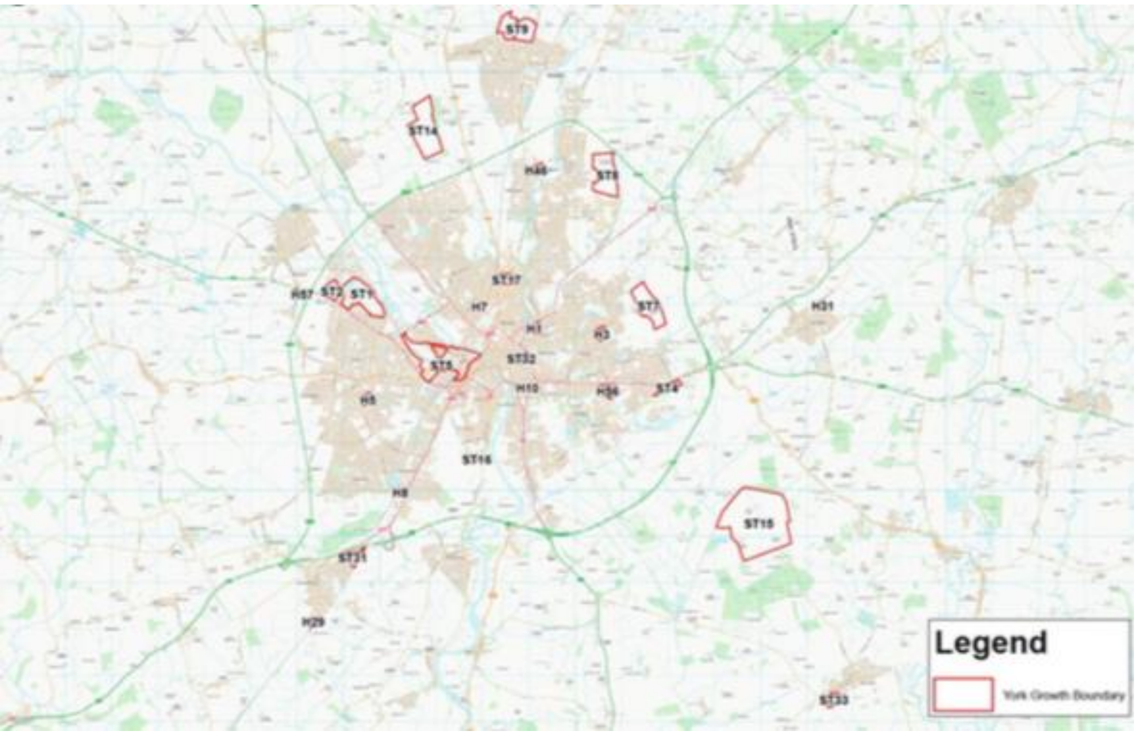
The key wastewater service needs identified by Arup were:

- The nearest existing wastewater treatment works (WwTW) – Richmond and Colburn – are within 4km of the Catterick development. Capacity at Richmond WwTW is not comparable to the new development implying that extension would involve a major rebuild. Current performance at Richmond is also close to current consented levels with 5 BOD and 4 Suspended Solids failures in the last 5 years. Colburn is expected to have future issues with dry weather flow (DWF) compliance even before the Catterick development is considered. Current capacity therefore cannot meet the new demands at Catterick.
- The proposed development sites are constrained by statutory environmental designations, heritage sites and flood risk (Zone 2 and Zone 3).

1.2.4. York

Significant housing development is projected for York over the next 10 to 15 years, with an extra 6,597 properties expected to be built during 2020-25 with a projected total of 12,851 by 2035-40. We have therefore undertaken a full review of the wastewater infrastructure serving York to ensure it will continue to be able carrying and treating future sewage loads in the city. Figure 4 illustrates the growth locations in York.

Figure 4: York growth locations



The details of the new settlements in York are identified in the York Local Plan Preferred Sites Consultation (2016).[5] This identified 37 sites within York for housing development. Arup were commissioned on our behalf to undertake a review of infrastructure needs and solutions for the York developments. The details of this review are presented in the document:

- 'Appendix 8I: vi. AMP7 Growth Planning, York' - issued 13 April 2018

The key wastewater service needs identified by Arup were:

[5] City of York Council (2016) City of York Local Plan Preferred Sites Consultation. Available from: https://www.york.gov.uk/downloads/file/11256/preferred_sites_consultation_document

- As the new developments are spread across York there would be no requirement to design a new sewage works to meet the expected increase in loads. The WwTWs located at Naburn, Rawcliffe, Haxby Walbutts and Wheldrake would provide the bulk of the required treatment capacity (with a number of extension options evaluated – see below).
- The proposed development sites are constrained by statutory environmental designations, heritage sites and flood risk (Zone 2 and Zone 3).

1.2.5. Actions Taken to Control Cost

We commissioned Arup to undertake detailed appraisals of engineering options to meet these new infrastructure requirements. These were submitted as part of our May submission.

We have since been speaking to a number of New Appointment and Variations (NAVs), and carried out high-level scenario modelling, to explore whether an alternative market option would be a better way of delivering services for customers.

Engagement with the market suggests there is interest in providing a NAV service offering. Our analysis suggests a self-service NAV would deliver greatest benefit to our existing customers, whereby a NAV is appointed to the site and is contracted by the Developer to lay and connect the on-site infrastructure. The NAV would then also build and operate Water and Wastewater treatment assets to independently provide services to the site.

We plan to continue to investigate these alternative market options for the four growth sites, including working with the developers to understand whether a NAV model is a beneficial option for their customers also.

To understand how we can accommodate these additional demands most effectively, Arup first undertook detailed and independent optioneering for each of the four development areas.

We have also looked to understand the opportunities for market based solutions to minimise the impact on customer bills and ensure best value for money, including scenario modelling three market scenarios; Self-Lay Provider Delivered Network, Bulk-Connected NAV and Self-Served NAV. When looking at the transfer of charges for these four specific growth schemes in a purely theoretical sense, the Self-Served NAV model appears the best for minimising impact on customer bills.

Engagement with a number of NAVs that have previously expressed an interest in operating in our area has demonstrated there is appetite for this activity. Parlington and Green Hammerton in particular lend themselves to a NAV model, due to their being more localised and not served by an existing network.

The best scenario, taking into account feasibility, would likely be a self-served NAV providing waste services to these sites – i.e. a NAV company is contracted by the Developer to lay and connect on-site infrastructure, combined with development and operation of its own treatment works. A NAV developing its own potable supply is generally considered to be higher risk and not cost effective on these scales, meaning on the clean side the sites will likely have to be supplied by a Yorkshire Water bulk connection, supported by some form of NAV delivered final effluent / water re-use to lessen demand. Consequently, Yorkshire Water would still need to deliver some investment in its network, but the vast majority of cost associated with waste infrastructure would be removed.

The main challenge associated with pursuing this approach is that the choice belongs to the developer, so we do not have ultimate control over whether this scenario progresses or therefore the costs incurred.

Furthermore, for the developer to opt for a NAV self-serve approach there would have to be a suitably convincing business case. Due to the Developer Services Charging Rules this would need to include the costs of the NAV delivering the whole works (onsite infrastructure and treatment facilities) for less than our costs for the onsite infrastructure and connection to our network. Likewise, any development of water efficiency approaches to minimise impact on our network would have to be cost effective.

We plan to continue to investigate these alternative market options for the four growth sites, prioritising Parlington and Green Hammerton which are more developed and appear to be better suited to a NAV model. Due to the uncertainty in pursuing this approach, we have opted to leave these charges in our cost adjustment claim. However, we aim to minimise impact on customer bills by ensuring that that any cost savings achieved via market options are passed back to Yorkshire Water customers through the appropriate sharing mechanism.

Customers are already protected to a degree through cost recovery from developers via connection and infrastructure charges. It is estimated that the network reinforcements required for each growth scheme will allow for about 30% cost recovery through charges to developers. These offsets are included in the projections of infrastructure charge revenues and contributions from developers which will feed through to lower (than otherwise) impacts from the gross expenditures in this claim.

Planned next steps involve engaging with the developers to make them aware of the option of the NAV model and to try and understand whether this might be a beneficial option for their customers also.

1.2.6. Benefits Arising from this investment

The proposed investments have been designed to ensure adequate wastewater service infrastructure that meets all statutory obligations (e.g. flow compliance) is available to meet these anticipated demands for new development in the Yorkshire region. This will bring benefits to the wider regional Yorkshire economy.

1.3. Stakeholder Support for Investment

The proposed expenditures that give rise to this claim are derived from statutory obligations to supply wastewater services that comply with our legal requirements. We have actively been in discussion with local planning authorities to ensure the needs can be fully understood and accommodated by the most efficient means possible (see further below). This approach will deliver best value for our customers now and in the future.

1.3.1. Initial Engagement with Customers

We undertook a first phase of customer engagement relating to our cost adjustment claims. Out of all the claims tested with customers, ‘Infrastructure for New Towns’ ranked as fifth in a priority list.

Whilst this was at the lower end of priorities when considering all the claims outlined in this submission it gains nearly twice as much support as the least priority claim. When the investment requirement and bill equivalents were introduced support grew by a non-trivial amount.

We also provided a report summarising the findings of this engagement within ‘Appendix 8l: vii. Cost Adjustment Claim Research - Redacted Report’.

Please refer to ‘Appendix 5a: PR19 Customer and Stakeholder Engagement’, section 7.14 for additional information.

1.3.2. Engagement with the Yorkshire Forum for Water Customers (YFWC)

As well as engaging widely with our customers, we have also engaged extensively on our cost adjustment claims with the YWFC.

We gained a letter of support from the YWFC for our early submissions in May which included our proposed cost adjustment claims. We have continued to make revisions and challenge ourselves with regards to our cost adjustment claims and with have done this with the YWFC. The output of this engagement is that the YFWC are supportive of the inclusion of three cost adjustment claims submitted as part of the final plan.

This can be seen from in the Forum report[6] as well as a further specific letter of support[7] from the YWFC relating to our final submission of cost adjustment claims and performance commitments.

1.3.3. Affordability and Acceptability

In addition to the above customer surveys and engagement with the YWFC we have undertaken further consultation around the scope of our final plan, which included the three cost adjustment claims that we are submitting. The engagement was to gauge customers’ overall acceptability and affordability of the plan as a whole.

The results of this testing are as follows where the percentage represents the proportion of customers that are in support of the package as a whole, including our proposed cost adjustment claims.

Overall customer support for our plan is that 86% of customers support our business plan. Of that, 76% of our financially vulnerable customers are also supportive of our plan (with a sample of 487 customers classed as financially vulnerable in the survey).

In addition, 67% of household customers find the plan good value for money. 52% of our financially vulnerable customers also believe the plan is good value for money. It should

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[6] ‘Yorkshire Forum for Water Customers’ PR19 Assurance Report, Yorkshire Water’s Customer Challenge Group’s comments on the company’s 2020-2025 Business Plan submitted to Ofwat

[7] ‘Appendix 8p: Yorkshire Forum for Water Customers Statement of Support’

be noted as well that roughly a third of our customers registered an indifferent response to the value for money question. A full breakdown is below within tables 3 and 4.

Table 3: "Question: Please rate how much you support Yorkshire Water's entire plan, based on the Big Goals and the forecast for future bills?"

	Household	Financially Vulnerable
Very supportive	37%	25%
Supportive	49%	51%
Unsupportive	4%	7%
Very unsupportive	3%	7%
Not sure	8%	10%

Table 4: "Question: Given the plan that you have seen, to what extent would you say that the Yorkshire Water Business Plan represents value for money?"

	Household	Financially Vulnerable
Very good value for money	17%	10%
Good value for money	50%	42%
Neither good nor poor value for money	23%	30%
Poor value for money	4%	9%
Very poor value for money	3%	7%
Don't know	4%	3%

Please refer to 'Appendix 5a: PR19 Customer and Stakeholder Engagement', section 7.16 for additional information.

We note that the values we tested with customers for cost adjustment claims specifically differ slightly to those included in the plan and in this document. As part of affordability and acceptability testing we presented £55m, whereas the final claim value is £55.31m. We don't believe this would change customers overall acceptability of the plan.

1.4. Need for Cost Adjustment

1.4.1. Atypically large investment

Our own recent cost assessment work indicates that our historical growth-related expenditures are at an efficient level. The average unit totex over the 5-year period 2011-12 to 2016-17 of a new wastewater connection is £1,306 per new connection. This estimate is built up as follows:

- A - Totex over the period 2011-12 to 2016-17 (£78.33m) summed for the categories:
  - S3020CAS: Total wholesale wastewater totex – New development and growth;
  - S3021CAS: Total wholesale wastewater totex – Growth at sewage treatment works (excluding sludge treatment)
  - S3024CAS: Total wholesale wastewater totex – Transferred private sewers and pumping stations
  - S3022CAS: Total wholesale wastewater totex – Resilience
- B - Total new connections during period (59,952)
- Unit totex per new connection = A / B = £1,306

With a projected 9,634 new properties expected in AMP7 directly associated with the creation of these new communities, an allowance based on this unit expenditure would equate to £12.58m (9,634 x 1,306). This value of £12.58m represents the potential allowance the Ofwat models would be likely to recognise for the incremental cost associated with these new connections. This is significantly below the identified AMP7 cost of £55.31 million for the four development areas but the claim would remain material even with recognition of an implicit allowance of this level.

This higher level of expenditure derives directly from exceptional circumstances, principally driven by the location of the new developments, relative to existing infrastructure and the need to create new infrastructure and works to service the needs of these new settlements.

1.4.2. Consideration of allowances in the round

We have noted above we believe that the circumstances influencing these wastewater growth costs would not be fully captured within Ofwat's econometric models. We are mindful however, that it is possible that those models may overcompensate Yorkshire Water in other areas and price controls, where our regional circumstances may be favourable relative to other companies. In order to ensure that we are only submitting cost adjustment claims which are prudent and efficient, we have commissioned economic consultants Oxera, to examine the possibility of such overcompensation.

The report found that on a historical assessment basis, there is no evidence to suggest that the claims set out are adequately accounted for in the models produced by ourselves and Ofwat. Further that it is likely that our costs are incremental to those captured in the models. When considered with a history of efficient assessment as set out in the report, there would not be opportunity to offset the claims through overcompensation in the round.

A copy of their report is appended to this submission and should be considered in conjunction with this claim document and the other supporting evidence we have provided.

1.5. Identifying Best Value Solutions

1.5.1. Option Identification and Evaluation Process

Arup were commissioned to undertake detailed and independent optioneering for each of the four development areas to help us identify the most beneficial options for accommodating the additional wastewater demands. Carbon impacts and Integrated Water Management (IWM) approaches were included in the appraisal of options. Full details are provided in the previously mentioned reports for each development area. The appraisal methodology developed with Arup covers:

- Capex estimates from the YW Unit Cost Database and/or Arup/external suppliers;
- Independent opex estimates estimated by Arup and our models;
- Option costs evaluated on basis of 40 years Net Present Value; and
- Environmental and social impact appraisal using the Five Capital Appraisal Framework (options scored on Natural Capital impacts, Social Capital impacts, Human Capital Impacts, Financial Capital).

Opportunities for cost recovery from other parties (developers, IWM installers) have also been identified and considered in the appraisals. We estimate that about 30% of the capex costs (£20m) will be recoverable from developers through connection and infrastructure charges.

A summary of the options appraisal on a site by site basis is provided in Table 5 (these costs are pre-efficiency and have not been subject to RPE adjustment – unless stated). For each site the lowest Whole Life Cost (WLC) option is currently identified as the preferred solution, except in the case of Green Hammerton. The currently preferred solution for Green Hammerton is a conventional activated sludge plant (ASP) option. An option to include a lagoon offers a potentially lower WLC (albeit marginally), although there are material uncertainties regarding lagoon sizing and operations. Current pilot trials with lagoon solutions are being undertaken in AMP6/early AMP7 and these will be used to improve the certainty around the lagoon option for Green Hammerton.

The costs derived by our consultants drew on our Unit Cost Database and their own estimating data and we consider them to be robust and based on a realistic scope. However, in the final costs included in our business plan, we have applied our efficiency challenge to those initial estimates to reflect potential savings which we may achieve through our AMP7 delivery route for these schemes, whether that is through supply chain re-tendering or use of other market solutions.

Table 5: Options Appraisal

	Options	Capex £m	Opex £m	WLC £m	Capex £m Post Efficiency & RPE Adjusted	Comments
York	1a - flows to local works	34.3	0.593	35.98	29.71	Lowest WLC
	2a - flows to local works & new WWTW (ASP)	33.8	0.787	38.87		
	2c - Flows to local works & new WWTW (Lagoon)	32.0	0.464	39.44		
	3a - Centralised Naburn WWTW	70.9	0.451	55.4		
	4a - Centralised Naburn & Haxby Walbuts WWTWs	66.4	0.720	59.3		
Parlington	Temporary Package Plant	3.49	0.069	3.74	3.08	Selected Temporary package plant. Full scale treatment deferred to AMP8.
	ASP	7.8	0.160	9.09		
	Lagoon	4.6	0.083	5.04		
	IWM ASP	7.8	0.148	8.86		
	IWM Filter	18.8	0.360	19.51		
	IWM Lagoon	7.9	0.142	8.99		
Green Hammerton	1b Expansion (ASP-IWM)	12.89	0.210	13.74		Conventional Option Lowest WLC - uncertainty regarding lagoon sizing and operations. Only marginal cost difference. Will learn from pilot lagoon schemes in late AMP6/early AMP7
	3a New ASP	11.15	0.218	12.13		
	2a New Works (ASP)	10.35	0.183	11.13	9.19	
	2b New Works (ASP-IWM)	12.62	0.180	12.2		
	2e New Works (Lagoon)	10.5	0.129	10.13		
Catterick	1a(1) Colburn TF expansion	32.8	0.773	37.09		Lowest WLC option
	2a Colburn ASP expansion A	15.63	0.425	20.05		
	2b Colburn ASP expansion B	16.02	0.423	19.31		
	3a Colburn ASP expansion A IWM	15.37	0.256	16.64	13.34	
	3b Colburn ASP expansion B IWM	15.78	0.258	17.08		
	Total Post Efficiency & RPE Adjusted Capex for Preferred Options (£m) =				55.31	

Please see above for an explanation as to how the costs contained within Table 5 were obtained.

The whole life cost of this claim is less than the indicative threshold (£100m) for consideration of direct procurement for customers (DPC). Additionally, the activities associated with this claim are not a single discrete project and as such does not lend itself to a DPC submission.

1.5.2. Further work on Option Identification and Evaluation Process

For this September submission we have reviewed our work on optioneering. This is reflected in Table 5 above. This review has identified an understatement in error of the expenditure for Catterick Option 2b. The proposed solution for Catterick is now option 3b which represents the lowest WLC option. This option contains measures to implement IWM infrastructure. This would typically include installation of grey water recycling systems at individual property and property cohort level and ensuring that the amount of surface water that goes into the sewerage system and to the receiving wastewater treatment works is reduced as far as possible. Whilst the options for Parlington, Green Hammerton and York do not include this option, where we have tested IWM options i.e. at Parlington and Green Hammerton, the WLC was marginal and therefore we are committed to working with developers to pursue these sustainable opportunities.

1.5.3. Market testing subsequent to May submission

In the May submission we committed to undertake further market testing of the solutions identified in the Arup reports prior to the September submission. This work is described in section 1.2.5 above. To re-iterate, on the basis of this assessment we have concluded the preferred approach is to assume the growth schemes are progressed via option 1.

1.5.4. Cost Benefit Assessment

1.5.4.1. Methodology

The cost-benefit analysis of schemes for the Cost Adjustment Claims (CAC) compares present value costs and benefits in the need or 'do nothing' scenario with present value costs and benefits in the scenario where the solutions are implemented.

1.5.4.1.1. Cost

The costs referred to in this instance are the capital and operational expenditure (i.e. capex and opex, or totex), where the costs in the solution are the same as those presented in this claim and in the relevant data tables.

The whole life cost calculation is as follows:

- Using the Spackman approach to discounting, capex is annuitized over 40 years using an annuity rate of 2.4% reflecting the Weighted Average Cost of Capital. This reflects the annual cost of capex if Yorkshire Water borrows money over 40 years to fund capital expenditure.
- Annuitised capex and opex are added together to get totex, and totex values are discounted using the HM Treasury Green Book discount rate of 3.5% for the first 30 years, dropping to 3% for the next 10 years. The discounting adjusts future values into present value terms.

1.5.4.1.2. Benefits

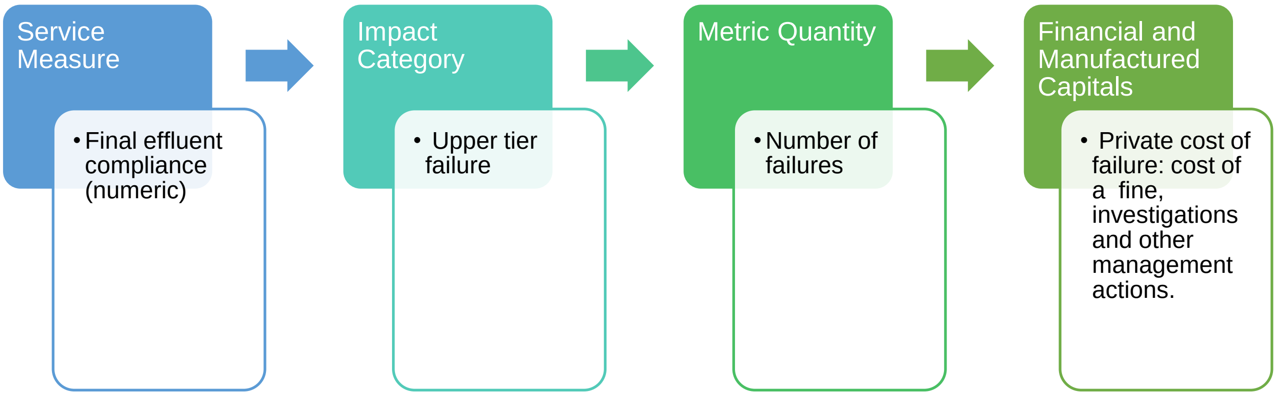
The benefits are measured and valued according to the different service measure impacts on natural, social, human, financial and manufactured capital. The monetary values of the different relevant capitals for each service measure have been estimated using different techniques, including benefits transfer (i.e. using available and relevant information from existing studies and adjusting where necessary), desk-based studies and primary research.

Additionally, different economic valuation approaches were used in the estimation of these values. This includes price or cost approaches (using market price as a proxy for economic value), revealed preference valuation and stated preference valuation.
The diagram below shows an example of how a change in service translates to a benefit impact (please see section 9 ‘Decision efficiency’ of our main narrative for a description of Yorkshire Water’s Service Measure Framework).

The introduction of a solution leads to an improvement in service relative to the need scenario (e.g. reduction in final effluent compliance (numeric) upper tier failures).
The total benefit value of a service measure impact at a point in time equals the unit benefit value for that service measure impact (e.g. private costs (£) to Yorkshire Water

per final effluent compliance upper tier failure) multiplied by the quantity of service impact (e.g. number of failures).

Figure 4: Process flow



As with costs, benefits are also adjusted in present value terms.

The cost-benefit analysis is performed for the needs and associated solutions for each Cost Adjustment Claim, where the net present value benefit is calculated by:

$$\left(\sum PVcost_{need} - \sum PVcost_{solution}\right) + \left(\sum PVbenefit_{need} - \sum PVbenefit_{solution}\right)$$

For a given period, a net beneficial scheme is one where the total present value costs and benefits in the need scenario are greater than the total present value costs and benefits in the solution scenario. We use a 40-year period for the cost-benefit analysis.

1.5.4.2. Cost Benefit Analysis results

The table below shows the results of the cost-benefit analysis for the schemes under the waste water growth cost adjustment claim.

Table 6 – wastewater growth claim cost benefit analysis

Investment Need	Cost/Benefit	AMP7 total PV	40-year total PV
Wastewater Growth claim	$\sum PVcost_{need} - \sum PVcost_{solution}$	-£7.325m	-£63.179m
	$\sum PVbenefit_{need} - \sum PVbenefit_{solution}$	£1.601m	£1,187.092m
	net benefit	-£5.723m	£1,123.913m

The benefit values are associated with four Capitals: Social, Human, Financial and Manufactured Capitals.

The Social Capital value comes from household customers' willingness to pay to avoid internal flooding and the monetised impact on customer bill payments following an internal flooding incident (as used as a proxy for the value of trust). The present value of this Social Capital benefit over AMP7 is zero but comes to a total of around £1.1bn over 40 years[8], highlighting the large future benefits of reduced internal flooding to our household customers.

The Human Capital value comes from business customers' willingness to pay to avoid internal flooding, with an estimate of around £71m over 40 years.

The Financial and Manufactured Capitals value come from avoided private costs associated with upper tier final effluent compliance failure and avoided costs associated with clean-ups and investigations after an internal sewer flooding incident. The present value of this benefit is around £1.6m over AMP7[9] and around £23.9m over 40 years.

Table 7 – Benefit breakdown by associated capital category

Capital benefits	AMP7 total PV (£m)	40-year total PV (£m)
Social Capital	£0.000	£1,091.834
Human Capital	£0.000	£71.308
Financial and Manufactured Capitals	£1.601	£23.950
total	£1.601	£1,187.092

1.6. Protecting stakeholders' interests

1.6.1. Alignment with Outcomes and Incentives

The primary performance commitment that this cost adjustment claim links to is discharge permit compliance. The claim also links to our performance commitment for operational carbon.

Please refer to 'Appendix 19c: Performance Commitments & ODIs' for further details.

[8] Avoidance of the risks of internal flooding and associated benefits are not expected to occur until 2025 at the earliest.

[9] This benefit value over AMP7 is only associated with avoided private costs from upper tier final effluent compliance failure. See Footnote 8.

We are of the opinion that the linked PCs, both primary and secondary, are not sufficient to protect our stakeholders' interests. Therefore, we have set out our proposed protection mechanism in the section below namely 1.6.2.

Table 8 – Links/alignments to performance commitments/outcomes (APP1)

Performance commitment	Wastewater (Growth)
Discharge Permit Compliance	Part
Operational Carbon	Part

1.6.2. Reduction or Cancellation of Investment

For this claim we are proposing the following mechanism to protect customers from any reduction or cancellation of investment relating to this claim for atypically large wastewater growth expenditure. The reason why we think it appropriate for this claim is that whilst it has been indicated that development at the four sites relating to this claim will occur there is a scenario where development does not go ahead at one or more of the sites identified. As such it would seem to be appropriate to protect customers from this scenario.

Therefore, we are proposing that should development not occur, and we have not incurred any expenditure driven by the new developments identified in this claim, then we will return the investment requirement to customers at end of the control period, based on the values in the table below:

Table 9: AMP7 capex return to customers if developments are delayed or cancelled prior to YWS undertaking planned investment

Development	AMP7 Capex
Green Hammerton	£9.19 m
Parlington	£3.08 m
Catterick	£13.34 m
York	£29.71 m
Total	£55.31 m

To be clear we are not proposing to incrementally reduce our investment and true this up at the end of the period where the development is smaller than expected. This is due to the fact that we are likely to incur the full cost in the case of development going ahead to ensure the site(s) are adequately served from point of the development and into the future.

1.7. Assurance

The Yorkshire Water Board has reviewed this cost adjustment claim and satisfied itself that the investment proposals are robust and deliverable and result from an appropriate option appraisal process and that the proposed solution is in the best interests of our customers.

As part of this they have signed a board assurance statement that relates to the whole of the business plan, including a statement relating to our use of cost adjustment claims.

"The Board has made responsible use of cost adjustment claims ensuring that the majority of costs are exposed to the efficiency challenge. It has only proposed claims where there are conditions it considers to be specific to the Company's operating circumstances."[10]

To support this statement relating to cost adjustment claims the board were presented with the findings of our external assurance. All of the cost adjustment claims submitted as part of our plan have been subject to third party independent assurance from Jacobs. We have taken on board all of the audit actions and queries and provided sufficient responses and amendments that means all claims submitted have no outstanding material audit issues (red or amber status).

[10] Chapter 3, Board Asurance Statement, Page 6, paragraph 5.

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YorkshireWater

Part of Appendix 8l:

iii. AMP7 Growth Planning, Catterick

Author: Arup

YorkshireWater

Yorkshire Water Services Ltd

AMP7 Growth Planning

Catterick

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Issue | 13 April 2018

Job number 256398-00

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Appendices

1 Introduction

Local authorities are required to set out their Local Plans for housing development to meet demand needs for population growth in the future. The Yorkshire Water Land Use Planning Team has received the latest population data to 2035 from Edge Analytics that combines local Plan information and trend based projections.

The MOD has recently confirmed that 2,900 military personnel will be relocated to Catterick Garrison/Colburn, with an estimated additional related civilians (dependants) of 1,900 giving an estimated total increase of 4,800 people. The expansion is scheduled to take place between 2019 to 2031. However, indications are that the bulk of the relocation will take place in the early years (2019-2025).

In addition, Richmondshire District Council has allocated 1,000 new homes to be built in the period up to 2028. The distribution of these houses is partly dependent on where/if the MOD releases land for open market housing.

There are uncertainties around the exact figures, locations and phasing of the Catterick developments. YW is expected to be part of a working group, which includes Richmondshire District Council, the MOD and infrastructure providers, that will plan for these new developments.

2 Future growth

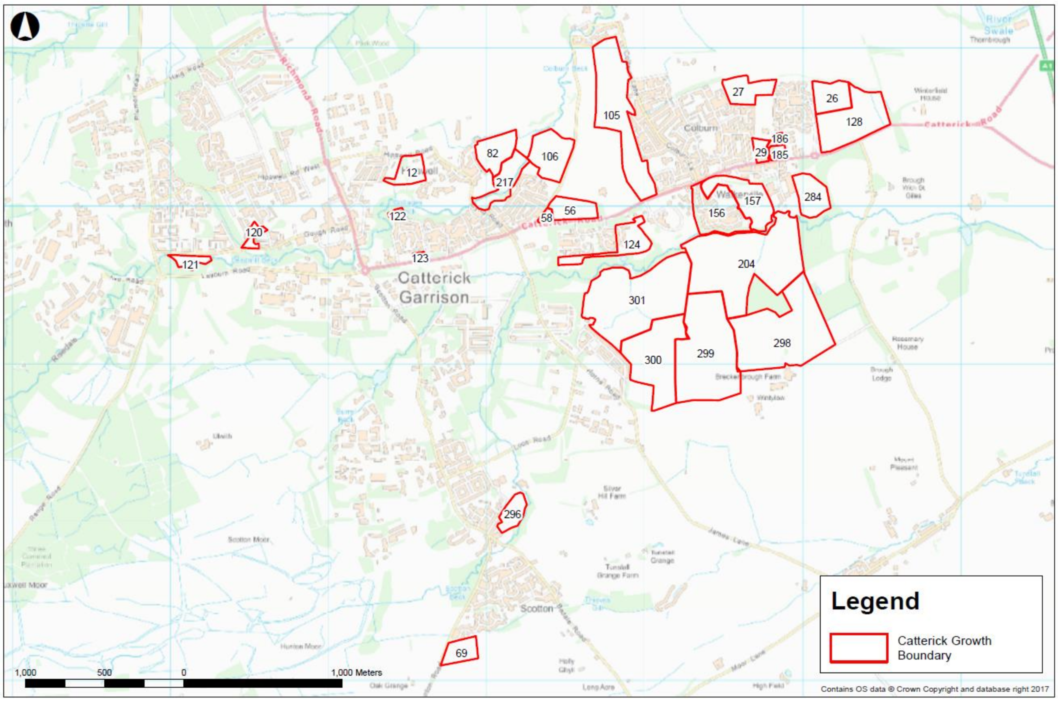
2.1 Location

Figure 1 shows the locations and boundaries of the new settlements in Catterick as identified in the Richmondshire District Council Strategic Housing Land Availability Assessment[1] (SHLAA). The SHLAA was used as it provided the best available information on the sizes and locations of future growth in Catterick at the time of assessment.

It was noted from discussions with YW's planning team that the sites identified in the SHLAA have high levels of uncertainty regarding the MOD Estate rationalisation and also due to the fact that housing numbers in Catterick are very susceptible to changes in MOD strategy.

The growth sites identified in the SHLAA are mostly located in and around the existing settlements of Colburn, Catterick Garrison and Scotton. There are 28 land parcels covering total land area of approximately 211 hectares.

Figure 1 Catterick growth locations



2.2 Phasing

Information on the phasing of developments was taken from the SHLAA[1]. Table 1 shows the projected development phasing for Catterick from 2020 to 2040 and have been broken down by AMP.

[1] Richmondshire district Council (2015) Rchmondshire Plan Area Strategic Housing Land Availability Assessment. Available from: http://www.richmondshire.gov.uk/planning/local-plan/1045-strategic-land-availability-assessment [last accessed 27/11/2017]

Table 1: Catterick development phasing

Sites		AMP 7	AMP 8	AMP 9	AMP 10	Total (units)
Ref	**Name**	**2020-25**	**2025-30**	**2030-35**	**2035-40**	
12	Hipswell Croft	72	-	-	-	72
29	In Pipes	47	-	-	-	47
58	Old Sports Field, Catterick Garrison	32	-	-	-	32
120	Somerset Close	40	-	-	-	40
121	Gough Road	29	-	-	-	29
124	Arras Lines	126	-	-	-	126
156	Former Colburn Pipeworks site	175	-	-	-	175
157	Former Colburn Pipeworks site (Phase 2)	250	-	-	-	250
26	Land to East of Cookson Way	75	-	-	-	75
82	Hipswell Mill	93	-	-	-	93
185	Land adjacent Lidl	24	-	-	-	24
217	Land E of Byng Road	10	-	-	-	10
300	Land S of Sour Beck - Site 4	302	-	-	-	302
301	Land S of Sour Beck - Site 5	533	-	-	-	533
27	Land East of Regents Park Estate	-	90	-	-	90
56	Old Sports Field, Catterick Garrison	-	71	-	-	71
69	Land adj Oaktree Av, Scotton	-	61	-	-	61
106	Land W Colburn Lane	-	133	-	-	133
122	Coronation Park	-	19	-	-	19
123	Land E Belton Park	-	8	-	-	8
204	Land S of Sour Beck - Site 1	-	615	-	-	615
284	Land adj Walkerville Ind Est	-	97	-	-	97
296	Land NE of Low Hall Lane	-	59	-	-	59
298	Land S of Sour Beck - Site 2	-	487	-	-	487
299	Land S of Sour Beck - Site 3	-	477	-	-	477
128	Land East of Walkerville	-	118	-	-	118
105	Land at Colburn Grange	-	-	-	-	n/a
186	Richmond Park	-	-	-	-	n/a
Total		**1,808**	**2,235**	**-**	**-**	**4,043**

An additional 2% of the total population has been assumed as employment. This is based on YW guidelines of 40 jobs/hectare as a worst-case scenario. An additional 5.2% of the total population has been assumed as school growth. This is in line with the assumptions used for other AMP7 growth planning reports.

3 Assessment of impacts to YW assets

3.1 Water demand

A high-level water demand assessment was undertaken on the basis of the following parameters to estimate the projected water demand up to year 2045:

- Per capita water demand of 140l/d per person;
- Household occupancy rate of 2.3 people.

This was done for each of the housing development plots identified in Section 1 and the results are summarised in Table 2:

Table 2: Summary of projected water demand for Catterick

Parameter	AMP7	AMP8	AMP9	AMP10	AMP11	Total Demand
	2020-25	2025-30	2030-35	2035-40	2040-45	
Housing units	1,808	2,235	-	-	-	4,043
Average Demand l/s	7.53	8.82	-	-	-	16.35

3.2 Flows and Loads

The sewage flows and loads have been calculated based on the information provided agreed with YWS for the Catterick development. Key assumptions are as follows:

- Per capita sewage discharge of 130 l/d per person
- Household occupancy rate of 2.3 people.
- Infiltration for new residents of 40 l/d per person

The projected cumulative sewage flows and loads over the next four AMPs, assuming no trade or imports, are as follows:

Table 3 - Catterick sewage flows and loads

Parameter	AMP7	AMP8
	2025-30	2030-35
Housing units	1,808	2,235
Cumulative housing units	1,808	4,043
Population equivalent, p.e.	4,246	9,494
Dry weather flow (DWF), m^3/d	730	1,632
Flow to Full Treatment (FFT), m^3/d	1,857	4,152
BOD load, kg/d	255	570
Suspended solids load, k/d	297	665

Parameter	AMP7	AMP8
	2025-30	2030-35
Ammonia load, kg/d	32	71

3.3 Discharge consents

In order to design process units for Catterick flows, a working consent must be selected. The main options for treating flows from the Catterick development are to build a new works locally or to transfer flows to an existing local works. Local works are as follows:

- Colburn WwTW
- Tunstall WwTW
- Richmond WwTW
- Catterick Village WwTW

Tunstall WwTW and Catterick Village WwTW were discounted due to their small size and only Colburn and Richmond were considered.

The working consents for the new works were assumed to be in line with the tightest consent detailed in the Mineral Media Filters Asset Standard in order to provide a worst-case footprint; this corresponds to 20mg/l BOD and 5 mg/l ammonia on a 95%ile basis. The working consent has been agreed with the YWS Environmental Regulation team.

In the event that a tighter consent is set, it is expected that an Activated Sludge Plant (ASP) shall be the standard process selected for biological treatment. The discharge consent shall be set in discussion with the EA.

The local works consents, discharge locations, and the working consent for Catterick is summarised below:

Table 4 - Catterick and local works consent

Site	BOD consent (95%ile)	SS consent (95%ile)	Ammonia consent (95%ile)	Discharge watercourse
Colburn WwTW	30	50	10	River Swale
Richmond WwTW	25	40	24	River Swale
New Works	20	40	5	River Swale (proposed)

3.4 Identified risks and impacts

3.4.1 Water supply

The Catterick Garrison area is supplied from two YWS sources as illustrated in Figure 1:

1. Catterick Boreholes and WTW;
2. Thornton Steward WTW and pumping station.

Water is pumped from Thornton Steward to Gandale SRE from where it gravitates to supply properties in the Garrison supply area. This supply is supplemented by Catterick WTW supply which is pumped to Wintylow CRE and further pumped into the supply area during peak demand time. When the Wintylow WPS is not pumping, water gravitates backwards from the Wintylow CRE to supply the village of Colburn.

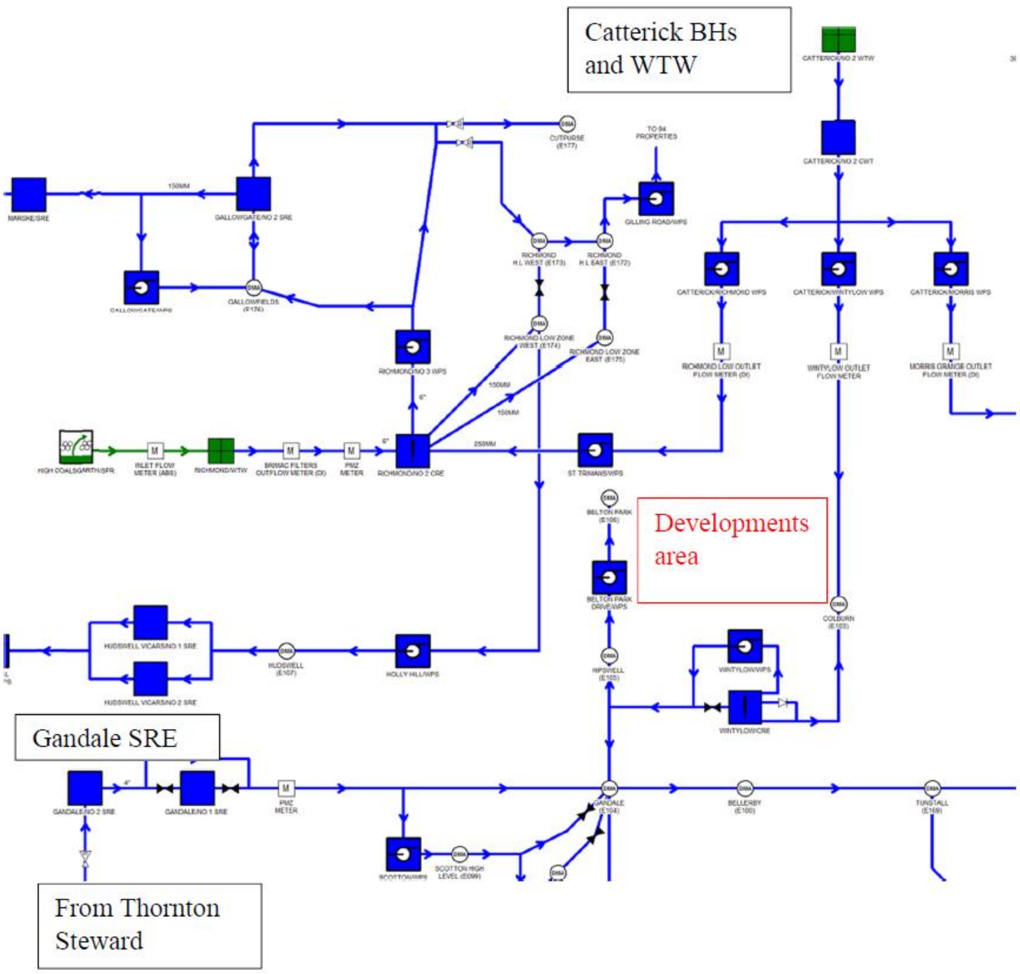


Figure 2 Existing supply system in Catterick Garrison area

Results of hydraulic modelling have indicated the following adverse impacts to the existing network arising from the projected increased future water demand:

- Storage time in the Wintylow CRE which is currently less than the YWS minimum storage requirement will reduce from 23 to 13 hours. A minimum storage of 24 hours is required.
- Storage time in Gandale SRE will reduce from 13 to 12 hours.
- Unit head losses and flow velocities in the following trunk mains which are in excess of YWS recommended operating thresholds:
    1. 180mm diameter from Thornton Steward to Gandale;
    2. 5″ main Gandale SR to James Lane;
    3. 150mm main James Lane to Catterick Road.

3.4.2 Wastewater treatment

Richmond and Colburn WwTW are located within 4.0 km of the Catterick development. These works have been assessed for capacity by comparing the FFT consent and the measured flows, and by comparing the final effluent quality to the current consent. The results for each site are as follows:

Table 5 - Catterick local works capacity review (2012 – 2017)

Site	Colburn	Richmond
Measured 95%ile flow, m^3/d	6,591	3,367
Measured maximum flow, m^3/d	9,251	6,776
Consented FFT, m^3/d	12,355	5,548
Current Population Equivalent	19,693	8,774

Table 6 - Catterick local works treatment capacity review (2012 – 2017)

Site	Colburn	Richmond
No. samples	40	68
Measured average BOD, mg/l	14	14
Measured 95%ile BOD, mg/l	22	24
Consented 95%ile BOD, mg/l	30	25
Measured average Ammonia, mg/l	2.8	3.9
Measured 95%ile Ammonia, mg/l	5.9	12
Consented 95%ile Ammonia, mg/l	10	24
Measured average SS, mg/l	16	19
Measured 95%ile SS, mg/l	25	39
Consented 95%ile SS, mg/l	50	40

The Richmond WwTW sample data contained five BOD sample failures and four suspended solids failures over the last 5 years; Colburn has two BOD sample failures over the same period.

It is noted that Richmond WwTW is comparable to the size of the proposed development, implying that any extension would necessarily involve a major rebuild of the works. Any works would also need to address some of the performance issue with the current site noting how close the performance has been to the consent.

Colburn WwTW, on the other hand, is generally a well performing site but is expected to struggle with DWF compliance in the near future.

3.4.3 Wastewater Networks

All twenty-eight development sites are located south of Richmond in two small towns Catterick Garrison and Colburn. In the assessment process, it was assumed that two sites (105 and 186) will not be developed due to the lack of population data for these two sites and development permissions. Therefore, further analysis was carried out for twenty-six sites through the Colburn catchment. Figure 3 below shows the location of the sites.

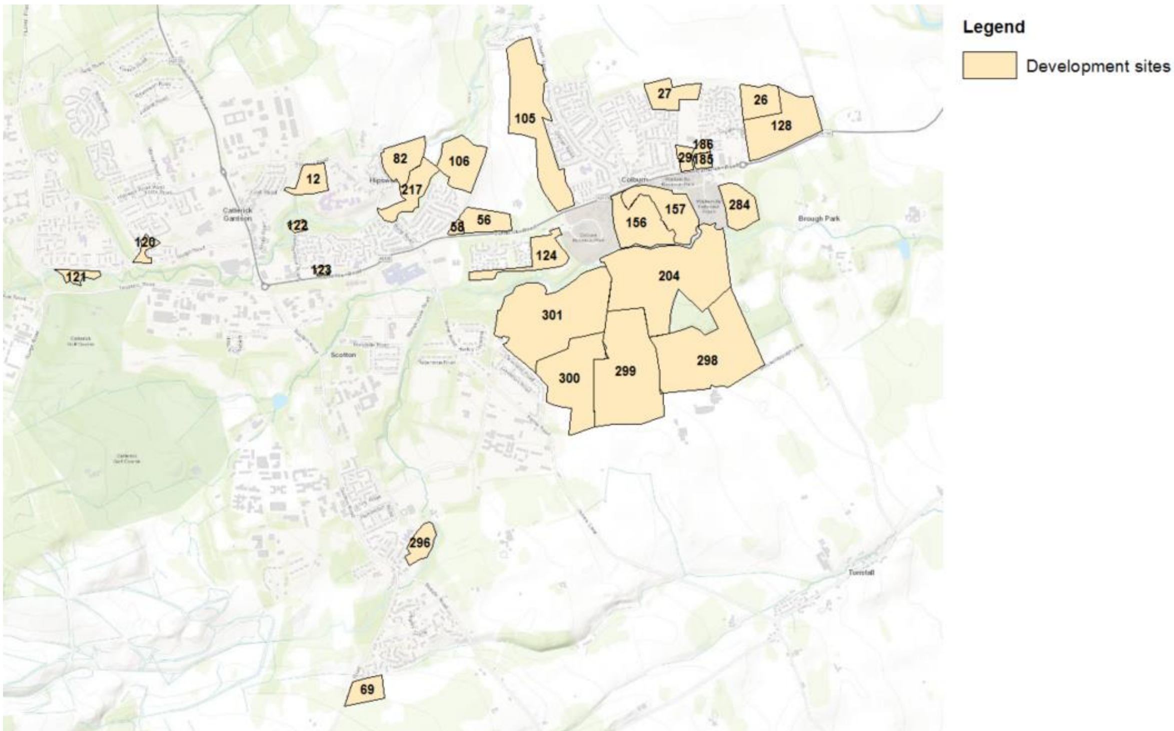


Figure 3 Developments growth sites in Catterick area

The assessment of YW's wastewater network was based on GIS network obtained from the YW database. At the time of the assessment there was no YW hydraulic model available for the Colburn catchment, therefore there is no information about the existing network's capacity.

3.4.3.1 Existing Network in YW's GIS database

According to YW's GIS database, both Catterick Garrison and Colburn are currently served by wastewater networks, with all foul and combined sewers draining to Colburn WwTW. Surface water sewers drain to the nearby watercourses or rivers.

The layout of the network is presented below in Figure 4. Blue pipelines represent the surface water pipes, brown pipelines the foul pipes and red pipelines the combined sewers. As it can be seen, majority of Colburn and Catterick Garrison area is served by separate system - foul and surface pipe network. Only a small proportion of the area is served by combined sewers. The more detailed map for network in Catterick area can be found in the Appendix E.

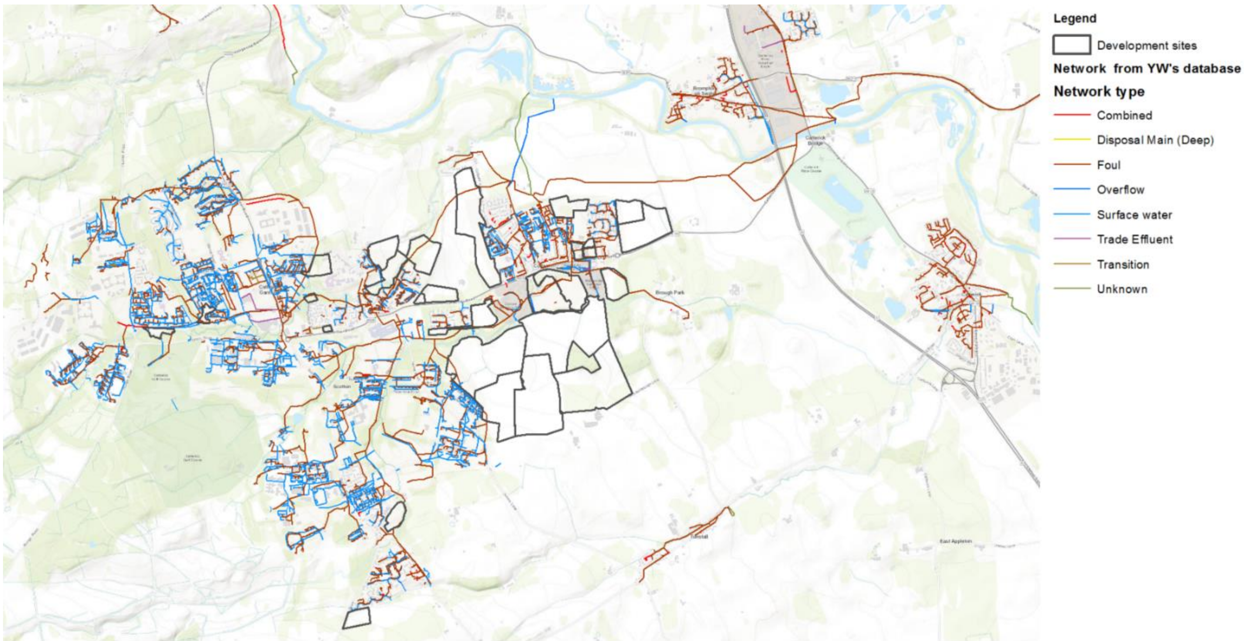


Figure 4 YW's database coverage in Colburn area

3.4.3.2 AMP7 sites

Some 15 out of the 26 sites are forecasted to be developed by 2025. These were analysed further to produce a costing for inclusion in the PR19 business plan. The requirements of AMP8 sites were considered only in locations where they shared civil works with AMP6/7 sites.

4 Environmental and social constraints

A desktop based study was undertaken to understand the existing environmental and social constraints at the growth location to inform the development of clean water and wastewater infrastructure solutions. The study area was defined by a two kilometre radius measured from the development boundaries. The search has returned a number of features of interest. A summary of these features is provided below and a full list of these features of interests are included in Appendix D.

4.1 Ecology

The search identified one statutory designation within the study area, Foxglove Covert Local Nature Reserve (LNR), as shown in Figure 5. An LNR is a site that is locally important for wildlife, geology, education or enjoyment which has been identified by the local authority.

There are a number of non-statutory designations within the study area, including:

- *Ancient woodland:* An inventory administrated by natural England of ancient woodland sites in England. There are 10 areas of ancient woodland within the study area as shown in Figure 5.
- *Sites of Importance for Nature Conservation (SINC)*: A site of importance for nature conservation is a local designation which seeks to protect areas rich in wildlife, including ancient woodland and flower-rich grassland. There are two SINC within the study area shown in Figure 5.

4.2 Heritage

There are three Scheduled Monuments within the study area, which are Easby Abbey Premonstratensian Monistary located in Richmond; Cataractonium Roman Forts and Town; and St Giles Medieval Hospital, located to the east of Brompton-on-Swale.

77 Listed Buildings were identified within the study area, including six Grade I listing, five Grade II* listings and 66 Grade II listings. They are mostly concentrated in the Easby, Brompton-on-Swale and on the outskirts of Coalburn. The Grade I listings are Abbey Gatehouse, the Ruins of Abbey St Agatha, the Church of St Agatha, Hipswell Hall, Courthouse to the east of Coalburn Hill, and Brough Hall. The locations of heritage features are shown in Figure 5.

4.3 Landscape and recreation

There is no nationally or regionally designated landscape areas within the study area. However, the study has highlighted some features of interest for landscape and recreation, including:

- *Public Rights of Way (PRoW):* There are a number of Public Rights of Ways within the study area. Richmondshire Borough Council has not released under licence the data about their rights of ways, as such, the PRoW in the study area has not been mapped. However, PRoW is available from Ordnance Survey 1:25,000 Colour Raster map and have been given due consideration during option development.

4.4 Flood risk

Both Flood Zone 2 and 3 are present in the study area as shown in Figure 5. These Flood Zones refer to the probability of river and sea flooding without the presence of defences and are defined as below:

- *Flood Zone 2:* Medium probability. 1 in 100~1,000 annual probability of river flooding or 1 in 200~1,000 annual probability of sea flooding.
- *Flood Zone 3:* High probability. 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding.

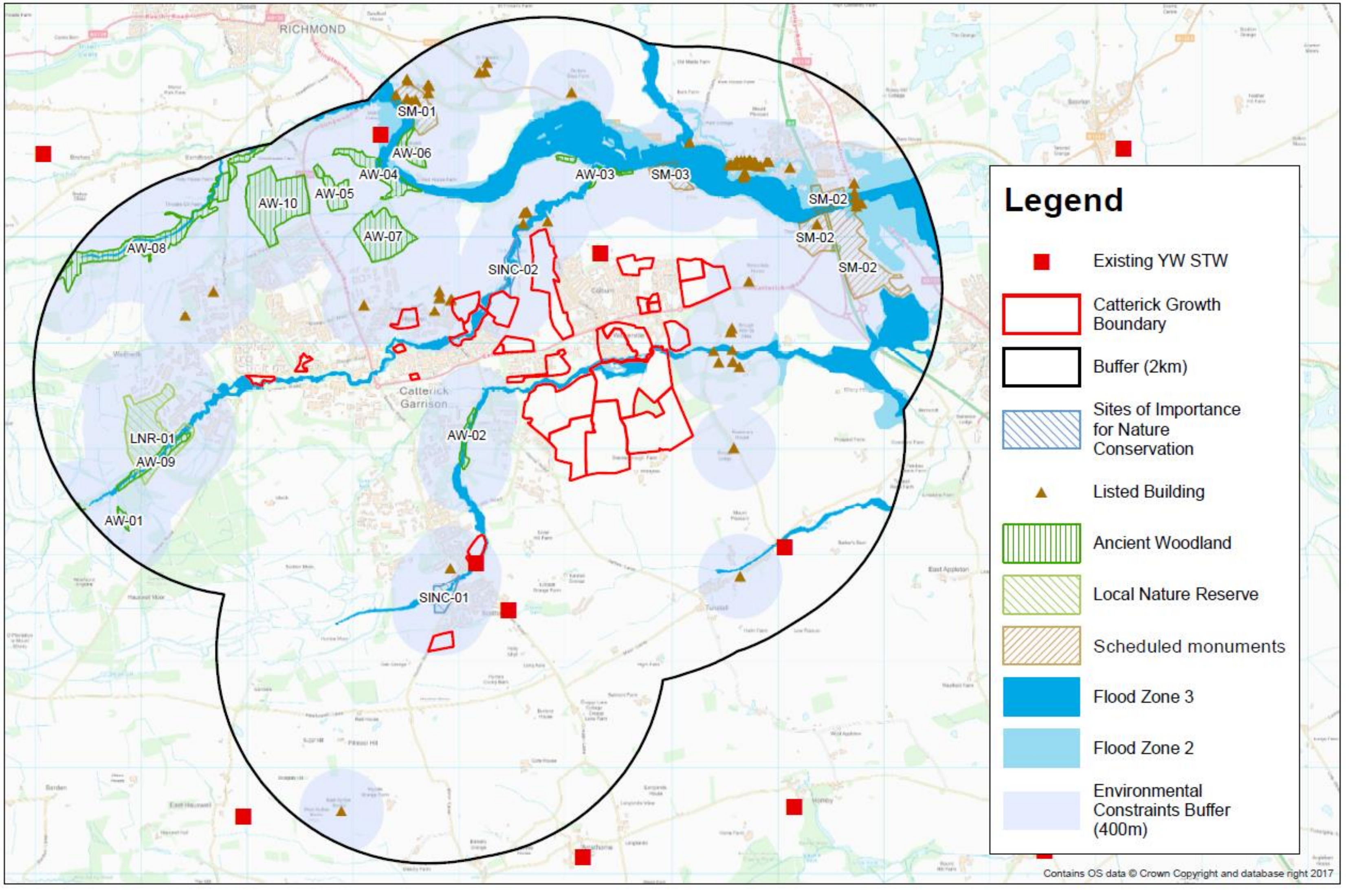
4.5 Sensitive receptors

A number of sites are located within and adjacent to the settlements of Catterick Garrison, Coalburn and Walkerville. Two sites are located adjacent to the settlement of Scotton. There are also a number of smaller clusters or individual dwellings scattered across the study area. Existing commercial and residential properties have been used to represent sensitive receptors.

4.6 Approach to constraints mapping

For the purpose of option development, a buffer of 400m has been applied to all the environmental and social constraints identified, with the exception of Flood Zones, to create a screening map highlighting the areas that are most suitable for new water and wastewater infrastructure from an environmental perspective. The mapping is used during option development to inform the siting and routing of new infrastructure. The screening map is shown in Figure 5.

Figure 5 Catterick environmental and social constraints



5 Initial option identification and appraisal

5.1 Clean water infrastructure options

The options have been screened against clean water infrastructure criteria and environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	Clean water infrastructure			
	Distance	Pumping	Crossings	Commentary
Supply from Thornton Steward WTW & PS	<10.2 km	Existing pumping	8no road crossings 1no railway line crossing 2no water course crossings	**The following works will be required to reinforce the network:** Connection to Thornton Steward PS delivery main incl. flow meter. Construction of a new 4ML SRE to replace Ganadale SRE. Laying approx 8km of 200mm diameter dulpicate main from Thornton Steward to the new SRE (60% in fields, 40% in road) incl. connections to new SRE. Laying approximately 2.6km by 400mm dia outlet main from the new SRE to connect to existing mains from the old Gandale SRE. Connection to existing 250mm main on James Lane. Lay approx 2km of 200mm diameter main in road from James Lane to Catterick Road. Connection to existing main on Catterick Road. **Works required to connect water supply to development sites:** 7 No. connections from existing networks to development.
Supply from Catterick WTW	N/A	Not required	N/A	Not considered due to raw water abstraction restrictions at Catterick. Boreholes - raw water is abstracted from the aquifer via 2 boreholes, but the current licence conditions do not allow both to be pumped simultaneously.

The main clean water option is to supply water from the Thornton Steward WTW and PS to the Catterick Garrison supply system, as presented in Figure 6 below. Further details are set out in section 6.

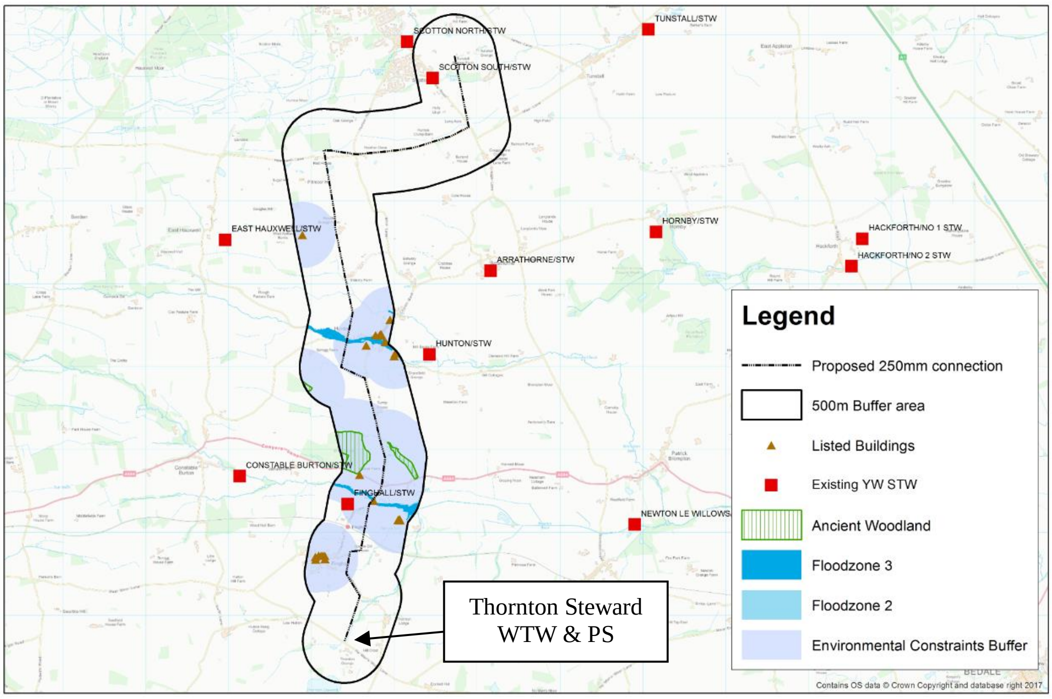


Figure 6 Catterick clean water connection option

5.2 Wastewater networks options

The options are described in Section 8 of this report.

5.3 Wastewater treatment options

The proposed developments are mainly located around the proposed Colburn WwTW as illustrated in Figure 5. If a new works were to be built to cater exclusively for the new development, its ideal location would be within a few hundred meters of the existing Colburn WwTW. No other locations would be appropriate as Colburn is in between the developments and the river Swale, and is slightly downhill from them.

The locations have been screened against several wastewater infrastructure and treatment criteria as well as environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	Wastewater treatment			Environmental and Social				
	Distance	Pumping	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Environmental constraints
Colburn WwTW TF expansion	Existing site, near development	- pumping required - gravity discharge	The site would require additional settlement and treatment capacity to accommodate the additional flows. It would be suggested that tertiary nitrifying filters be installed to bring the ammonia concentration down, given the good performance of the existing units.	No	No land purchase required	Yes	Houses approximately 100m away	Existing operational site
Colburn WwTW conversion to an ASP	Existing site, near development	- pumping required - gravity discharge	Converting the site to an ASP would involve a major rebuild. Although space is available on site, this would involve building even closer to the existing receptors. No significant improvement in effluent quality would be expected over the tertiary nitrifying filter option. The option would also incur write-off costs in excess of £750k relative to the trickling filter installation.	No	No land purchase required	Yes	Houses approximately 50m away	Existing operational site
Richmond WwTW expansion	3 km away	- pumping required	The site has no available headroom and suffers poor performance. It is also smaller than the proposed AMP8 development therefore require a major rebuild to accommodate the flows.	No	Land purchase may be required	Yes	Houses approximately 150m away	Current works is a in flood zone

Option	Wastewater treatment			Environmental and Social				
	Distance	**Pumping**	**AMP7 headroom**	**Low carbon potential**	**Land Availability (AMP10 horizon)**	**Existing discharge**	**Proximity to receptors**	**Environmental constraints**
New location near Colburn WwTW	New site, <500m away from existing site	- pumping required - gravity discharge	New WwTW for Catterick development. Building a new works almost adjacent to the existing site would be nonsensical as it would be cheaper and easier to make use of the existing operational site.	No	Land purchase required	No, would require negotiation of	The site could be built further away from receptors	Would involve new planning application for new site as opposed to permitted development.

The Colburn WwTW TF expansion was taken for further consideration.

6 Clean water infrastructure options

The option of supplying the increased future water demand from the Catterick WSS system has not been considered. This is mainly been due to the known raw water abstraction restrictions from the Catterick boreholes. The raw water is abstracted via 2 boreholes, but the current licence conditions do not allow both to be pumped simultaneously.

To enable a sufficient supply from the Thornton Steward WTW the following works, illustrated in Figure 7, will be required:

- Construction of a new 4ML service reservoir to replace the Gandale SRE which is currently undersized and located on MOD land with access difficulties.
- Installation of approximately 8km long 250mm diameter main from the Thornton Steward pumping station to the new Gandale service reservoir.
- Installation of approximately 2.6km long 300mm diameter main from the new Gandale SRE to Catterick Road. This main will form the future 'spine' of the water supply to Catterick Garrison enabling the rezoning of areas currently supplied from Catterick.
- Installation of approximately 2km long 200mm diameter main on Catterick Road.

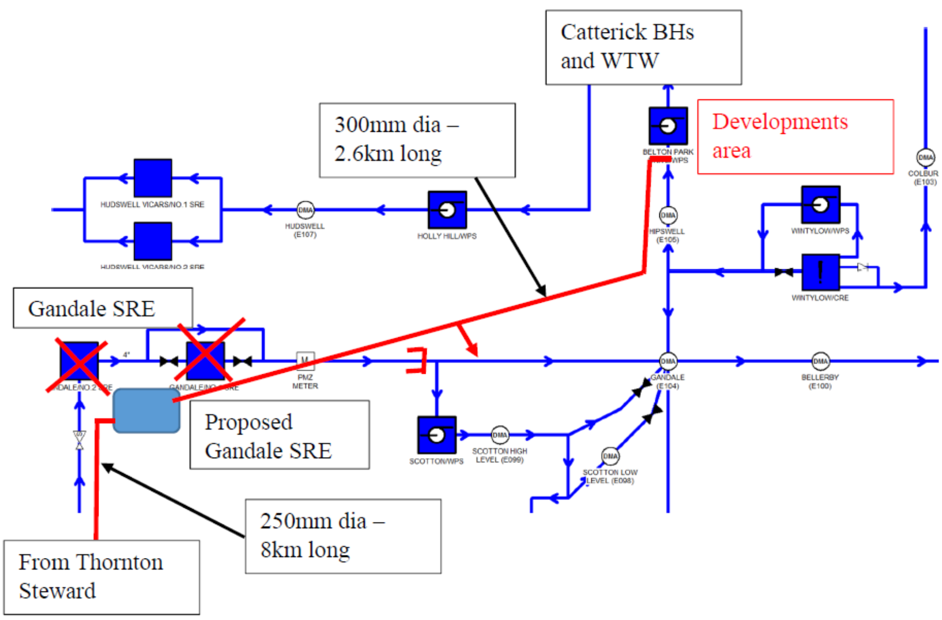


Figure 7 Proposed water supply solution for Catterick Garrison

Figure 8 and Figure 9 illustrate the proposed water mains reinforcement from Thornton Steward to the Catterick Garrison supply system.

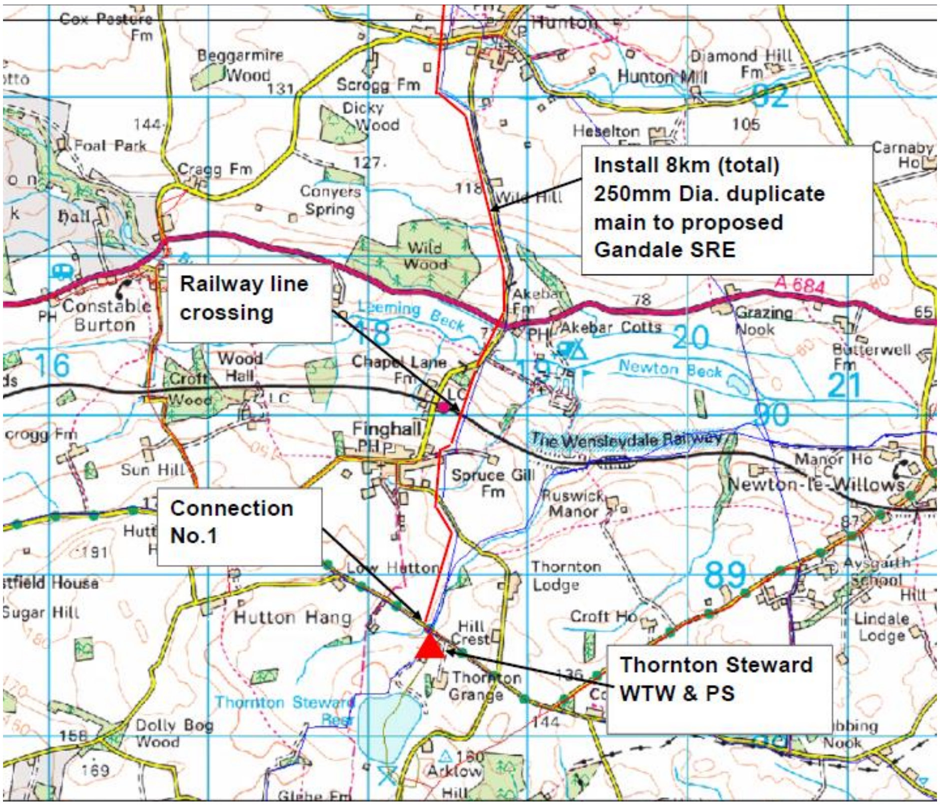


Figure 8 Schematic of proposed mains reinforcement from Thornton Steward

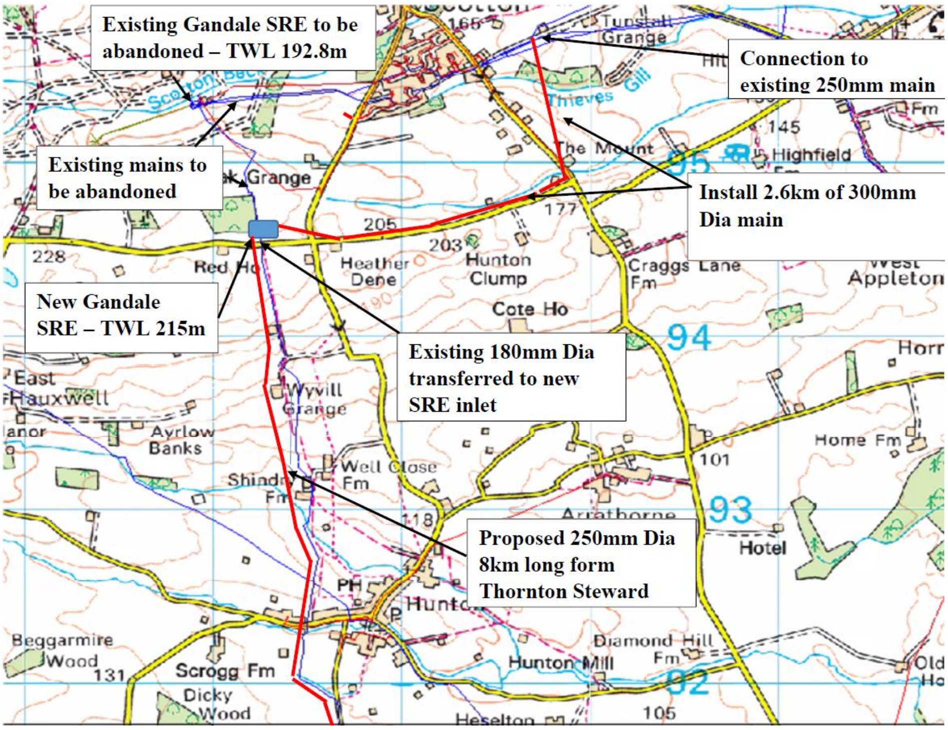


Figure 9 Schematic of proposed mains reinforcement from Thornton Steward

7 Wastewater treatment solutions

7.1 Expansion of Colburn WwTW

As part of the options appraisal process, Colburn was reviewed with a view to expanding the works to accommodate additional the Catterick flows. The works was reviewed on the basis of adding further trickling filters capacity.

All sizing for Colburn is based on the 2025 projected flows and loads at Colburn plus 2025 calculated flows and loads for Catterick. Design values are specified in Table 7 below.

Table 7 - Colburn plus Catterick 2025 design basis

Parameter	2025 Colburn	2025 Catterick	2025 Combined
DWF[1], m^3/d	5,005	730	5,735
ADF, m^3/d (DWF x 1.3)	6,507	949	7,456
FFT, m^3/d	12,355	1,857	14,212
BOD, kg/d	1,200	255	1,455
Ammonia, kg/d	154	32.7	186.7
SS, kg/d	1,400	297	1,697

[1]DWF consent at Colburn is 4,708 m^3/d.

[2] There is no FFT consent for Colburn, however YWS Operations personnel stated that the maximum FFT on the triggers sheet is 143 l/s, therefore this has been taken as the site FFT value, equating to 12,355 m^3/d.

As the 2025 combined DWF exceeds the existing consented DWF, an estimate has been made of a revised final effluent consent in order to maintain the same load discharged to river. This is summarised in Table 8

Table 8 - Colburn expansion – proposed discharge consent

Parameter	Existing	2025 combined	% difference
DWF, m^3/d	4,708	5,735	+22%
BOD 95%ile consent, mg/l	30	24.6	-22%
Ammonia 95%ile consent, mg/l	10	8.2	-22%
SS 95%ile consent, mg/l	50	41	-22%

The works was assessed against process unit sizing from YWS asset inventory database. It is noted that the existing mineral media trickling filters are 39 metres in diameter, which is well in excess of the 25 metres specified in the relevant Asset Standard. They are also about 8% undersized but they perform well, meeting the current ammonia consent of 10 mg/l. We have assumed that the performance of these filters will deteriorate as the new Catterick flows are introduced. The most space and cost-efficient solution has been taken to add tertiary nitrifying filters fitted with plastic media. The asset standard requires then for this solution to have solids capture as the solids consent is less than 50 mg/l; disc filters have been proposed to provide this as they can be supplied as package plants for the required flows.

The existing units, additional units and details are presented in Table 9; where process unit sizing was not available on AI, an estimate has been made.

Table 9 - Colburn trickling filter expansion process unit capacity

Process unit	**Existing**	**Additional required**	**Comments**
Inlet works	12,355 m^3/d	1,857 m^3/d	This may be through a separate inlet works for the additional flows, or an expansion of the existing inlet works.
Primary Settlement Tanks	2 No. @ 19m D	1 No. @ 19m D	Assumed to be the same size as the existing PST to meet AS upflow rates.
Trickling filters	4 No. @ 39m D	Not specified	It is proposed to maintain
Humus tanks	2 No. @ 22m D	No increase	Humus tanks comply with AS for AMP7, but 1 new tank required for AMP8.
Tertiary nitrifying filters	None	3 No. @ 8m D 4.8m deep	Plastic media filters in single-pass mode.
Tertiary solids capture	None	2 No. Disc filters sized for total flow of 14,212 m^3/d	Required to meet AS. No standby capacity has been assumed, as one filter can deal with DWF.

8 Wastewater networks assessment and solutions

8.1 Methodology

8.1.1 General

Location and data about new development sites were taken from Richmondshire Local Plan 2012 – 2028 Core Strategy. There are planned 28 new development areas in Catterick. In the assessment process it was assumed that two sites (105 and 186) will not be developed as there was lack of population data. Therefore, the analysis was carried out for twenty-six sites through the Colburn catchment.

Arup undertook an assessment of both Foul and Surface Water flows from each site. Surface water was an addition to the original scope, agreed with YW at the meeting on 6th September 2017. How each type of flow was assessed is described in the sections below.

Key Assumptions

For the purpose of the assessment, several key assumptions were made:

- The assessment has considered the impact of a new development's flows on the wider YW network and where necessary has proposed and costed a solution. The assessment did not just focus on each individual site's drainage.
- Hydraulic assessment of the wider YW network used the information available from the YW GIS database, typically this was just type of sewer (e.g. foul) and pipe sizes but even sizes were not always available.
  As gradients were generally not available, actual pipe full capacity was not known, therefore Arup had to use engineering judgement using the assumption that minimum gradients would be those to achieve self cleansing velocities.
- For individual sites, the costs to YW were assumed to be any network improvements needed to connect to a suitable drainage point outside the site's boundaries.
- In cases where site topography shows low point within the site, this assessment has provided a cost for YW for a connection from the low point of the site to the nearest appropriate YW asset or river/watercourse.
- Where site topography is unknown/hard to determine, this assessment has provided a cost for YW for a connection from the centre of the site to the nearest appropriate YW asset or river/watercourse.
- For sites where sewers/rivers cross sites it is assumed the developer will connect directly and therefore there will be no costs for YW connected with these sites.

- Gravity solutions were always favoured over pumped solutions, for long term sustainability, however a number of sites did require some pumped drainage.

8.1.2 Brown and Greenfield Sites

To determine the size of the new flows that will be generated by sites in the Catterick area, developments were divided into 2 categories: brownfield and greenfield. It was assumed that brownfield is the site which is or was previously developed, as assessed from aerial photographs, and greenfield sites were defined as previously not developed at all. Figure 10 presents the location of greenfield and brownfield sites.

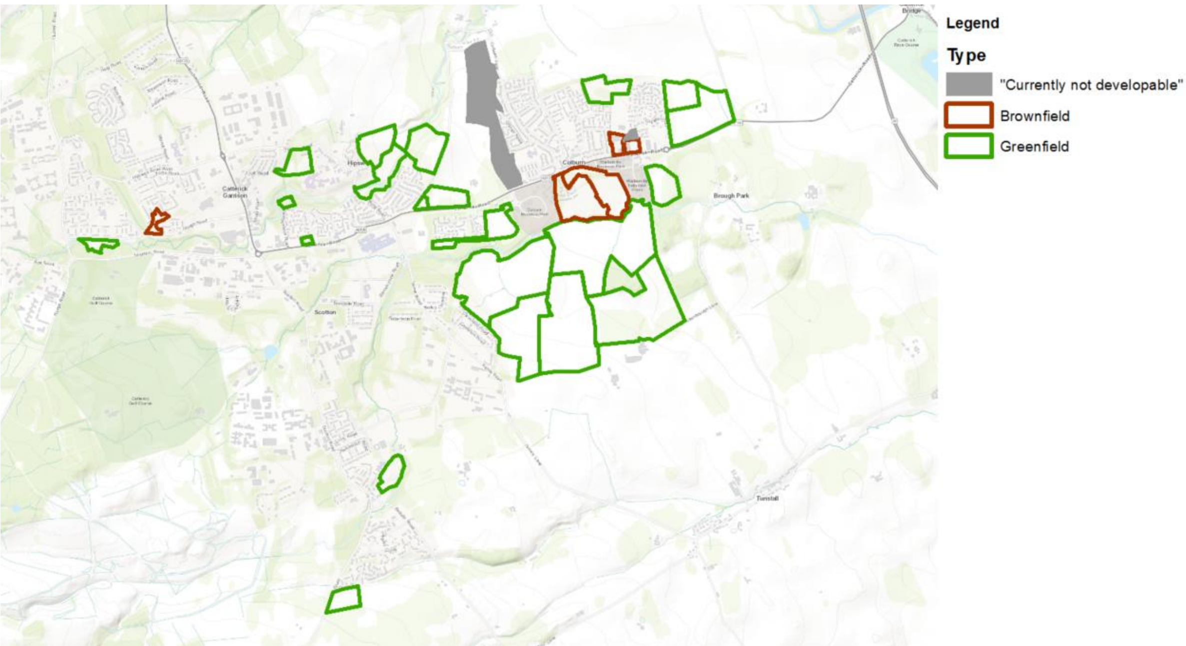


Figure 10 Brownfield and greenfield sites in the Catterick area

8.1.3 Foul Flows

DWF was used to assess the size of the connection pipe/rising main. Typically the YW GIS Network did not provide gradients or invert levels, where this was the case Arup assumed that self cleansing gradients for pipe full flow had been used, using the principal that a gradient equivalent to diameter provides this (e.g. 225Ø at 1 in 225). Thus, based on these factors, the impact of the new developments on the wider YW network was assessed.

The approach followed to assess if new developments pose a risk on the YW assets is described below.

8.1.3.1 Dry Weather Flow

Dry Weather Flow (DWF) for the total development proposal up to AMP10 were calculated for each site in order to see how much additional foul flow will be entering the YW network.

The following formula was used to assess DWF from all sites:

$$DWF = PG + I + E$$

Where:

DWF – Dry weather flow in m3/day and then converted into l/s

P – Population (number of people)

G – Average domestic wastewater contribution (130 l/hd/day)

I – Infiltration (assumed from YW figures 40 l/hd/day)

E – Employment/School wastewater contribution (50 l/hd/day – employment, 90 l/hd/day school contribution).

Employment and schools were not calculated for Catterick due to the fact that developments in Catterick were small.

8.1.3.2 Site Topography and Gravity versus Pumped

The site topography was assessed by using a LiDAR data obtained from the Environmental Agency. Each site was analysed and determined if it could be drained by gravity from the lowest point on the site. However, where there was no possibility to connect the site by gravity system, pumping was introduced.

In total 10 out of 26 development sites required pumping through six pumping stations.

The pump ratings were calculated by the following standard pump power formula using the flow and head and an assumed efficiency of the pumps.

$$P_{hydraulic} = Q \times \rho \times g \times h$$

Where:

$P_{hydraulic}$– hydraulic power (W)

Q – flow rate (m^3/s)

ρ – density of the liquid (kg/m3)

g – acceleration of gravity (m/s2)

h – head (m)

$$P_{pump} = \frac{P_{hydraulic}}{Pump\ Efficiency}$$

The efficiency assumption varies – modern pumps can run at high efficiencies of over 70%, but this is only at their optimum point and efficiencies can be much lower depending on the pump size and the relationship between flow and head. Efficiencies are particularly low for low flow but relatively high head duty.

Pump efficiency has been estimated on a case by case basis for the various duty applications. Due to the small flows and large static head most of pumps had a lower efficiency than 70 %. For all cases, it is assumed that submersible/immersible close-coupled wastewater pumps will be used. The calculated power ratings have been checked against manufacturer product ranges to ensure the proposed ratings are feasible, with corrections made as appropriate.

Rising mains were sized based on minimising friction losses whilst maintaining self-cleansing velocity through the pipes. For particularly low flows, the mains were sized based on the minimum permissible size according to Sewers for Adoption 7th edition - 80 mm diameter. In this case pumped flows were increased from required flow in order to maintain sufficient velocity.

The emergency storage was calculated based on the population value feeding to each pump. The value of 160 litres per head was used to size the emergency storage as required by Sewers for Adoption 7th edition. Due to the small size of the pumps introduced in Catterick, the wet well volume was assumed to be 10m^3 for each pump.

8.1.3.3 Site by Site Assessment

Using the brown/greenfield information, site topography (where available), plus calculated flows, Arup undertook an engineering judgement on a site by site assessment of all the sites using the available GIS network and considered the impact that the new flows from each would have on the wider network, plus any new sewers/assets the site needed.

Where the GIS information contained depth or gradient information for pipes this was considered but many did not.

The outcome of the assessment is also shown in the table in Appendix C.

8.1.4 Surface Water Flows

In order to assess how given site will be dealing with surface water, several assumptions were made. The assessment approach is described below.

8.1.4.1 Surface Water Assumptions

For the purpose of the surface water assessment several general assumptions had to be made:

- Surface water drainage should be drained from sites by considering the options using the drainage hierarchy. Firstly, consider infiltration, then river/watercourse, then surface water sewer and finally, only if no other option is available, combined sewer.
- Infiltration drainage is assumed to not be viable in Catterick and Colburn due to the ground conditions. Arup consulted the BGS SuDS Infiltration Map and the depth to groundwater and ground stability assessment as well as significant constrains for majority of the sites identified by BGS SuDS maps meant that we ruled out the possibility of using infiltration for surface water. Site by site studies, during other more detailed studies at a later stage may find it possible on some sites.

- During the September 2017 meeting with Yorkshire Water agreed that the impact of new development's SW flows on the wider network, where they can not drain to a watercourse, should be assessed to a 1 in 5 year return period for no increased flooding. 1 in 5 year's was suggested to be in line with the DG5 2 in 10 year criteria, the lowest DG5 storm magnitude.
- As already stated, at the time of the assessment, there was no YW hydraulic model available for the Colburn catchment, therefore no modelling has been undertaken. The assessment is based on the engineering judgement of the existing network, using the details supplied from the YW GIS network.

8.1.4.2 Watercourse and Existing Drainage Proximity

Firstly, all 26 sites were divided into three categories based on their proximity to drain to a watercourse:

- Watercourse through/on the boundary of the site
- Watercourse less than 50 meters from the site
- Watercourse more than 50 meters from the site

The 50 meters threshold was used because it was decided that it is relatively easy to access the watercourse which is located 50 meters from the site and be able to discharge to it. Any greater distances start to cause legal issues crossing private land that a developer may have no rights to do.

The assessment found that the majority of sites in Catterick are able to be drained to watercourses. Only sites 29, 122, 123, 124 and 185 had to be drained to sewers.

A similar assessment was taken regarding the coverage of existing surface water drainage. Sites were again divided to three categories:

- Covered by surface water network
- Covered by combined network only
- Not covered at all by either combined nor surface water network

These two assessments helped identify the sites that can be drained directly to watercourses and which sites will influence YW assets. It was assumed that if the watercourse runs through or on the boundary of the site, the developer will have a duty to discharge surface water directly to watercourse.

8.1.4.3 Brownfield or Greenfield Sites

As described previously, in order to calculate new flows generated by new developments, sites were divided into 2 categories: Brownfield and Greenfield sites. The calculation of flow depends on this classification. Below there can be found explanation about the methods taken to assess flow generated by greenfield and brownfield sites.

Brownfield SW Flow Calculation

The following reasoning was undertaken to calculate the flows discharging from brownfields. The September 2017 meeting with Yorkshire Water agreed that if surface water cannot be drained to a watercourse then the assessment was to assume LLFA & YW will restrict the development's surface water to at least 30% reduction from existing surface water flows. The following formula was used to calculate the flow generated by brownfield sites:

$$Q_{brown} = 0.7 \times 3.61 \times CIA_{imp}$$

Where:

0.7 – reduction coefficient of the brownfield flow by 30%

C – Dimensionless coefficient of permeability – 0.95

I – Rainfall intensity (mm/hr) – 50 mm/hr

A_{imp} – Current/previous impermeable area of the site (ha)

The value for rainfall intensity was chosen to be 50 mm/hr because this figure is often used LLFAs and it was therefore felt appropriate for use in this assessment. For information 50mm/hr is the average intensity for a roughly equivalent 1 in 5 year return period summer storm in Catterick.

Greenfield Runoff Calculation

At the September 2017 meeting with Yorkshire Water it was agreed that if SW cannot be drained to a watercourse then Arup were to assume the LLFA & YW will restrict a development's SW discharge rate of 3 l/s/ha (i.e. greenfield runoff rates) into a surface water or combined sewer.

Following the meeting, as Arup were considering the application of this into the assessment, it was considered that it is unlikely the planning process would impose a simple rigid 3l/s/ha. This is because, from Arup's development experience, 3l/s/ha could be found to be too low and not covering a range of rates as storm sizes increase. Therefore, this could be easily challenged and by a developer and the assessment would therefore not reflect reality. It was felt that to apply an appropriate greenfield run-off calculation to each site would be more applicable. As such the greenfield runoff was calculated using the ICP SUDS method for the 1 in 5 years return period.

This calculation method was designed to calculate flows from undeveloped and partly urbanised catchments and it is also used for determination of allowable discharge for new developments. This technique is based on Flood Studies Report approach. It yields the Mean Annual Maximum Flood (knows as QBAR). The growth factors are generated based on recommendations from CIRIA Book 14 and used to convert QBAR to different return periods for different regions of UK. The ICP SUDS method is designed to calculate flow for catchments smaller than 50 ha.

The resultant greenfield run-off flow rates calculated and used for the assessment were to the 1 in 5 year return period, in line with the brownfield flow rate calculation.

Assessment of areas in Catterick and Colburn

Arup undertook an engineering judgement on a site by site assessment of all the sites using the available GIS network and considered the impact that the new flows from each would have on the wider network, plus any new sewers/assets the site needed. This was undertaken using the Watercourse and Existing Drainage Proximity, brown/greenfield information, site topography (where available), plus calculated flows from each new development.

Where the GIS information contained depth or gradient information for pipes this was considered but many did not. Where pipes needed upsizing Arup sized these to self cleansing gradients for pipe full flow with the anticipated increased flows, typically using the principal that a gradient equivalent to diameter provides self cleansing velocities (e.g. 225Ø at 1 in 225).

8.2 Proposed solutions

The proposed solutions for each location are summarised in Appendix C.

10 IWM opportunities

Integrated Water Management (IWM) is the management of the water cycle (water efficiency, potable water demands, non-potable water demands, surface water, wastewater and water supply) in harmony with the built environment through planning and urban design. Within this approach the water cycle is considered from the outset and throughout the planning and design process for developments.

Water management approaches are also consistent with the designs for successful places and consider:

- Understanding of the local constraints, such as local environment, infrastructure capacity, available space, etc.
- Making the best use of existing infrastructure and delaying or minimising the need for reinforcements and upgrades.
- Provision of resource security and greater resilience in the future.

The IWM approaches can deliver multiple benefits, include reduced cost of water abstraction and treatment, reduced pumping of potable water and wastewater, increased headroom in water supply and drainage networks, and reduced footprint of wastewater treatment plants.

Meeting the demands for water that can be satisfied by non-potable quality water is one of the central parts of the IWM approach and included measures such as rainwater harvesting.

The non-potable water supply system (rainwater, stormwater, or greywater) can take three primary forms, which are outlined in the image below:

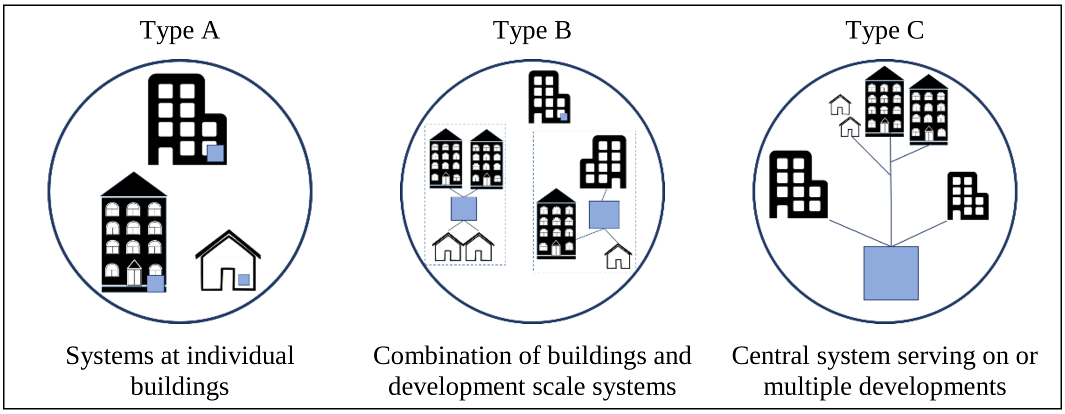


Figure 11 Typologies of non-potable reuse systems

The selection of most suitable system configuration will be dependent on the development type, layout, phasing, as well as local constraints.

10.1 Review of IWM options

There are a number of processes at work within IWM. The approaches considered in the options appraisal for Catterick include:

- Higher water efficiency measures
- Rainwater Harvesting
- Stormwater Harvesting
- Greywater Reuse

The higher water efficiency estimates are based on Building Regulations Part G and assume water demand of 105 l/d per person. The potential supply of rainwater (from rooftops) and stormwater (from catchment surfaces) has been estimated assuming plot area of 250 m^2 and a building footprint of 70 m^2. The potential supply of greywater is estimated using British Standard as well as micro-component breakdown of water uses within homes.

Table 10 - Demand reduction potential of IWM options

	Reduction in potable demand ^	**Non-potable demand satisfied**
Rainwater	14%	48%
Rainwater + Stormwater	29%	100%
Greywater	29%	100%

^ compared to Part G 'high efficiency'

** over 25 years and assuming simple payback*

The driver for Integrated Water Management (IWM) at Catterick is predominantly the water supply network and associated resources. The opportunity to implement IWM measures vary by development type, ranging from high water efficiency in design to greywater treatment. The strategy has explored suitable options for each development and developing a holistic strategy covering all new developments.

Table 11 lists our recommendation of IWM measures for each proposed development.

Table 11 – IWM recommendations for each site

AMP	**SHELAA Ref**	**Address**	**Units**	**Sum**	**IWM measure**
AMP6	120	Somerset Close	40	620	High Water Efficiency
	121	Gough Road	29		
	124	Arras Lane	126		
	156	Fmr Colburn Pipeworks site, Woodside Close	175		
	157	Fmr Colburn Pipeworks site, Woodside Close (ph2)	250		

AMP	SHELAA Ref	Address	Units	Sum	IWM measure
AMP7	217	Land East of Byng Road	10	34	High Water Efficiency
	185	Land adjacent to Lidl	24		
	26	Land east of Cookson Way	75	168	Rain Water Harvesting
	82	Hipswell Mill	93		
	300	Land South of Sour Beck – Site 4	302	835	Surface Water Harvesting / Greywater Reuse
	301	Land South of Sour Beck – Site 5	533		
AMP8	122	Coronation Park	19	27	High Water Efficiency
	123	Land E Belton Park	8		
	27	Land East of Regent Park Estate	90	629	Rain Water Harvesting
	56	Old Sports Field, Catterick Garrison	71		
	69	Land adj. Oaktree Ave Scotton	61		
	106	Land West Colburn Lane	133		
	284	Land adj Walkerville Ind Estate	97		
	296	Land NE of Low Hall Lane	59		
	128	Land East of Walkerville	118		
	204	Land South of Sour Beck – Site 1	615	1579	Surface Water Harvesting / Greywater Reuse
	298	Land south of Sour Beck – Site 2	487		
	299	Land S of Sour Beck – Site 3	477		

The following assumptions were made:

- **AMP6 developments**: It would not be possible to implement rainwater harvesting, surface water harvesting or greywater reuse in development expected to be delivered in AMP6, as many of these developments would have progressed or in possession of planning permissions.
- **Greywater reuse** was selected as an option over surface water harvesting due to higher confidence in reduced demand for water infrastructure, specifically during low rainfall / drought conditions.
- **Rainwater Harvesting** would be feasible to implement for small developments, whereas large developments could potentially implement greywater reuse

10.2 Impact on clean water infrastructure solutions

IWM solutions could result in a reduction in water mains diameters and a reduction in the volume of Gandale SRE from 4,000m^3 to 3,000m^3. The IWM solutions are detailed in Appendix A.

10.3 Impact on wastewater treatment solutions

The IWM option involves a reduced potable water consumption and grey water recycling, which results in a revised sewage flow of 75 l/d per person. This is a conservative figure, as the flows can be reduced up to 60 l/d per person based on the industry standard 'water calculator'. The revised design flows are shown in Table 12.

Table 12 – Colburn expansion summary - IWM design @ 75 l/hd.d

AMP	7	8
P.E.	24,158	29,299
FFT, m^3/d	13,548 (-664)	14,973 (-1,534)

The reduced flow has an impact on all hydraulic processes, namely settlement stages and pumping costs. It does not impact on the secondary treatment process capacity as this is based on load per person and this does not change from implementing IWM.

In our specific design, we have proposed that additional settlement capacity matches that of the existing for operational purposes, therefore no benefit is drawn from IWM. Marginal savings would be possible in terms of the inlet works sizing and that of the tertiary solids capture as they would be designed for a lower FFT.

10.4 Impact on sewerage solutions

The proposed IWM options may result in reduced foul flows reaching the sewers. As such there may be opportunity to reduce the size of some of the proposed wastewater assets by either reducing pipe, storage or pump sizes. In particular, the sizing of the emergency storage may be able to be reduced significantly if a lower volume per dwelling is agreed from the figure of 160l per dwelling given by Sewers for Adoption.

10.5 IWM Cost basis and assumptions

The cost estimates (refer to Table 13 and Table 14) are based on the approach devised and agreed for Old Oak Common Integrated Water Management Study and the Thames Water study on Non Potable Water Reuse as a Demand Management Option for WRMP19. They are totex estimates over 40 years assuming a 6.25% discounting factor.

The cost estimates utilise the New Rules of Measurement (NRM) and Building Cost Information Service (BCIS) from Royal Chartered Institute of Surveyors (RCIS), and are suitable for initial cost estimates at masterplanning stage.

The energy cost of pumping for local non-potable supply have been based on research by University of Exeter on energy consumption in RWH systems.

More detail costing would be possible once there is greater level of understanding of site and building layouts and designs. This would also enable optimisation of costs and finding cost efficiencies.

It is assumed that the necessary storage in pre-treatment stage for rainwater and stormwater will be met by the storm attenuation that will be required to comply with surface water runoff constraints.

Although passive treatment systems are available, to ensure a guaranteed non-potable water quality it is assumed the surface water harvesting will require similar type of membrane treatment systems as used in greywater reuse.

The cost of implementing the holistic IWM strategy covering all developments in AMP6 & AMP7 are in Table 13 below:

Table 13 – Cost estimate for IWM strategy to 2025 (AMP7)

	#	**Cost Item**	Cost borne by	**High Water Efficiency**	**Rainwater Harvesting**	**Greywater**	**Total**
		Properties	-	654	168	835	**1,657**
		Water Demand	-	0.16 MLd	0.037 MLd	0.15 MLd	**0.352 MLd**
CAPEX	1	Dual plumbing (supply)	Developer	NA	£109 k	£0.44 mil	**£0.63 mil**
	2	Dual plumbing (greywater drainage)	Developer	NA	-	£0.44 mil	**£0.44 mil**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	NA	-	£145 k	**£0.145 mil**
	4	Membrane replacement (every 10 years)	Facility Management (FM) or iWaSCo	NA	-	£14,400	**£14,400**
	5	Pump renewal / replacement (15 years)	Householder, FM or iWaSCo	NA	£22 k (pumps at individual house)	£17,300 (communal pumps)	**£39,300**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	NA	-	£16,800 / year	**£16,800**
	7	Non-potable supply – annual	Householder, FM or iWaSCO	NA	£710 / year	£7,500 / year	**£7,500**

	#	Cost Item	Cost borne by	High Water Efficiency	Rainwater Harvesting	Greywater	Total
		energy cost for pumping water					

As the number of housing AMP8 and beyond is greater than AMP6 &7, the cost for these further developments applying same approach were also estimated and presented in Table 14.

Table 14 – Cost estimate for IWM strategy after 2025 (AMP8)

	#	Cost Item	Cost borne by	High Water Efficiency	Rainwater Harvesting	Greywater	Total
		Properties	-	27	629	1,579	**2,235**
		Water Demand	-	0.007 MLd	0.14 MLd	0.28 MLd	**0.43 MLd**
CAPEX	1	Dual plumbing (supply)	Developer	NA	£437 k	£0.87 mil	**£1.31 mil**
	2	Dual plumbing (greywater drainage)	Developer	NA	-	£0.87 mil	**£0.87 mil**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	NA	-	£0.29 mil	**£0.29 mil**
	4	Membrane replacement (every 10 years)	Facility Management (FM) or iWaSCo	NA	-	£29,000	**£29,400**
	5	Pump renewal / replacement (15 years)	Householder, FM or iWaSCo	NA	£22 k (pumps at individual house)	£35,000 (communal pumps)	**£57,300**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	NA	-	£34,000 / year	**£34,000**

	#	Cost Item	Cost borne by	High Water Efficiency	Rainwater Harvesting	Greywater	Total
	7	Non-potable supply – annual energy cost for pumping water	Householder, FM or iWaSCO	NA	£700 / year	£14,100 / year	**£15,800**

- The capital costs for dual plumbing will be borne by the developer in the first instance as the infrastructure will need to be implemented at the time of construction.
- The capital cost of the treatment plant may be borne by developer or an independent operator (WaSCo) if developer enters into such an agreement.
- The operating costs for non-potable system (treatment plant and pumping system) and will be borne by the site Facilities Management or WaSCo.
- For rainwater harvesting, the pump renewal / replacement costs will be borne directly by the householder, as the systems will be at individual households.
- Some or all of these additional costs for others may be recouped through a charging mechanism (service charge or a volumetric charge for non-potable supply).

In Olympic Park in London, the non-potable water supply is charged at a rate below potable water supply charges. In some office buildings where greywater systems are employed, the cost of their operation are included within the service charges for tenants. It is noted that the reduced YW revenue has not been included in the calculations.

11 Totex calculations

11.1 Data and assumptions

The capex for the costed AMP7 option has been estimated by YWS using the Yorkshire Water Unit Cost Database (UCD). Any items that are not covered in the UCD have been costed by Arup and/or suppliers. The source of the costing information for each work element is presented in Appendix A.

The opex of AMP7 option has been estimated by Arup and is presented in Appendix B. The totex has been calculated over a 40-year period.

The assumptions used for the design and costing exercise are summarised below:

Area	Capex assumptions	Opex assumptions
Land requirements	AMP9 footprint	n/a
Sewerage	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	
Wastewater treatment	AMP7 requirements	Estimate is based on the AMP7 solution only
Clean water infrastructure	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	

11.2 Costed options

The following option has been costed for AMP7 implementation.

ID	Option
1	Colburn WwTW trickling filter expansion and water supply from Thornton Stewart WTW
2	Option 1 with IWM measures

11.3 Costs

The option costs (capex, opex and totex) over a 40-year period (NPV) are summarised below.

Option ID	Sewerage / wastewater treatment		Clean water infrastructure		Totex (£m)
	Capex (£m)	Opex (£m)	Capex (£m)	Opex (£m)	
1	12.0	0.5	5.2	-	17.7
2	11.9	0.5	4.4	-	16.8

12 Environmental and social appraisal of future options

The future options are listed below.

ID	Option
1	Colburn WwTW trickling filter expansion and water supply from Thornton Stewart WTW
2	Option 1 with IWM measures

A five capital approach has been developed to qualitatively appraise the environmental and social impact of the shortlisted options. The assessment framework provides scoring criteria against 21 aspects as listed in the table below, from high negative impact (-3) to high positive impact (+3). The detailed scoring criteria can be found in Appendix F.

The score under each of the aspects were summed to provide a total for each of the options. Equal weighting has been assumed for all aspects considered.

Table 15: Five capital appraisal summary for all Catterick options

Option ID	Natural												Social			Human				F&M		Total score
	Crops and Livestock	Fisheries	Energy	Water supply	Global climate	Air quality	Flood Regulation	Water quality	Pollination	Recreation	Amenity	Non-Use Value	Physical activity	Quality of place	Trust	Employment	Skills	Health & Safety	Local economy	Private costs	Private benefits	
1	0	0	-1	-2	-1	-3	0	0	0	-2	0	0	0	-2	0	2	2	0	2	1	3	-1
2	0	0	-1	-1	-1	-3	0	0	0	-2	0	0	0	-2	0	2	2	0	2	1	3	**0**

As shown in Table 15, the preferred option by their overall impact on the five-capital is option 2, Colburn WwTW trickling filter expansion + IWM option.

13 Conclusions and recommendations

Based on the latest phasing information, expansion of the trickling filters at Colburn WwTW is the preferred AMP7 wastewater treatment option. The additional clean water supply will have to be met from Thornton Stewart WTW. This will also provide futureproofing for the expected growth in AMP8. The totex has been estimated at £17.7m.

Implementing IWM solutions in this location will reduce YWS totex by £0.9m, but will result in additional costs for others (developers, non-potable reuse system installers) through provision of additional on-site infrastructure required to enable non-potable use.

The costs of the non-potable reuse system and supply of non-potable water are likely to be recouped through a charging scheme. This could be as a flat service charge or metered charges for non-potable supply. The end users (e.g. homeowners) are likely to save on their water bills, provided the non-potable water is supplied at rate below the potable water supply.

Appendix A

List of items for Options Costing

A1 Options

ID	Option
1	Colburn WwTW trickling filter expansion and water supply from Thornton Stewart WTW
2	Option 1 with IWM measures

A2 Option 1

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	322 m length, 100 mm dia, rural	ZY7311	Length	322	m
Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	21 m length, 150 mm dia, urban	ZY7270	Length	21	m
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crownn	21 m length, 300 mm dia, urban	ZY7279	Length	21	m
Sewerage	Pumping station to works	PS26 & 128 , 10 m3 normal storage, 30.88 m3 emergency storage	ZY1601	Total internal volume	41	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	5.8	kW
Sewerage	Power supply		ZY1355	Power	5.8	kW
Sewerage	Storm outfall to watercourse Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	833 m length, 300 mm dia, urban	ZY7279	Length	833	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	84 m length, 100 mm dia, urban	ZY7312	Length	84	m
Sewerage	Pumping station to works	PS58, 10 m3 normal storage, 5 m3 emergency storage	ZY1601	Total internal volume	15	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	4.8	kW
Sewerage	Power supply		ZY1355	Power	4.8	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	308 m length, 100 mm dia, rural	ZY7311	Length	308	m
Sewerage	Pumping station to works	PS82&217, 10 m3 normal storage, 16.5 m3 emergency storage	ZY1601	Total internal volume	26.5	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	5.8	kW
Sewerage	Power supply		ZY1355	Power	5.8	kW
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	28 m length, 300 mm dia, urban	ZY7280	Length	28	m
Sewerage	Storm outfall to watercourse Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	73m length, 300 mm dia, rural	ZY7279	Length	73	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Sewerage	Storm Pipeline to existing netowrk Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	114m length, 300 mm dia, urban	ZY7279	Length	114	m
Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	11 m length, 150 mm dia, urban	ZY7270	Length	11	m
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	294 m length, 100 mm dia, rural	ZY7311	Length	294	m
Sewerage	Pumping station to works	PS156&157 10 m3 normal storage, 68 m3 emergency storage	ZY1601	Total internal volume	78	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	3.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	3.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	6.8	kW
Sewerage	Power supply		ZY1355	Power	6.8	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	90 m length, 100 mm dia, urban	ZY7312	Length	90	m
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	108 m length,225 mm dia, urban	ZY7270	Length	108	m
Sewerage	Pumping station to works	PS185 10 m3 normal storage, 4 m3 emergency storage	ZY1601	Total internal volume	14	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	4.3	kW
Sewerage	Power supply		ZY1355	Power	4.3	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	160 m length,100 mm dia, rural	ZY7311	Length	160	m
Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe	15 m length,100 mm dia, rural	ZY7306	Length	15	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	jacking and auger boring)					
Sewerage	Foul pipeline to pumping station PS300&301 Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	369 m length, 150 mm dia, rural	ZY7267	Length	369	m
Sewerage	Pumping station to works	PS300&301 10 m3 normal storage, 134 m3 emergency storage	ZY1601	Total internal volume	144	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	7.8	kW
Sewerage	Power supply		ZY1355	Power	7.8	kW
Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Additional Inlet Works Civil including bypass		ZY6000	Flow	1,857	m3/d
Wastewater Treatment	Additional Inlet Screens and Screens handling package	Duty	ZY6790	Flow	1,857	m3/d
Wastewater Treatment	Grit detritor plus bypass		ZY6750	Flow	1,857	m3/d
Wastewater Treatment	Additional Grit classification package plant	Duty/standby	ZZ6730	Flow	1,857	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 3		ZY6920	Area	284	m2
Wastewater Treatment	New PST desludge pump @ 0.5 l/s	Duty	ZY6100	Power	5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	5	kW
Wastewater Treatment	Half bridge scraper 3		ZY6900	Area	284	m2

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Pumping station to works		ZY1601	Total internal volume	50	m3
Wastewater Treatment	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	30	kW
Wastewater Treatment	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	30	kW
Wastewater Treatment	Trickling filter 1 - plastic		ZY6540	Area	50	m2
Wastewater Treatment	Trickling filter 2- plastic		ZY6540	Area	50	m2
Wastewater Treatment	Trickling filter 3 - plastic		ZY6540	Area	50	m2
Wastewater Treatment	Plastic Media		ZY1873	Volume	700	m3
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Discfilters		ZY6468	Flow	14,212	m3/d
Wastewater Treatment	Plinth for disc filters		ZY1335	Area	112.0	m2
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	24	kW
Wastewater Treatment	Additional co-settled sludge storage	1 no	ZY1650	Volume	34	m3
Wastewater Treatment	Additional thickened sludge storage	1 no	ZY1650	Volume	7	m3
Wastewater Treatment	Additional sludge dewatering capacity		ZY1780	Through put	0.25	tDS/d
Wastewater Treatment	Additional dewatering plinth		ZY1335	Area	10.0	m2
Wastewater Treatment	New co-settled Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
Wastewater Treatment	New co-settled Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	New Thickened Sludge tanks mixing 1	Duty	ZY1260	Power	0.5	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	New Thickened Sludge tanks mixing 2	Standby	ZY1260	Power	0.5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	1	kW
Wastewater Treatment	Washwater booster package	@ 25 l/s ins flow, all mech plus elec	ZY1567	m3/h	197	m3/d
Wastewater Treatment	New Odour control	Sludge storage tank	ZY6025	m3/h	41	m3/h
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	900	m
Other	Security site fencing		ZY1175	Length	600	m
Other	Earthworks/Landscaping		ZY1090	Volume	300	m3
Other	Brick building housing SCADA		ZY1040	Area	25	m2
Other	Power supply		ZY1355	Power	217	kW
Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
Sewerage	Outfall pipe from treatment works to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	890 m length,375 mm dia, rural	ZY7279	Length	890	m
Clean Water	250 / 200mm under pressure tee connection at Thornton Steward PS	2	Covered by Pipe Lay Model	Number	1	no
Clean Water	200mm dia. flow meter and chamber	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	Lay 250mm diameter HDPE main in road verge		ZY7325	Length	4,600	m
Clean Water	Lay 250mm diameter HDPE main in grass		ZY7325	Length	3,100	m
Clean Water	250mm diameter HDPE main road crossings		ZY7329	Length	70	m
Clean Water	Twin 180mm HDPE river crossing by directional drilling		ZY7329	Length	60	m
Clean Water	250mm diameter HDPE main railway line		ZY7329	Length	30	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	crossing by directional drilling					
Clean Water	250mm diameter HDPE main major road crossing by directional drilling		ZY7329	Length	30	m
Clean Water	New service reservoir to replace Gandale SRE		ZY4118	Volume	4,000	m3
Clean Water	Lay 2.6km of 300mm diameter HDPE main in road verge		ZY7325	Length	2,600	m
Clean Water	Connections and valves to new SRE	1	Covered by All-in SRE model	Number	1	no
Clean Water	180 / 200mm under pressure tee connection c/w valve	2	Covered by Pipe Lay Model	Number	1	no
Clean Water	200mm diameter pipeline railway line crossing	1	Covered by item 7	Number	1	no
Clean Water	200mm diameter pipeline water course crossing	2	Covered by item 6	Number	2	no
Clean Water	Lay 2km 200mm diameter main in road		ZY7051	Length	2,000	m
Clean Water	6-inch / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	100mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	100mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	160mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	2	ZY0059	Number	2	no

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	3	ZY0059	Number	3	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A3 Option 2

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	322 m length, 100 mm dia, rural	ZY7311	Length	322	m
Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	21 m length, 150 mm dia, urban	ZY7270	Length	21	m
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crownn	21 m length, 300 mm dia, urban	ZY7279	Length	21	m
Sewerage	Pumping station to works	PS26 & 128 , 10 m3 normal storage, 30.88 m3 emergency storage	ZY1601	Total internal volume	41	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	5.8	kW
Sewerage	Power supply		ZY1355	Power	5.8	kW
Sewerage	Storm outfall to watercourse Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	833 m length, 300 mm dia, urban	ZY7279	Length	833	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	84 m length, 100 mm dia, urban	ZY7312	Length	84	m
Sewerage	Pumping station to works	PS58, 10 m3 normal storage, 5 m3 emergency storage	ZY1601	Total internal volume	15	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	4.8	kW
Sewerage	Power supply		ZY1355	Power	4.8	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	308 m length, 100 mm dia, rural	ZY7311	Length	308	m
Sewerage	Pumping station to works	PS82&217, 10 m3 normal storage, 16.5 m3 emergency storage	ZY1601	Total internal volume	26.5	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	5.8	kW
Sewerage	Power supply		ZY1355	Power	5.8	kW
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4	28 m length, 300 mm dia, urban	ZY7280	Length	28	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	reinstatement), 2-4m depth to crown					
Sewerage	Storm outfall to watercourse Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	73m length, 300 mm dia, rural	ZY7279	Length	73	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Sewerage	Storm Pipeline to existing netowrk Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	114m length, 300 mm dia, urban	ZY7279	Length	114	m
Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	11 m length, 150 mm dia, urban	ZY7270	Length	11	m
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	294 m length, 100 mm dia, rural	ZY7311	Length	294	m
Sewerage	Pumping station to works	PS156&157 10 m3 normal storage, 68 m3 emergency storage	ZY1601	Total internal volume	78	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	3.5	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	3.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	6.8	kW
Sewerage	Power supply		ZY1355	Power	6.8	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-	90 m length, 100 mm dia, urban	ZY7312	Length	90	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	urban roads (T3/4 reinstatement)					
Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	108 m length,225 mm dia, urban	ZY7270	Length	108	m
Sewerage	Pumping station to works	PS185 10 m3 normal storage, 4 m3 emergency storage	ZY1601	Total internal volume	14	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	4.3	kW
Sewerage	Power supply		ZY1355	Power	4.3	kW
Sewerage	Foul Pipeline to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	160 m length,100 mm dia, rural	ZY7311	Length	160	m
Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	15 m length,100 mm dia, rural	ZY7306	Length	15	m
Sewerage	Foul pipeline to pumpin station PS300&301 Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	369 m length, 150 mm dia, rural	ZY7267	Length	369	m
Sewerage	Pumping station to works	PS300&301 10 m3 normal storage, 134 m3 emergency storage	ZY1601	Total internal volume	144	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.5	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.5	kW
Sewerage	Brick building		ZY1040	Area	9	m2
Sewerage	New MCC		ZY1255	Power	7.8	kW
Sewerage	Power supply		ZY1355	Power	7.8	kW
Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Additional Inlet Works Civil including bypass		ZY6000	Flow	1,193	m3/d
Wastewater Treatment	Additional Inlet Screens and Screens handling package	Duty	ZY6790	Flow	1,193	m3/d
Wastewater Treatment	Grit detritor plus bypass		ZY6750	Flow	1,193	m3/d
Wastewater Treatment	Additional Grit classification package plant	Duty/standby	ZZ6730	Flow	1,193	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 3		ZY6920	Area	284	m2
Wastewater Treatment	New PST desludge pump @ 0.5 l/s	Duty	ZY6100	Power	5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	5	kW
Wastewater Treatment	Half bridge scraper 3		ZY6900	Area	284	m2
Wastewater Treatment	Pumping station to works		ZY1601	Total internal volume	50	m3
Wastewater Treatment	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	28.5	kW
Wastewater Treatment	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	28.5	kW
Wastewater Treatment	Trickling filter 1 - plastic		ZY6540	Area	50	m2
Wastewater Treatment	Trickling filter 2- plastic		ZY6540	Area	50	m2
Wastewater Treatment	Trickling filter 3 - plastic		ZY6540	Area	50	m2

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Plastic Media		ZY1873	Volume	700	m3
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Distributor 1 inc motor drive and rotation sensors		ZY6420	Area	50	m2
Wastewater Treatment	Discfilters		ZY6468	Flow	13,548	m3/d
Wastewater Treatment	Plinth for disc filters		ZY1335	Area	112.0	m2
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	24	kW
Wastewater Treatment	Additional co-settled sludge storage	1 no	ZY1650	Volume	34	m3
Wastewater Treatment	Additional thickened sludge storage	1 no	ZY1650	Volume	7	m3
Wastewater Treatment	Additional sludge dewatering capacity		ZY1780	Through put	0.25	tDS/d
Wastewater Treatment	Additional dewatering plinth		ZY1335	Area	10.0	m2
Wastewater Treatment	New co-settled Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
Wastewater Treatment	New co-settled Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	New Thickened Sludge tanks mixing 1	Duty	ZY1260	Power	0.5	kW
Wastewater Treatment	New Thickened Sludge tanks mixing 2	Standby	ZY1260	Power	0.5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	1	kW
Wastewater Treatment	Washwater booster package	@ 25 l/s ins flow, all mech plus elec	ZY1567	m3/h	197	m3/d
Wastewater Treatment	New Odour control	Sludge storage tank	ZY6025	m3/h	41	m3/h
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	900	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Other	Security site fencing		ZY1175	Length	600	m
Other	Earthworks/Landscaping		ZY1090	Volume	300	m3
Other	Brick building housing SCADA		ZY1040	Area	25	m2
Other	Power supply		ZY1355	Power	217	kW
Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
Sewerage	Outfall pipe from treatment works to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	890 m length,375 mm dia, rural	ZY7279	Length	890	m
Clean Water	250 / 200mm under pressure tee connection at Thornton Steward PS	2	Covered by Pipe Lay Model	Number	1	no
Clean Water	200mm dia. flow meter and chamber	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	Lay 180mm diameter HDPE main in road verge		ZY7325	Length	4,600	m
Clean Water	Lay 180mm diameter HDPE main in grass		ZY7325	Length	3,100	m
Clean Water	280mm diameter HDPE main road crossings		ZY7329	Length	70	m
Clean Water	Twin 100mm HDPE river crossing by directional drilling		ZY7329	Length	60	m
Clean Water	180mm diameter HDPE main railway line crossing by directional drilling		ZY7329	Length	30	m
Clean Water	180mm diameter HDPE main major road crossing by directional drilling		ZY7329	Length	30	m
Clean Water	New service reservoir to replace Gandale SRE		ZY4118	Volume	3,000	m3
Clean Water	Lay 2.6km of 200mm diameter HDPE main in road verge		ZY7325	Length	2,600	m
Clean Water	Connections and valves to new SRE	1	Covered by All-in SRE model	Number	1	no

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	180 / 200mm under pressure tee connection c/w valve	2	Covered by Pipe Lay Model	Number	1	no
Clean Water	200mm diameter pipeline railway line crossing	1	Covered by item 7	Number	1	no
Clean Water	200mm diameter pipeline water course crossing	2	Covered by item 6	Number	2	no
Clean Water	Lay 2km 200mm diameter main in road		ZY7051	Length	2,000	m
Clean Water	6-inch / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	100mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	100mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	160mm / 100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	1	ZY0059	Number	1	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	2	ZY0059	Number	2	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	200mm /100mm connection c/w meter	3	ZY0059	Number	3	no
Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Appendix B

Operating Costs

B1 Options

ID	Option
1	Colburn WwTW trickling filter expansion and water supply from Thornton Stewart WTW
2	Option 1 with IWM measures

B2 Option 1

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
26 & 128 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.67	kW	2.5 kW	8 hrs/day	5.33 kWh/d	196 £/yr
26 & 128 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.67	kW	2.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW		ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**2.27**	**kW**	**5.8 kW**			
Power supply			**Power**	**2.27**	**kW**	**5.8 kW**		**9.23 kWh/d**	**339 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
58 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.32	kW	1.5 kW	8 hrs/day	2.5 kWh/d	93 £/yr
58 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.32	kW	1.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.92**	**kW**	**4.8 kW**			
Power supply		**ZY1355**	**Power**	**1.92**	**kW**	**4.8 kW**		**6.4 kWh/d**	**237 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
82 & 217 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.33	kW	2.5 kW	8 hrs/day	2.6 kWh/d	96 £/yr
82 & 217 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.33	kW	2.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.93**	**kW**	**5.8 kW**			
Power supply		**ZY1355**	**Power**	**1.93**	**kW**	**5.8 kW**		**6.5 kWh/d**	**239 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
156 & 157 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1.10	kW	3.5 kW	8 hrs/day	8.8 kWh/d	323 £/yr
156 & 157 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1.10	kW	3.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**2.70**	**kW**	**6.8 kW**			
Power supply		**ZY1355**	**Power**	**2.70**	**kW**	**6.8 kW**		**12.7 kWh/d**	**467 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
185 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.03	kW	1 kW	8 hrs/day	0.3 kWh/d	9 £/yr
185 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.03	kW	1 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.63**	**kW**	**4.3 kW**			
Power supply		**ZY1355**	**Power**	**1.63**	**kW**	**4.3 kW**		**4.2 kWh/d**	**153 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
300 & 301 opt a Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.12	kW	4.5 kW	8 hrs/day	17.0 kWh/d	623 £/yr
300 & 301 opt a Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.12	kW	4.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**3.72**	**kW**	**7.8 kW**			
Power supply		**ZY1355**	**Power**	**3.72**	**kW**	**7.8 kW**		**20.9 kWh/d**	**767 £/yr**
Total transfer opex cost				**14.16**		**35.00**		**59.9 kWh/d**	**2200.8 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Additional Inlet Screens and Screens handling package 1 @ 863 m3	Duty	ZY6790	Power	4	kW	10.5 kW	8 hrs/day	32 kWh/d	1,176 £/yr
Additional Inlet Screens and Screens handling package 2 @ 863 m3	Standby	ZY6790	Power	4	kW	10.5 kW	0 hrs/day	0 kWh/d	- £/yr
Additional Grit classification package plant @ 863 m3/d	Duty/standby	ZZ6730	Power	3	kW	3.5 kW	8 hrs/day	24 kWh/d	882 £/yr
PST Half bridge scraper 3, 284m2	Duty	ZY6900	Power	0.5	kW	2.2 kW	24	12 kWh/d	441 £/yr
PST pump 1@ 0.5 l/s	Duty	ZY1638	Power	0.33	kW	2 kW	8 hrs/day	2.616 kWh/d	96 £/yr
TF distributor arm, 1195 m2, 5	Duty		Power	1.00	kW	4 kW	24 hrs/day	24 kWh/d	882 £/yr
TF distributor arm, 1195 m2, 6	Duty		Power	1.00	kW	4 kW	24 hrs/day	24 kWh/d	882 £/yr
TF distributor arm, 1195 m2, 7	Duty		Power	1.00	kW	4 kW	24 hrs/day	24 kWh/d	882 £/yr
TF Filter Feed PS and recirc	Duty	ZY6100	Power	11.00	kW	30 kW	24 hrs/day	264.0 kWh/d	9,700 £/yr
TF Filter Feed PS and recirc	Standby	ZY6100	Power	11.00	kW	30 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1, 54 m3	Duty	ZY1260	Power	0.86	kW	2 kW	16 hrs/day	13.76 kWh/d	506 £/yr
Sludge tanks mixing 2, 54 m3	Standby	ZY1260	Power	0.86	kW	2 kW	0 hrs/day	0 kWh/d	- £/yr
Additional dewatering	Duty	ZY1262	Power	30		90 kW	7 hrs/day	210 kWh/d	7,716 £/yr
Washwater booster pump 1	Duty	ZY1567	Power	3	kW	4 kW	8 hrs/day	24 kWh/d	882 £/yr
Washwater booster pump 2	Standby	ZY1567	Power	3	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control, 54 m3/h	Sludge storage tank	ZY6025	Power	0.7	kW	1.5 kW	24 hrs/day	16.8 kWh/d	617 £/yr
Level transmitters, 2 No. @ 0.05 kW	flowmeter, Sludge	ZY0146	Power	0.1	no	2 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Rotation sensor, 4 No. @ 0.05kW each	TF distributor arm		Power	0.2	kW	1 kW	0.017 hrs/day	0.003 kWh/d	0 £/yr
Building services (heating, lighting etc)			Power	4	kW	6 kW	4.000 hrs/day	16 kWh/d	588 £/yr
New MCC		**ZY1255**	**Power**	**64**	**kW**	**171 kW**			
Power supply		**ZY1355**	**Power**	**64**	**kVA**	**171 kW**		**690 kWh/d**	**25,337 £/yr**
Total opex power cost				**78**	**kVA**	**206 kW**		**749 kWh/d**	**27,538 £/yr**

Odour media - Activated carbon				**4 £/kg**
Volume per year (assumes 75% media spent)		26.4 m3	ZY6035	**106 £/kg**
Dewatering Polymer				
Daily volume				0.41 m3/d
Daily mass				0.00165 tDS/d
Cost per tonne				2060 £/tonne
Cost/year				1241 £/year
Sludge disposal (additional Catterick sludge only)				
Sludge volume				m3/d
				DS
				113.5 tds/year
				0 m3/yr
Treatment and disposal cost				43.48 £/tonne
	TDS/yr sludge			**4,936 £/yr**
Manpower (Additional only)				
Annual salary				35,000 £/yr
Operational Hours/week				hrs/wk
				0 hrs/yr
Additional callouts				1 hrs/month
				12 hrs/yr
Maintenance hours				1 hrs/month
				12 hrs/yr
hours/yr				24 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)				1%
Cost / yr				**424 £/yr manpower**
Total Opex costs				**34,244 £/year**

B3 Option 2

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
26 & 128 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.67	kW	YWS	2.5 kW	8 hrs/day	5.3 kWh/d	196 £/yr
26 & 128 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.67	kW	YWS	2.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**2.27**	**kW**	**YWS**	**5.8 kW**			
Power supply		**ZY1355**	**Power**	**2.27**	**kW**		**5.8 kW**		**9.2 kWh/d**	**339 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
58 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.32	kW	YWS	1.5 kW	8 hrs/day	2.5 kWh/d	93 £/yr
58 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.32	kW	YWS	1.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.92**	**kW**	**YWS**	**4.8 kW**			
Power supply		**ZY1355**	**Power**	**1.92**	**kW**		**4.8 kW**		**6.4 kWh/d**	**237 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
82 & 217 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.33	kW	YWS	2.5 kW	8 hrs/day	2.6 kWh/d	96 £/yr
82 & 217 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.33	kW	YWS	2.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.93**	**kW**	**YWS**	**5.8 kW**			
Power supply		**ZY1355**	**Power**	**1.93**	**kW**		**5.8 kW**		**6.5 kWh/d**	**239 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
156 & 157 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	1.10	kW	YWS	3.5 kW	8 hrs/day	8.8 kWh/d	323 £/yr
156 & 157 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	1.10	kW	YWS	3.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**2.70**	**kW**	**YWS**	**6.8 kW**			
Power supply		**ZY1355**	**Power**	**2.70**	**kW**		**6.8 kW**		**12.7 kWh/d**	**467 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
185 Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	0.03	kW	YWS	1 kW	8 hrs/day	0.3 kWh/d	9 £/yr
185 Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	0.03	kW	YWS	1 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**1.63**	**kW**	**YWS**	**4.3 kW**			
Power supply		**ZY1355**	**Power**	**1.63**	**kW**		**4.3 kW**		**4.2 kWh/d**	**153 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
300 & 301 opt a Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.12	kW	YWS	4.5 kW	8 hrs/day	17.0 kWh/d	624 £/yr
300 & 301 opt a Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.12	kW	YWS	4.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	Duty	ZY0146	Power	0.1	kW	YWS	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Pumping station building services	Duty		Power	1.5	kW	YWS	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
New MCC		**ZY1255**	**Power**	**3.72**	**kW**	**YWS**	**7.8 kW**			
Power supply		**ZY1355**	**Power**	**3.72**	**kW**		**7.8 kW**		**20.9 kWh/d**	**767 £/yr**
Total transfer opex cost				**14.16**			**35.00**		**59.9 kWh/d**	**2201.8 £/yr**

Item	No	Model Reference	Measure unit	Power consumption	Unit	Costed by:	Installed	Hours run	Power /day	Opex cost/yr
Additional Inlet Screens and Screens handling package 1 @ 863 m3	Duty	ZY6790	Power	4	kW	YWS	10.5 kW	8 hrs/day	32 kWh/d	1,176 £/yr
Additional Inlet Screens and Screens handling package 2 @ 863 m3	Standby	ZY6790	Power	4	kW	YWS	10.5 kW	0 hrs/day	0 kWh/d	- £/yr
Additional Grit classification package plant @ 863 m3/d	Duty/standby	ZZ6730	Power	3	kW	YWS	3.5 kW	8 hrs/day	24 kWh/d	882 £/yr
PST Half bridge scraper 3, 284m2	Duty	ZY6900	Power	0.5	kW	YWS	2.2 kW	24	12 kWh/d	441 £/yr
PST pump 1@ 0.5 l/s	Duty	ZY1638	Power	0.33	kW	YWS	2 kW	8 hrs/day	2.616 kWh/d	96 £/yr
TF distributor arm, 1195 m2, 5	Duty		Power	1.00	kW		4 kW	24 hrs/day	24 kWh/d	882 £/yr
TF distributor arm, 1195 m2, 6	Duty		Power	1.00	kW		4 kW	24 hrs/day	24 kWh/d	882 £/yr
TF distributor arm, 1195 m2, 7	Duty		Power	1.00	kW		4 kW	24 hrs/day	24 kWh/d	882 £/yr
Removed										£/yr
Removed										£/yr
Removed										£/yr
Removed										£/yr
TF Filter Feed PS and recirc	Duty	ZY6100	Power	11.00	kW	YWS	30 kW	24 hrs/day	264.0 kWh/d	9,703 £/yr
TF Filter Feed PS and recirc	Standby	ZY6100	Power	11.00	kW	YWS	30 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1, 54 m3	Duty	ZY1260	Power	0.86	kW	YWS	2 kW	16 hrs/day	13.76 kWh/d	506 £/yr
Sludge tanks mixing 2, 54 m3	Standby	ZY1260	Power	0.86	kW	YWS	2 kW	0 hrs/day	0 kWh/d	- £/yr
Additional dewatering	Duty	ZY1262	Power	30		YWS	90 kW	7 hrs/day	210 kWh/d	7,719 £/yr
Washwater booster pump 1	Duty	ZY1567	Power	3	kW	YWS	4 kW	8 hrs/day	24 kWh/d	882 £/yr
Washwater booster pump 2	Standby	ZY1567	Power	3	kW	YWS	4 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control, 54 m3/h	Sludge storage tank	ZY6025	Power	0.7	kW	YWS	1.5 kW	24 hrs/day	16.8 kWh/d	617 £/yr
Level transmitters, 2 No. @ 0.05 kW	flowmeter, Sludge	ZY0146	Power	0.1	no	YWS	2 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Rotation sensor, 4 No. @ 0.05kW each	TF distributor arm		Power	0.2	kW	YWS	1 kW	0.017 hrs/day	0.003 kWh/d	0 £/yr
Building services (heating, lighting etc)			Power	4	kW		6 kW	4.000 hrs/day	16 kWh/d	588 £/yr
New MCC		**ZY1255**	**Power**	**64**	**kW**	**YWS**	**171 kW**			
Power supply		**ZY1355**	**Power**	**64**	**kVA**	**YWS**	**171 kW**		**690 kWh/d**	**25,346 £/yr**
Total opex power cost				**78**	**kVA**	**YWS**	**206 kW**		**749 kWh/d**	**27,548 £/yr**

Odour media - Activated carbon				**4 £/kg**
Volume per year (assumes 75% media spent)		26.4 m3	ZY6035	**106 £/kg**
Dewatering Polymer				
Daily volume				0.41 m3/d
Daily mass				0.00165 tDS/d
Cost per tonne				2060 £/tonne
Cost/year				1241 £/year
Sludge disposal (additional Catterick sludge only)				
Sludge volume				m3/d
				DS
				113.5 tds/year
				0 m3/yr
Treatment and disposal cost				43.48 £/tonne
	TDS/yr sludge			**4,936 £/yr**
Manpower (Additional only)				
Annual salary				35,000 £/yr
Operational Hours/week				hrs/wk
				0 hrs/yr
Additional callouts				1 hrs/month
				12 hrs/yr
Maintenance hours				1 hrs/month
				12 hrs/yr
hours/yr				24 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)				1%
Cost / yr				**424 £/yr manpower**
Total Opex costs				**34,254 £/year**

Appendix C

Wastewater networks – Site assessments and solutions

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
12	Hipswell Croft	72			72	Through the site/on the edge	Yes	Yes	Greenfield	0.00	21.60	0.33	Anticipated that the developer will connect to the sewer running through the site, at their own cost.	Anticipated that developer will discharge to watercourse through the site, at their own cost	As described left	No cost for YWS, see proposed solutions
26	Land to East of Cookson Way		75		75	Through the site/on the edge	Yes	Yes	Greenfield	0.00	29.70	0.34	Site sharing the new foul sewer with Site 128. Connection to the nearest sewer by pumping, 100mm diameter, 322 m long rising main with static head of 6 m	Anticipated that developer will discharge to watercourse through the site, at their own cost	As described left	Yes
27	Land East of Regents Park Estate			90	90	Through the site/on the edge	Yes	Yes	Greenfield	0.00	12.50	0.41	Solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Gravity towards the Colburn WwTW and pumped at end to lift it into works.	Watercourse on boundary of the site - developer will discharge to watercourse at their own cost		Not costed as development is post AMP7
29	In Pipes	47			47	more than 50 meters from nearest watercourse	Yes	Yes	Brownfield	62.42	0.00	0.21	New 150 mm diameter, 21 m long gravity sewer from low point on site to connect to the nearest foul sewer	New 300 mm diameter, 21 m long gravity from low point on the site sewer to connect to the nearest surface water sewer	As described left	Yes
56 (solution only for Surface Water)	Old Sports Field, Catterick Garrison			71	71	more than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	10.92	0.32	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Possibility of connection to nearest foul network via pumping. As existing network is head of system may possibly need to enlarge system downstream	Site to share new surface water sewer to beck with sites 58 and 124. See site 58 for details.		No, see site 58
58	Old Sports Field, Catterick Garrison	32			32	more than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	4.10	0.15	Connection to the nearest foul sewer by pumping, 100mm diameter, 84 m long rising main with static head of 3 m	New 300 mm diameter, 833m long gravity sewer to connect to the beck to	As described left	Yes

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
														serve sites 56, 58 and 124. Risk: The adjacent site is a recently built development that has a detention basin before it connects to the beck. Arup suspect that the detention basin is to restrict the flow rate before it is released to the beck, which is a risk for these sites, however, for this study it is assumed that flows will be restricted on each development by their developer, possibly using SuDS, therefore no detention basin has been priced as part of this assessment.		
69	Land adj Oaktree Av, Scotton			61	61	less than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	0.00	0.28	Solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Possibility of gravity drain to nearest foul network pipe with dia 150 (might be necessary to upsize the current foul network downstream).	Solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Possibility of 2 options (both gravity): Connect to nearest surface water network with new pipe of 35 m, 450 mm dia or taking it farther, through the neighbouring field, to nearest watercourse		Not costed as development is post AMP7

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
														(around 75 m from the site)		
82	Hipswell Mill		93		93	Through the site/on the edge	Yes	Yes	Greenfield	0.00	32.80	0.42	Site sharing the new foul sewer with Site 217 Connection to the nearest sewer by pumping from low point in Site 217. 100mm diameter, 308m long rising main with static head of 12m.	Watercourse on boundary of the site - developer will discharge to watercourse at their own cost	As described left	Yes
106	Land W Colburn Lane			133	133	Through the site/on the edge	No	Yes	Greenfield	0.00	0.00	0.60	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Half site will have a gravity drainage connected to the sewer running through the site, half needs to be pumped to nearest foul network pipe with 100 mm dia.	Developer to discharge to nearest watercourse via gravity.		Not costed as development is post AMP7
120	Somerset Close	40			40	Through the site/on the edge	Yes	Yes	Brownfield	0.00	7.40	0.18	Anticipated that the developer will connect to the sewer running through the site, at their own cost.	New 300 mm diameter, 28 m long gravity sewer to connect to the nearest watercourse (ditch), crossing beneath adjacent highway.	As described left	Yes
121	Gough Road	29			29	Through the site/on the edge	Yes	Yes	Greenfield	0.00	9.50	0.13	Anticipated that the developer will connect to the sewer running through the site, at their own cost.	Beck on boundary of the site - developer will discharge to watercourse at their own cost	As described left	Yes
122	Coronation Park			19	19	less than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	1.73	0.09	Anticipated that the developer will connect to the sewer running through the site, at their own cost.	Anticipated that developer will connect to the beck close by with a new drain, or connect to the existing single length of surface water network a short distance from the		Not costed as development is post AMP7

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
														boundary, as shown on GIS, also discharging to the beck. All at their own cost.		
123	Land E Belton Park			8	8	more than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	1.07	0.04	Connection to the nearest foul sewer by gravity 150 diameter. 2m fall in 173 m length so gravity possible.	Possibility of connection to the nearest surface water sewer 225 diameter. 1m fall in 130m length with low flow rates so self cleansing velocities could be an issue and may require pumping.		Not costed as development is post AMP7
124	Arras Lines	126			126	less than 50 meters from nearest watercourse	Yes	Yes	Greenfield	0.00	35.00	0.57	Foul system on the site. Gravity sewers can be placed. Anticipated that developer will connect to existing foul network. The north-east part of site connected to the nearby sewer by 11 m pipe with 150 mm dia.	Central part of the site is sharing the new sewer connection to the river with Sites 58 and 56. Refer to Site 58 for details. West part of site will discharge to beck with new sewer 300 mm diameter and 73 m long. Same risk of flow restriction and assumptions, as described in Site 58. North-east part of the site, due to the topography, will connect by gravity to the existing surface water sewer by 114 m pipe, 300 mm dia.	As described left	Yes
128	Land East of Walkerville			118	118	Through the site/on the edge	Yes	Yes	Greenfield	0.00	78.00	0.53	Site sharing the new foul sewer with Site 26. Connection to the nearest sewer by pumping, 100mm diameter, 322 m	Anticipated that developer will discharge to watercourse	As described left	No, see site 26

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
													long rising main with 6m static head.	through the site, at their own cost		
156	Former Colburn Pipeworks site Woodside Chase	175			**175**	Through the site/on the edge	Yes	Yes	Brownfield	0.00	0.00	0.79	Site sharing the new foul sewer with site 157. Foul flows will be pumped from the low point of the site, along the boundary between the two sites. 100 mm diameter, 294 m long rising main with 7 m static head.	Anticipated that developer will discharge to watercourse on boundary of the site, at their own cost	As described left	Yes
157	Former Colburn Pipeworks site (Phase 2)	250			250	Through the site/on the edge	Yes	Yes	Brownfield	0.00	0.00	1.13	Site sharing the new foul sewer with site 156. Foul flows will be pumped from the low point of the site, along the boundary between the two sites. 100 mm diameter, 294 m long rising main with 7 m static head.	Anticipated that developer will discharge to watercourse on boundary of the site, at their own cost	As described left	No, see site 156
185	Land adjacent Lidl		24		24	more than 50 meters from nearest watercourse	Yes	Yes	Brownfield	13.20	0.00	0.11	Brownfield site, therefore anticipated that the developer will connect to the sewer running through the site, at their own cost	Currently it is a brownfield. It is assumed that the site is currently draining to the sewers without using a pump. The site therefore is connected by gravity sewer with 108 m and 225 mm dia.	As described left	Yes
204	Land S of Sour Beck - Site 1			615	615	Through the site/on the edge	Yes	Yes	Greenfield	0.00	0.00	2.78	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. Foul - Need to cross the beck to get to the closest foul existing network. Alternatively pump through the adjacent development to the existing sever network. The new sewer serving this site may need to take future flows from sites 298	Anticipated that developer will discharge to beck on boundary of the site, at their own cost		Not costed as development is post AMP7

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
													and 299 as well. Risk that the downstream existing sewers that will eventually serve potentially five developments (204, 298, 299, 300 and 301) may require upsizing.			
217	Land E of Byng Road		10		10	Through the site/on the edge	Yes	Yes	Greenfield	0.00	32.70	0.05	Site sharing the new foul network with Site 82. Connection to the nearest sewer by pumping from low point in Site 217. 100mm diameter, 308m long rising main with static head of 12m.	Anticipated that developer will discharge to beck on boundary of the site, at their own cost		No, See site 82
284	Land adj Walkerville Ind Est			97	97	Through the site/on the edge	Yes	Yes	Greenfield	0.00	0.00	0.44	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. There is a rising main going through the site, however no data about diameter if this rising main is available. In absence of info, recommend pumping due to the long distance and no change in ground levels (0 m static head, 100mm and 355 m long rising main) to nearest foul sewer in Foss Way. This is a pumping station itself and may itself need upgrading to cope with the extra flows, albeit relatively small increase.	Anticipated that developer will discharge to beck on boundary of the site, at their own cost		Not costed as development is post AMP7
296	Land NE of Low Hall Lane			59	59	Through the site/on the edge	Yes	Yes	Greenfield	0.00	0.00	0.27	Anticipated that the developer will connect to the sewer running through the site, at their own cost.	Anticipated that developer will discharge to watercourse on the boundary of the site, at their own cost		Not costed as development is post AMP7

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
298	Land S of Sour Beck - Site 2			487	**487**	Through the site/on the edge	No	No	Greenfield	0.00	0.00	2.20	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. New >400m long gravity foul sewer will be needed to lowest point in development 204 and share the new network needed for these sites. There may be opportunity to share a sewer with flows from development 299. Risk that the downstream existing sewers that will eventually serve potentially five developments (204, 298, 299, 300 and 301) may require upsizing.	Surface water solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. New >400m long gravity surface water sewer will be needed to watercourse, passing through adjacent development 204. There may be opportunity to share a sewer with flows from development 299.		Not costed as development is post AMP7
299	Land S of Sour Beck - Site 3			477	477	more than 50 meters from nearest watercourse	No	No	Greenfield	0.00	68.99	2.16	Foul solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. New >600m long gravity foul sewer will be needed to lowest point in development 204 and share the new network needed for these sites. There may be opportunity to share a sewer with flows from development 298 or 301. Risk that the downstream existing sewers that will eventually serve potentially five developments (204, 298,	Surface water solution not developed further as scheme is not to be costed as development is post AMP7, in line with the YWS scope for this project. New >400m long gravity surface water sewer will be needed to watercourse, passing through adjacent development 204. There may be opportunity to share a sewer with flows from development 298.		Not costed as development is post AMP7

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
													299, 300 and 301) may require upsizing.			
300	Land S of Sour Beck - Site 4		302		**302**	Through the site/on the edge	Yes	Yes	Greenfield	0.00	100.00	1.37	New 369m long gravity foul sewer will be needed to lowest point in development 301 and share the new network needed for these sites. There may be opportunity to share a sewer with flows from development 299. Risk that the downstream existing sewers that will eventually serve potentially five developments (204, 298, 299, 300 and 301) may require upsizing. Site shares network with site 301, see below for solution considered and costed.	Anticipated that developer will discharge to watercourse on the boundary of the site, at their own cost	As described left	No, see 301

Site Ref in SHELAA	Site	AMP6 2015-2020 number of units	AMP7 2020-2025 number of units	AMP8 2025-2030 number of units	Total Number of units for all AMPs (2015-2035)	Next to watercourse	Surface Water Network Near by	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity)	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Foul solution	Surface water solution	Proposed solution for costing	Costed
301	Land S of Sour Beck - Site 5		533		533	Through the site/on the edge	Yes	Yes	Greenfield	0.00	176.50	2.41	Site 301 is the lowest point for all five developments that is to be developed up to AMP7. Therefore this site will need a new foul sewer that will need to serve up to 4 other development sites (204, 298, 299, and 300). Solution requires going below the beck with a new rising main. 175m long with dia 100 mm and static head of 10 meters. The river crossing is likely to be the major cost. Risk that the downstream existing sewers that will eventually serve potentially five developments (204, 298, 299, 300 and 301) may require upsizing.	Anticipated that developer will discharge to beck on boundary of the site, at their own cost	As described left	Yes

Appendix D

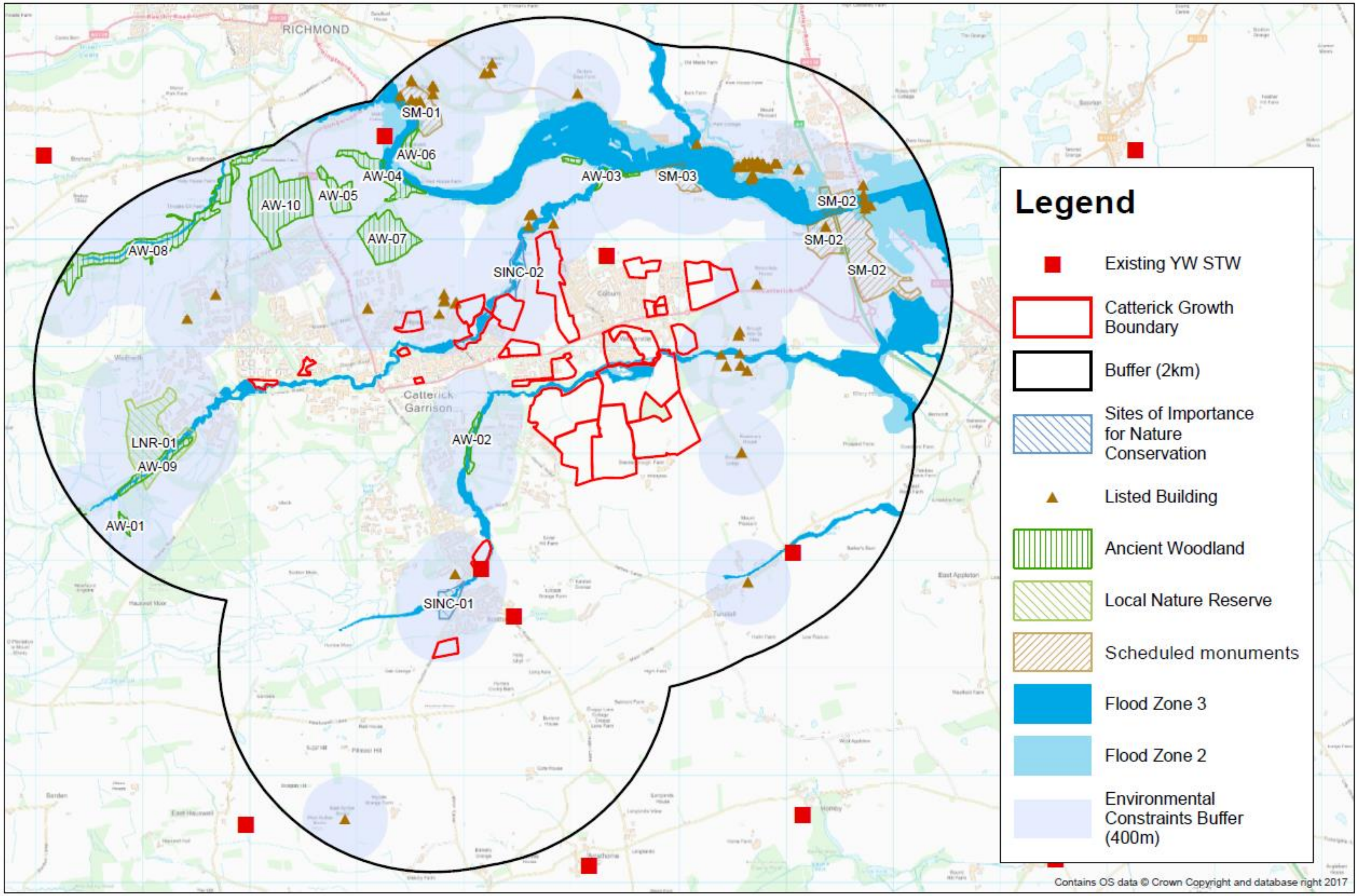
List of Environmental Features

This Appendix provides a full list of environmental and social features identified by the desk-top research (Table 16) and a reference map showing the locations of these features (Figure 12).

Table 16: List of environmental and social features with map reference

Aspects	**Map reference**	**Feature of interest**	**Location in relation to the nearest site**
Ecology			
Ancient woodland	AW-01	Stone Quarry Wood – Ancient and Semi-Natural Woodland	1.7km to the south west
	AW-02	Woodland adjacent to Wensleydale Road– Ancient and Semi-Natural Woodland	400m to the west
	AW-03	Coalburn Beck Wood - Ancient and Semi-Natural Woodland	600m to the north east
	AW-04	Hagg Wood - Ancient and Semi-Natural Woodland	1.1km to the north west
	AW-05	Wilson Wood – Ancient Replanted Woodland	1.1km to the north west
	AW-06	Abbey Wood - Ancient and Semi-Natural Woodland	1.1km to the north west
	AW-07	Park Wood - Ancient Replanted Woodland	500m to the north
	AW-08	Spring Wood - Ancient Replanted Woodland	1.5km to the north west
	AW-09	Stone Quarry Wood - Ancient & Semi-Natural Woodland	700m to the south west
	AW-10	West Wood - Ancient Replanted Woodland	1km to the north
Local Nature Reserve	LNR-01	Foxglove Covert	700m to the south west
Sites of importance for nature conservation	SINC-01	Bushby Gill Plantation	200m south
	SINC-02	Coalburn Beck	Adjacent to the north
Heritage			
Scheduled Monument	SM-01	Easby Abbey Premonstratensian monastery	1.3km to the north west
	SM-02	Cataractonium Roman forts and town	700m to the east
	SM-03	St Giles medieval hospital, post-medieval farmstead and Iron Age occupation site immediately north of St Giles Farm	600m to the north

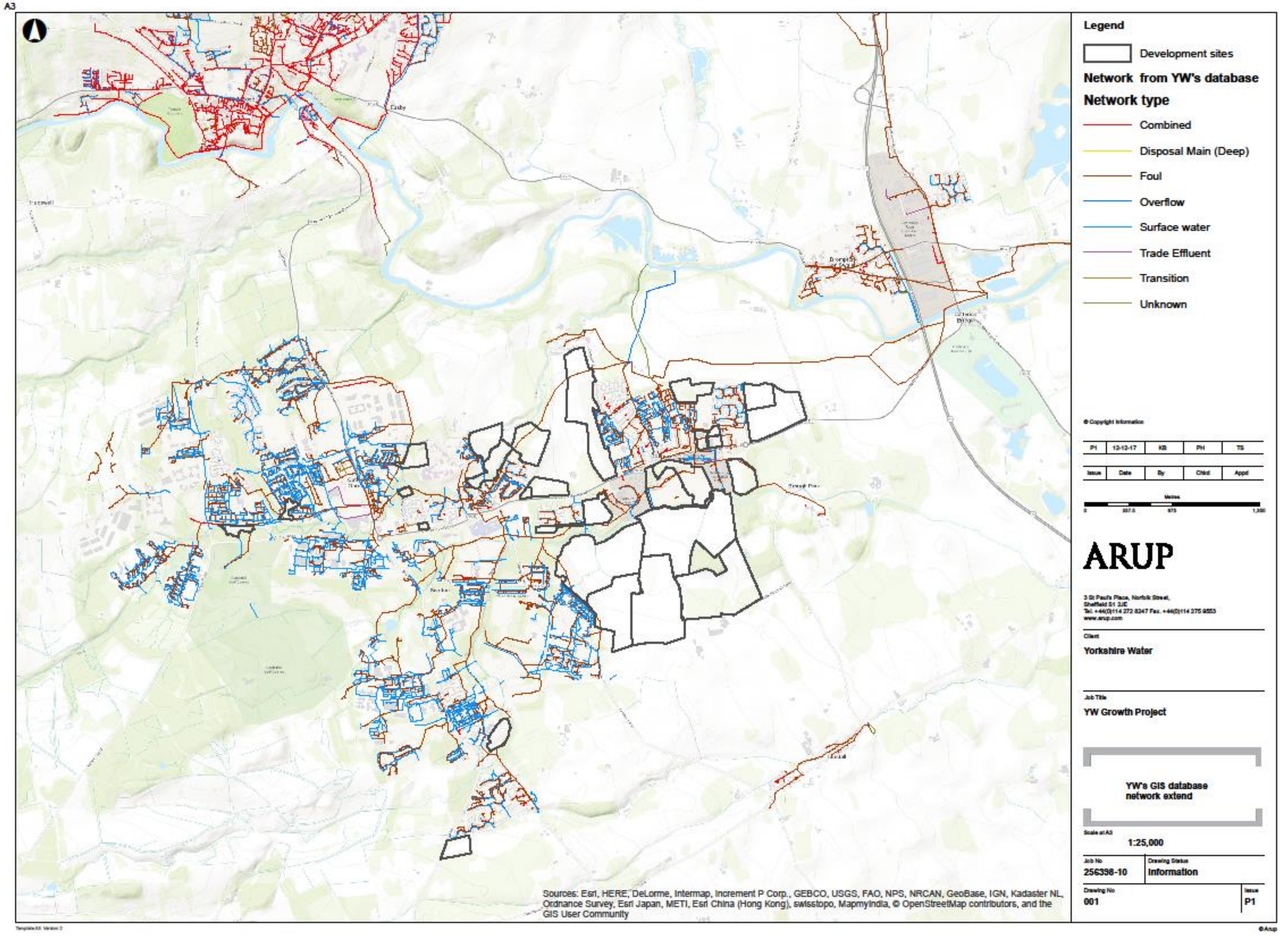
Figure 12: Catterick environmental and social constraints



Appendix E

Wastewater networks

E1 YW's GIS Database network



Appendix F

Five Capital Appraisal Framework

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
Natural	Crops and Livestock	What is the make up of agricultural land in the area e.g. quality/grade and type of food produced? Does the proposed option require land take of high quality agricultural land?	Permanent land take of Grade 1 agricultural land or other agricultural land of more than 5ha	Permanent land take of between 1ha and 5ha agricultural land of Grade 2 or below	Permanent land take of less than 1ha agricultural land of Grade 2 or below	Not relevant / negligible positive or negative impact	Minor positive impact on the ability of the affected land to support crops and livestock	Some positive impact on the ability of the affected land to support crops and livestock	Substantial positive impact on the ability of the affected land to support crops and livestock
	Fisheries	Are there fisheries (commercial or otherwise) which provide a food resource? (Avoid double counting with more recreational-based angling i.e. coarse fishing or catch and release). Are shellfish harvested in the area?	Substantial negative impact on the ability of the affected land to support fisheries	Some negative impact on the ability of the affected land to support fisheries	Minor negative impact on the ability of the affected land to support fisheries		Minor positive impact on the ability of the affected land to support fisheries	Some positive impact on the ability of the affected land to support fisheries	Substantial positive impact on the ability of the affected land to support fisheries
	Energy	Does the option allow energy production from water resources? What's the energy consumption during operation? Does it come from a sustainable source?	Operational energy consumption of over 0.7kWh/m3	Operational energy consumption of between 0.5 and 0.7kWh/m3	Operational energy consumption of less than 0.5kWh/m3		Minor net decrease in energy consumption during construction and/or operation	Some net decrease in energy consumption during construction and/or operation	Substantial net increase in energy consumption during construction and operation
	Water supply	How would the option change the quality or quantity of freshwater left in the environment? Does it include demand reduction measures?	Substantial negative impact on the availability of freshwater left in the environment, water demand increase of more than 5Ml/d	Some negative impact on the availability of freshwater left in the environment, water demand increase of between 1 and 5Ml/d, or options without demand reduction measures	Minor negative impact on the availability of freshwater left in the environment, water demand increase of less than 1Ml/d, or options which include demand reduction measures		Minor positive impact on the availability of freshwater left in the environment	Some positive impact on the availability of freshwater left in the environment	Substantial positive impact on the availability of freshwater left in the environment
	Global climate	Will the option affect any major peat deposits or large lakes and are these capturing carbon or releasing it? What is the whole life carbon associated with the option?	Substantial negative impact on the ability of affected land to sequester carbon. Large net increase in carbon emissions	Some negative impact on the ability of affected land to sequester carbon. Some net increase in carbon emissions	Minor negative impact on the ability of affected land to sequester carbon. Small net increase in carbon emissions		Minor positive impact on the ability of affected land to sequester carbon. Small net decrease in carbon emissions	Some positive impact on the ability of affected land to sequester carbon. Some net decrease in carbon emissions	Substantial positive impact on the ability of affected land to sequester carbon. Large net decrease in carbon emissions
	Air quality	Are there any known issues associated with car use and industry? Are there any nearby AQMA that will be affected by the option? Are there any nearby receptors? Will there be odour issues?	Site located within AQMA, or sensitive receptors within 200m	Site located adjacent to AQMA, or sensitive receptors within 400m	Site located within 400m of AQMA, or no sensitive receptors within 400m		Minor positive impact on air quality and odour	Some positive impact on air quality and odour	Substantial positive impact on air quality and odour
	Flood Regulation	Will the option require land take in Flood Zones 2 and 3? Consider how the option will impact on run-off and flood risk.	Land take within Flood Zone 2 or 3 of more than 10ha	Land take within Flood Zone 2 or 3 of between 5ha and 10ha	Land take within Flood Zone 2 or 3 of less than 5ha		Minor positive impact on the attenuation of water	Some positive impact on the attenuation of water	Substantial positive impact on the attenuation of water
	Water quality	Will the option positively or negatively affect water quality? Will the option improve the resilience of the YW operation that ensures the provision of quality water to users?	Substantial pollution of water quality with drop in WFD class or creating new red DWSP risk	Some pollution of water quality	Minor pollution of water quality with no drop in WFD class or element, slight impact on DWSP risk		Minor water quality improvement within WFD class or element. No impact on DWSP risks.	Some water quality improvement	Substantial water quality improvement, resulting in WFD class removal or avoidance of a DWSP risk.
	Pollination	Will the option impact on land which provide habitat for insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds?	Substantial negative impact on pollination, land take of woodland or grassland of more than 5ha	Some negative impact on pollination, land take of woodland or grassland of between 1 and 5ha	Minor negative impact on pollination, land take of woodland or grassland of less than 1ha		Minor positive impact on pollination	Some positive impact on pollination	Substantial positive impact on pollination
	Recreation	Does the option temporarily or permanently affect the use of recreational site and facilities e.g. country park, footpath along rivers and lakes, PRoWs? Does the option enhance the water environment for recreational use?	New infrastructure that permanently impact on recreation land	New pipeline of more than 1km, intersecting PRoW or national trails	New pipeline of less than 1km, intersecting PRoW		Minor positive impact on the recreational offering provided by affected land	Some positive impact on the recreational offering provided by affected land	Substantial positive impact on the recreational offering provided by affected land
	Amenity	Consider the presence of designated landscapes (National Parks, Heritage Coasts, AONBs), city scapes and areas of high visual amenity, will these be affected by the option?	Substantial negative impact on amenity	Some negative impact on amenity	Minor negative impact on amenity		Minor positive impact on amenity	Some positive impact on amenity	Substantial positive impact on amenity

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
	Non-Use Value	This is the value people place on simply knowing that something exists, often associated with valued habitats, flora and fauna, landscape or heritage assets. Does the option affect any nationally or internationally important areas or designations?	Substantial negative impact on areas or designations that are likely to provide a non-use value	Some negative impact on areas or designations that are likely to provide a non-use value	Minor negative impact on areas or designations that are likely to provide a non-use value		Minor positive impact on areas or designations that are likely to provide a non-use value	Some positive impact on areas or designations that are likely to provide a non-use value	Substantial positive impact on areas or designations that are likely to provide a non-use value
Social	Physical activity	Does the option promote physical activities and wellbeing? Does the option provide new green/blue infrastructure that will encourage active lifestyle of citizens?	Substantial negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Minor negative impact or net decrease in green/blue infrastructure or assets that promote physical activities		Minor positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Substantial positive impact or net decrease in green/blue infrastructure or assets that promote physical activities
	Quality of place	Does the option improve the quality of place in the local community? Does it provide new or improved community space/facilities?	High volume of traffic during construction and operation, down-wind receptors within 100m of new WWTW	Medium volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW	Low volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW		Minor positive impact on quality of place	Some positive impact on quality of place	Substantial positive impact on quality of place
	Trust	Does the option have the potential to damage YW's reputation and stakeholder trust? Does it disbenefit the local community?	Substantial negative impact on stakeholder trust or national media coverage and very high social media activity. Cited as laggard organisation	Some negative impact on stakeholder trust or regional media coverage and medium social media activity	Minor negative impact on stakeholder trust or local media coverage and very low social media activity		Minor positive impact on stakeholder trust or local media coverage and very low social media activity	Some positive impact on stakeholder trust or regional media coverage and medium social media activity	Substantial positive impact on stakeholder trust or national media coverage and very high social media activity. Cited as leading organisation
Human	Employment	Does the option offer employment opportunities? Are there policies to encourage the employment of local work force?	Loss of 50 or more existing FTE.	Loss of between 6 and 49 existing FTE	Loss of up to 5 existing FTE.		Enabling up to 15 new FTE.	Enabling between 15 and 49 FTE.	Enabling 50 or more FTE.
	Skills	Does the option offer the opportunity to upskill YW employees? Does it offer the opportunity for training and/or apprentice of the local labour force?	No opportunity for upskilling or training				Minor positive impact on upskilling and training, potential to support up to 0.5 apprenticeship by the scheme	Some positive impact on upskilling and training, potential to support up to 1 apprenticeship by the scheme	Substantial positive impact on upskilling and training, potential to support more than 1 apprenticeship by the scheme
	Health & Safety	Does the option pose a health and safety risk?	Creation of new Red business risk or escalation of existing business risk to Red threshold (strategic risk scale)	Creation of new Amber business risk or escalation of existing business risk to Amber threshold (strategic risk scale)	Creation of new Green business risk (strategic risk scale)		Removal of existing Green business risk (strategic risk scale)	Removal of existing Amber business risk or reduction of existing business risk to remove it from Amber threshold (strategic risk scale)	Removal of existing Red business risk or reduction of existing business risk to remove it from Red threshold (strategic risk scale)
	Local economy	Does the option benefit local economy? Does it create employment opportunities for local work force? Does it affect existing dwellings?	Loss of existing homes of more than 50 units	Loss of existing homes of between 10 and 50 units	Loss of existing homes of less than 10 units		Creating new homes of less than 1000 units	Enabling new homes of between 1000 and 5000 units	Creating new homes of over 5000 units
F&M	Private costs	Does the option impact on the long term financial viability of YW? Does it reduce YW's financial income or operational cost?	Loss of existing financial income or increased operating costs of £1m per year or more	Loss of existing financial income or increased operating costs of between £400k and £1m per year	Loss of existing financial income or increased operating costs of up to £400k per year		Creation of new financial income or reduced operating costs of up to £400k per year	Creation of new financial income or reduced operating costs of between £400,000 and £1m per year	Creation of new financial income or reduced operating costs of £1m per year or more
	Private benefits	Does the option expend on existing assets? Does it create new assets? Does it make any YW's assets redundant?	No private benefits				Increased asset value by up to £2m or Capital receipt of up to £2m	Increased asset value by between £2m and £10m or Capital receipt of between £2m and £10m	Increased asset value by £10m or more Capital receipt of £8m or more

Part of Appendix 8I:
iv. AMP7 Growth Planning, Green Hammerton
Author: Arup

YorkshireWater

Yorkshire Water Services Ltd

AMP7 Growth Planning

Green Hammerton

001

Issue | 14 February 2018

Job number 256398-00

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Document Verification

ARUP

Job title	AMP7 Growth Planning		**Job number** 256398-00
Document title	Green Hammerton		**File reference**
Document ref	001		

Revision	**Date**	**Filename**	Green Hammerton Report draft v0.docx		
Draft 1	23 Aug 2017	**Description**	First draft		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue	14 Feb 2018	**Filename**	Green Hammerton Report Issue.docx		
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

Appendices

1 Introduction

Local authorities are required to set out their Local Plans for housing development to meet demand needs for population growth in the future. The Yorkshire Water Land Use Planning Team has received the latest population data to 2035 from Edge Analytics that combines local Plan information and trend based projections.

A new settlement is planned at one of the sites (grid ref SE4556NE and SE3957NE) as part of Harrogate Council's emerging Local Plan. Currently the proposals are for:

- 3,244 houses at Flaxby; OR
- 2,809 houses at Green Hammerton

The Green Hammerton development is considered to be the frontrunner and it was agreed with Yorkshire Water to explore the impact of this development only on YW assets and operations (wastewater infrastructure and treatment and clean water infrastructure).

Discussions with the developer (Commercial Estates Group) of the Great Hammerton development have suggested that construction will commence in 2020/21. Early planning for AMP7 and AMP8 is a key requirement as the site is not currently served by waste water or water infrastructure.

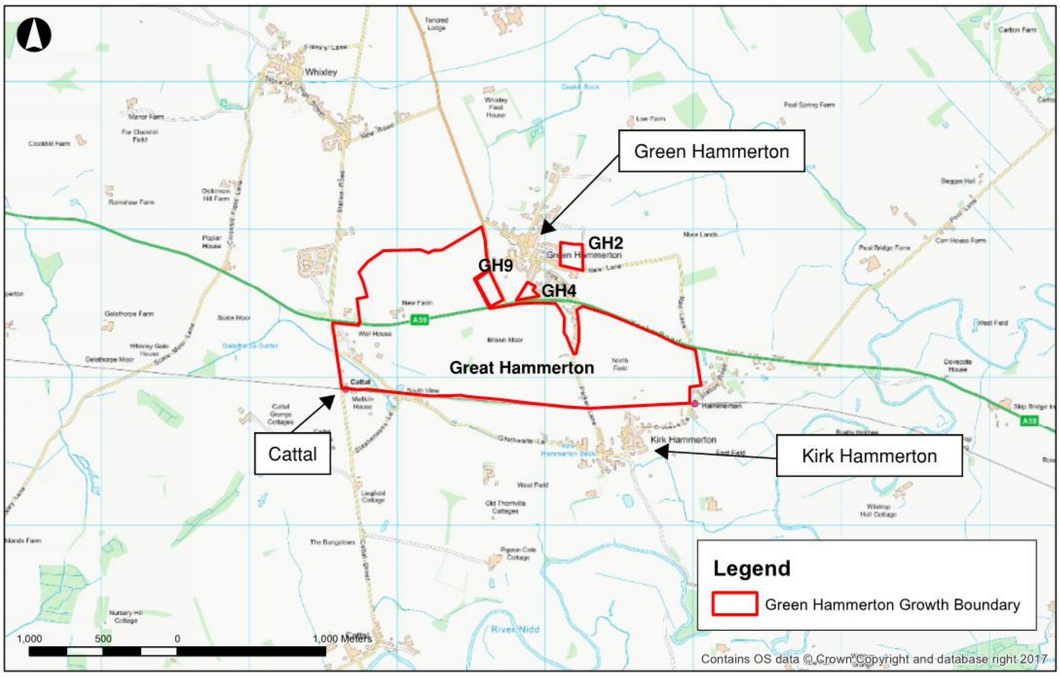
This report evaluates the risks and opportunities of the various options available to mitigate the impact of the new development and develops a number of costed solutions that can be considered in the PR19 business plan. Opportunities to reduce capital and operational carbon have also been considered as part of this study.

2 Future growth

2.1 Location

Figure 1 shows the location and boundary of the new settlement at Green Hammerton as identified in the Harrogate Local Plan Consultation Draft (October 2016). The development sites are bounded by Green Hammerton to the north, Cattal to the west and Kirk Hammerton to the south. Four land parcels have been identified in the draft Local Plan. The new settlement areas total to approximately 174 hectares in size, with the largest of them currently being developed by Commercial Estates Group (CEG).

Figure 1: Green Hammerton growth locations



2.2 Phasing

Information on the largest development parcel, known as Great Hammerton, was provided by the local developer CEG during a meeting held on 9th September 2017 and have been used to define the location, quantum and phasing of the development. For the three small parcels, the following documents have been referred to:

- Harrogate local Plan Consultation Draft (October 2016)[1]
- Harrogate SHELAA Consultation Draft (July 2016)[2]

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[1] Harrogate Borough Council (2016) Harrogate District Draft Local Plan. Available from: http://consult.harrogate.gov.uk/portal/pp/lp/dlp?pointId=s1472544211526 [accessed 04/09/2017]

[2] Harrogate Borough Council (2016) Strategic Housing and Economic Land Availability Assessment. Available from: http://consult.harrogate.gov.uk/portal/pp/so/shelaa/shelaa [accessed 04/09/2017]

Table 1 shows the projected development phasing for Green Hammerton from 2020 to 2040 and have been broken down by AMP.

Table 1: Green Hammerton development phasing

Sites	AMP7	AMP8	AMP9	AMP10	Total (units)
	2020-25	2025-30	2030-35	2035-40	
Great Hammerton	750	750	750	450	2,700
GH2	46	-	-	-	46
GH4	18	-	-	-	18
GH9	45	-	-	-	45
Units (per AMP)	859	750	750	450	2,809

For employment growth, 2% of the total population growth has been used as an assumption. This is based on YW guidelines of 40 jobs/hectare as a worst case.

For school growth, 5.2% of the total population growth has been used as an assumption. This is in line with the assumptions used for other AMP7 growth planning reports.

3 Assessment of impacts to YW assets

3.1 Water demand

A high-level water demand assessment has been undertaken taking into account the developer's proposed phasing plans. This has been undertaken based on the following parameters:

- Per capita water demand of 140 l/d per person;
- Household occupancy rate of 2.3 people.

The developer's phasing plans are included in Appendix C. The calculated water demand for each of the development area including the AMP period in which this would be expected are summarised in Table 2 below:

Table 2: Summary of projected water demand for Green Hammerton

AMP Period in which demand is expected	Plot Reference	Water Demand (l/s)
AMP7	Great Hammerton Stage 1 Yr2 2022 285 units	1.06
AMP7	Great Hammerton Stage 1 Yr4 2024 300 units	1.12
AMP7	Great Hammerton Stage 1 Yr6 2025 158 units	0.59
AMP7	Other developments in AMP7 109 units	0.41
AMP8	Great Hammerton Stage 1 2026 157 Units	0.59
AMP8	Great Hammerton Stage 2 Yr 8 to Yr 10 2028 to 2030 (600 Units)	2.24
AMP 9- 10	Great Hammerton Stages 2&3 Yr 12 to 18 (1200 units)	4.47

3.2 Flows and Loads

The sewage flows and loads have been calculated based on YW guidelines where applicable and population growth data provided for Green Hammerton. Key assumptions are as follows:

- Per capita sewage discharge of 130 l/d per person
- Household occupancy rate of 2.3 people
- Infiltration for new residents of 40 l/d per person (in line with the YW Flow Calculation Asset Standard)
- As requested by the YW brief, only foul flows from the Green Hammerton development were assumed as the development will discharge surface water separately (surface water to be addressed by the developer)

The projected cumulative sewage flows and loads over the next four AMPs, assuming no trade or imports, are as follows:

Table 3 - Green Hammerton sewage flows and loads

	AMP6	**AMP7**	**AMP8**	**AMP9**	**AMP10**
	2015-20	2020-25	2025-30	2030-35	2035-40
Housing units	-	859	750	750	450
Cumulative housing units	-	859	1,609	2,359	2,809
Dry weather flow (DWF), m^3/d	-	347	649	952	1,134
Flow to Full Treatment (FFT), m^3/d	-	882	1,652	2423	2,885
BOD load, kg/d	-	121	227	332	390
Suspended solids load, k/d	-	141	265	388	455
Ammonia load, kg/d	-	15	28	41	49
Population equivalent, P.E.	-	2,017	3,778	5,540	6,499

3.3 Discharge consents

As an initial check, local works discharge consents were reviewed on the basis that the discharge for Green Hammerton would enter the same watercourse as a local works. The consent for the local works and the assumed consent for Green Hammerton are presented in Table 4.

Table 4 - Green Hammerton and local works consent

Site	**BOD consent (95%ile) mg/l**	**SS consent (95%ile) mg/l**	**Ammonia consent (95%ile) mg/l**	**Receiving watercourse**
Kirk Hammerton	100 (25 under UWWTD)	150	21	River Nidd
Knaresborough	36 (25 under UWWTD)	50	10	River Nidd
Green Hammerton	20	40	5	River Nidd (proposed)

The working consents for the new works were assumed to be in line with the tightest consent detailed in the Mineral Media Filters Asset Standard in order to provide a worst case footprint; this corresponds to 20mg/l BOD and 5 mg/l ammonia on a 95%ile basis. The working consent has been agreed with the YWS Environmental Regulation team.

In the event that a tighter consent is set, it is expected that an ASP shall be the standard process selected for biological treatment. The final discharge consent shall be set in discussion with the Environment Agency.

3.4 Identified risks and impacts

3.4.1 Water supply

The proposed Green Hammerton development site is located at the boundary of the Boroughbridge and the Wetherby WSZs. Close to the site, the existing water supply network is part of the Boroughbridge water supply system which receives its water supply from the Acomb Landing WTW. Water from Acomb Landing WTW is pumped to the Marton-cum-Grafton SRE via the Kirk Harmerton Pumping station. From the Marton-cum-Grafton SRE the water is pumped to Whixley SRE which then supplies the villages of Whixley and Green Hammerton pumps installed to replace a water tower). Refer to schematic in Figure 2:

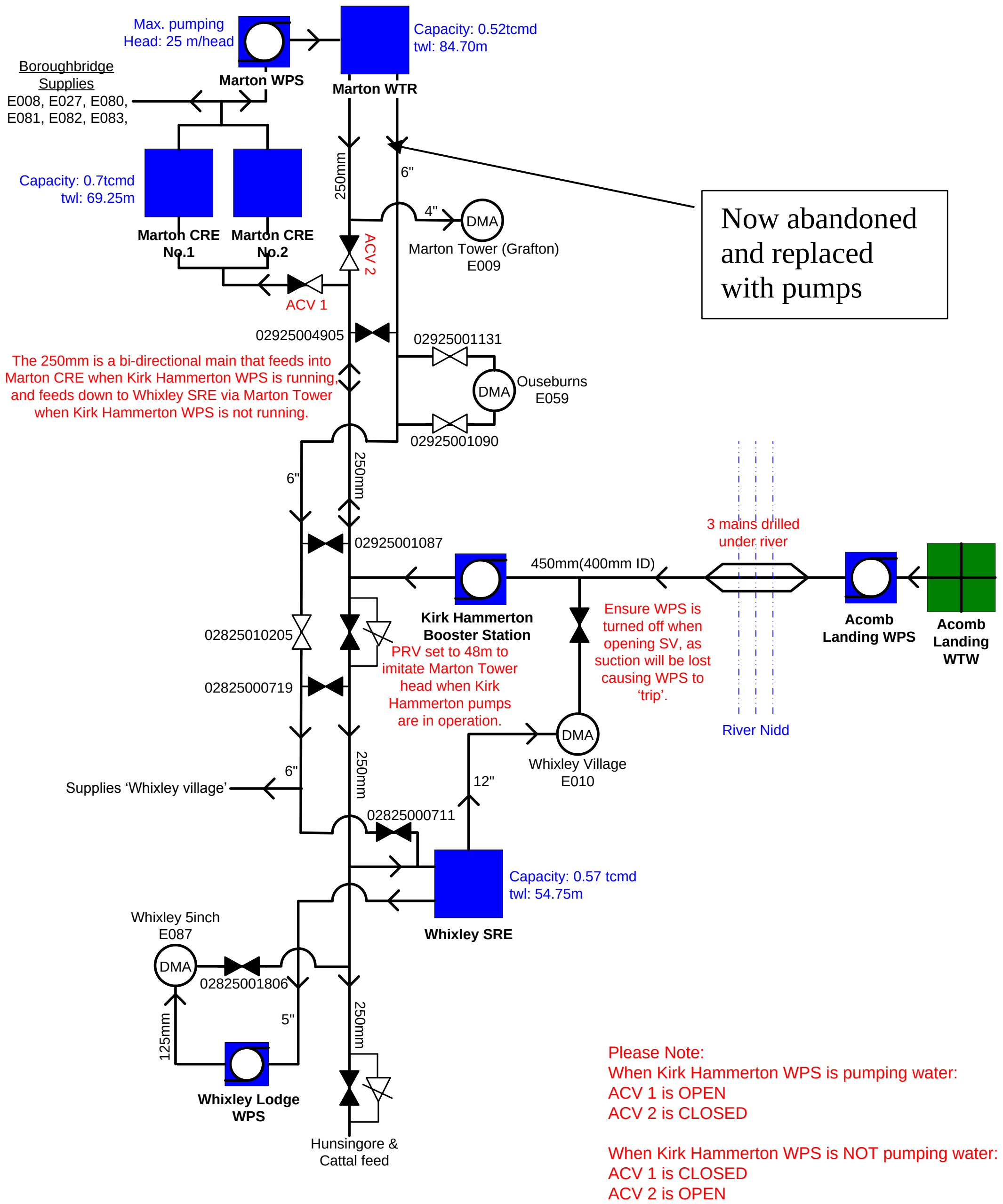


Figure 2: Schematic showing the Acomb Landing WTW to Marton / Whixley water supply system

The Whixle SRE, which is located just north of the proposed site, is currently under sized with about 14 hour's storage under average demand conditions. This falls short of the YWS requirement of a minimum storage of 24 hours. The projected additional demand reduces the storage time to 8 hours.

The option to supply the site from the Wetherby WSZ has not been reviewed further as YWS considers this WSZ to be currently operating beyond its capacity. In addition, there is a large number of future housing developments earmarked for locations within this water supply zone.

3.4.2 Wastewater treatment

Kirk Hammerton WwTW is within 2 km of the Green Hammerton Development. Knaresborough WwTW is located approximately 10 km away from the development. These works have been assessed for capacity by comparing the FFT consent and the measured flows, and by comparing the final effluent quality to the current consent. The results from each site are presented in Table 5 and Table 6.

Two additional WwTWs are present at Cattal and Old Chapel but these are small package plants and have not been assessed further.

Table 5 - Local WwTW capacity review (2012 - 2017)

Site	Kirk Hammerton	Knaresborough
Measured 95%ile flow, m^3/d	947	7,493
Measured 99%ile flow, m^3/d	1,016	7,530
Consented FFT, m^3/d	1,158	9,958
Current Population Equivalent	1,937	17,146

Table 6 - Local WwTW final effluent quality review (2012 - 2017)

Site	Kirk Hammerton	Knaresborough
No. samples	66	59
Measured average BOD, mg/l	24.7	10.2
Measured 95%ile BOD, mg/l	38.9	15.7
Consented 95%ile BOD, mg/l	100	36
Measured average Ammonia, mg/l	5.1	3.7
Measured 95%ile Ammonia, mg/l	11.2	6.9
Consented 95%ile Ammonia, mg/l	21	10
Measured average SS, mg/l	37.1	13.5
Measured 95%ile SS, mg/l	63.3	23.1
Consented 95%ile SS, mg/l	150	50

The sample data reviewed for Kirk Hammerton and Knaresborough final effluent identified no consent breaches for measured BOD, ammonia and suspended solids.

Kirk Hammerton is a relatively small works compared to the size of the proposed development, therefore it would require a major rebuild to accept additional flows. Knaresborough WwTW is a much larger works but does not have spare capacity to take the additional loads and flows associated with the development; it is also located 10km away from the Green Hammerton development.

3.4.3 Sewerage

The proposed Green Hammerton development site is located between two major towns York and Harrogate. The existing Green Hammerton wastewater network runs through the majority of the new development. The layout is presented below in the Figure 3. Blue pipelines represent the surface water pipes, brown pipelines the foul pipes and red pipelines the combined sewers. The location of existing in Kirk Hammerton WwTW is also presented on the figure as well as the new development site.

There is no existing hydraulic model in the Green Hammerton area, therefore there is no model information about Green Hammerton’s existing network hydraulic capacity. The existing sewer pipe sizes are not very large (375Ø just upstream from Kirk Hammerton works) and were assessed as being unlikely to have sufficient capacity and would need significant upsizing works. This is in line with the existing treatment works capacity assessment detailed in Section 3.4.2 above. Therefore, it is not recommended to connect the additional flows from the new development site into the existing network but instead provide a separate new network which shall also be more able to accommodate the potential for a new works location.

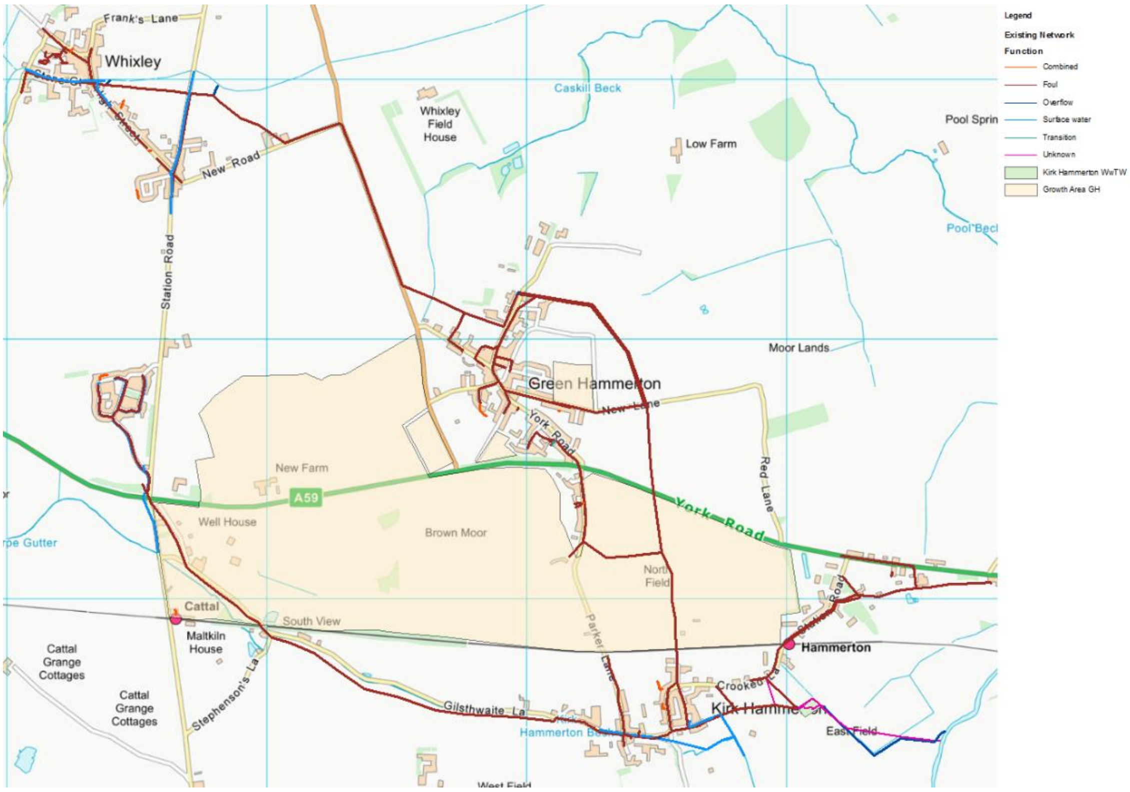


Figure 3 Green Hammerton existing network layout

4 Environmental and social constraints

A desktop based study was undertaken to understand the existing environmental and social constraints at the growth location to inform the development of clean water and wastewater infrastructure solutions. The study area was defined by a two kilometre radius measured from the development boundaries. The search has returned a number of features of interest. A summary of these features is provided below and a full list of these features of interests are included in Appendix D.

4.1 Ecology

The search identified one statutory designation within the study area. Aubert Ings, a Site of Special Scientific Interest (SSSI), designated for an area of unimproved neutral grassland, is located within a meander of the River Nidd approximately 1.9km to the south of the site.

There are a number of non-statutory designations within the study area, including:

- *Sites of Ecological or Geological Interest (SEGI):* These are areas of local conservation importance and have been identified by Harrogate Borough Council (HBC) following a field ecological survey carried out in conjunction with Natural England. The locations of SEGI can be found on the district-wide draft Policies Map on the HBC draft Local Plan consultation site[3].
- *Ancient woodland:* An inventory administrated by natural England of ancient woodland sites in England. There are two areas of ancient woodland within the study area as shown in Figure 4.

4.2 Heritage

There are three Conservation Areas within the study area, including Whixley village approximately 750m to the northwest of the growth sites, Green Hammerton immediately to the north of the sites, and Kirk Hammerton, 200m south of the sites.

There is one Scheduled Monument within the study area, which is the Grade II listed Cattal Bridge located in Cattal. The monument includes a bridge of three arches across the River Nidd.

43 Listed Buildings were identified within the study area, including one Grade I listing, two Grade II* listings and 40 Grade II listings. They are mostly concentrated in the Whixley, Green Hammerton and Kirk Hammerton Conservation Areas. The Grade I listing is the church of St John the Baptist located in Kirk Hammerton. The locations of heritage features are shown in Figure 4.

[3] Harrogate Borough Council (2016) Harrogate District Draft Local Plan – district wide Policies Maps. Available from: http://consult.harrogate.gov.uk/portal/pp/lp/dlp?pointId=s1472220595476#section-s1472220595476 [accessed 04/09/2017]

4.3 Landscape and recreation

There is no nationally or regionally designated landscape areas within the study area. However, the study has highlighted some features of interest for landscape and recreation, including:

- *Public Rights of Way (PRoW):* There are a number of Public Rights of Ways within the study area. Harrogate Borough Council has not released under licence the data about their rights of ways, as such, the PRoW in the study area has not been mapped. However, PRoW is available from Ordnance Survey 1:25,000 Colour Raster map and have been given due consideration during option development.

4.4 Flood risk

Both Flood Zone 2 and 3 are present in the study area as shown in Figure 4. These Flood Zones refer to the probability of river and sea flooding without the presence of defences and are defined as below:

- *Flood Zone 2:* Medium probability. 1 in 100~1,000 annual probability of river flooding or 1 in 200~1,000 annual probability of sea flooding.
- *Flood Zone 3:* High probability. 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding.

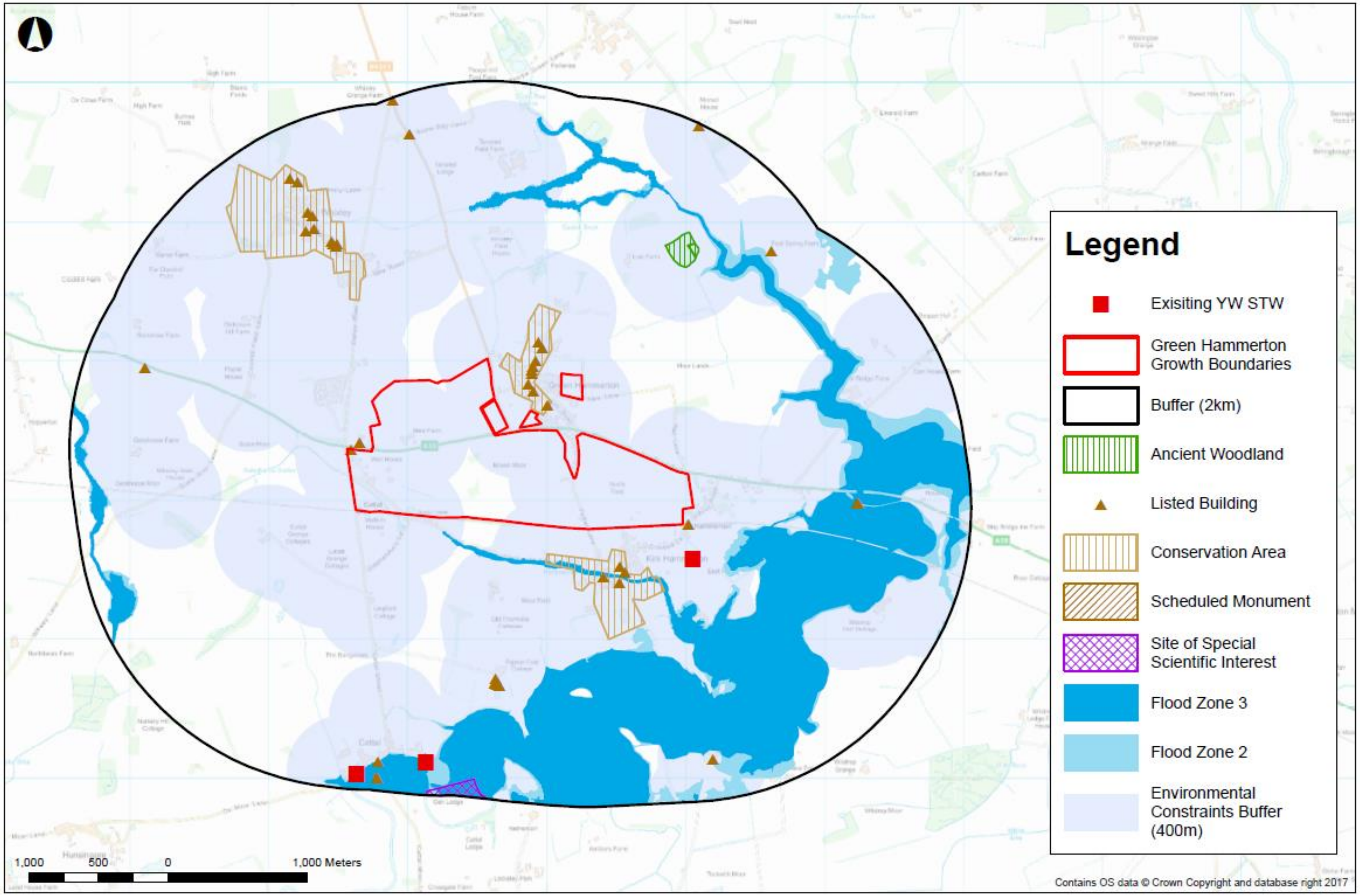
4.5 Sensitive receptors

Existing settlements in the vicinity of the site include Whixley village approximately 750m to the northwest of the sites, Green Hammerton immediately to the north, Cattal immediately to the west and Kirk Hammerton 200m to the south. There is also a number of smaller clusters or individual dwellings scattered across the study area. Existing commercial and residential properties have been used to represent sensitive receptors.

4.6 Approach to constraints mapping

For the purpose of option development, a buffer of 400m has been applied to all the environmental and social constraints identified, with the exception of Flood Zones, to create a screening map highlighting the areas that are most suitable for new water and wastewater infrastructure from an environmental perspective. The mapping is used during option development to inform the siting and routing of new infrastructure. The screening map is shown in Figure 4.

Figure 4: Green Hammerton environmental and social constraints



5 Initial option identification and appraisal

5.1 Clean water infrastructure options

The main clean water infrastructure options are presented in Figure 4.

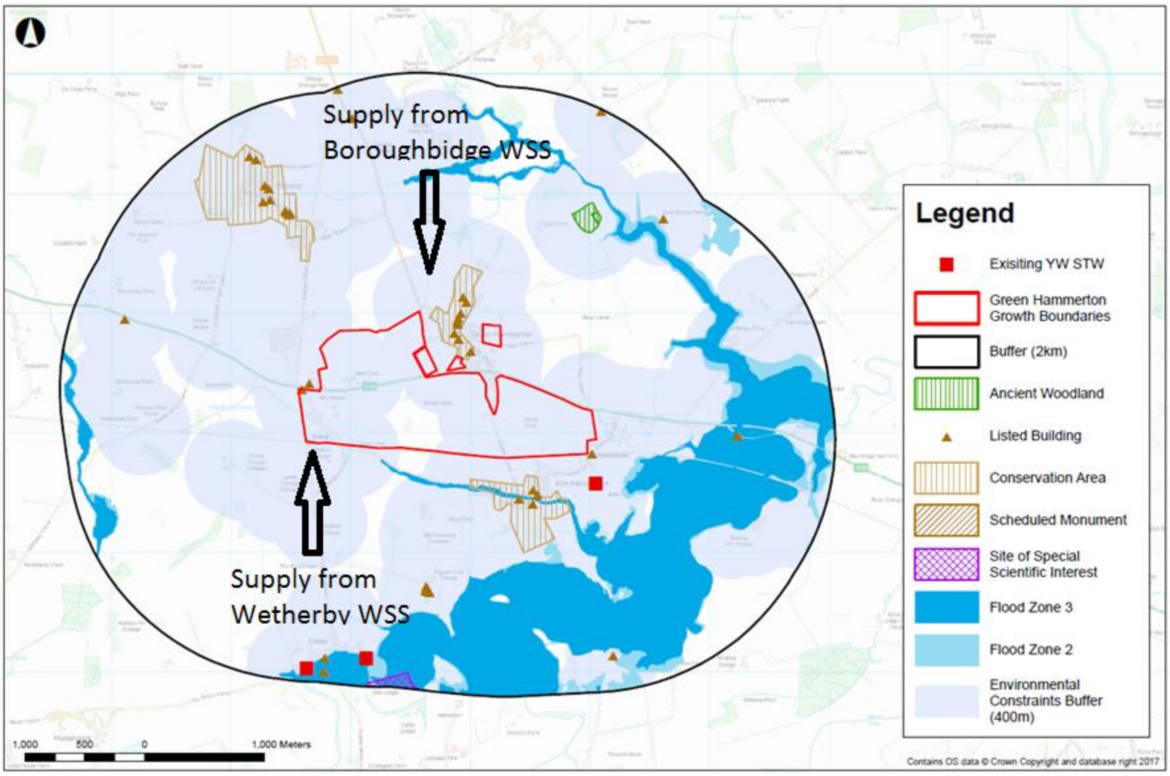


Figure 5: Water supply options for the Green Hammerton developments

The options have been screened against clean water infrastructure criteria and environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	Clean water infrastructure			
	Distance	Pumping	Crossings	Commentary
Supply from Boroughbridge WSS	<1 km	not required		Supply from upgraded Whixley SRE. 3 No. connections to the existing 12"/9" outlet from Whixley SRE 1 No. connection to 10" Whixley SRE bypass main
Supply from Wetherby WSS	<1 km	not required	N/A	This option has not been considered further due to large number of housing growth areas within the Wetherby WSZ.

The option involving the supply of the Green Hammerton developments from the Boroughbridge WSS was shortlisted for further investigation.

5.2 Wastewater treatment options

The options considered for dealing with the wastewater treatment are as follows:

- Receiving flows at Kirk Hammerton WwTW, or at Cattal and Old Chapel,
- Receiving flows at Knaresborough WwTW
- Building a new WwTW to take the additional flows

A site for a new WwTW was identified located off Pool Lane (see Figure 6). This location benefits from:

- Proximity to the river while outside the flood zone
- Being located at a reasonable distance from the Green Hammerton development, yet distant from sensitive receptors and environmental constraints.
- Good access to the road network

Other sites off Pool Lane could also be suitable for siting a new WwTW.

The main locations for additional wastewater treatment are shown in Figure 6.

ID	Option
A	Kirk Hammerton WwTW
B	Pool Lane WwTW (new WwTW)
C	Cattal and Old Chapel Cattal
D	Transfer to Knaresborough WwTW (10km east)

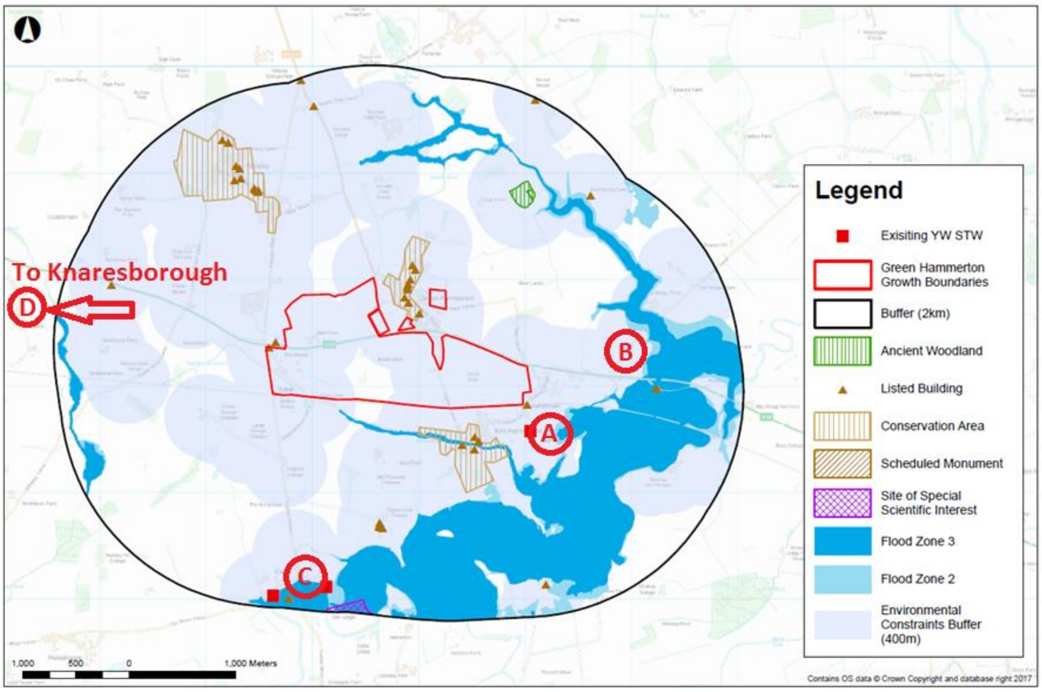


Figure 6: Possible locations for wastewater treatment

The locations have been screened against several wastewater infrastructure and treatment criteria as well as environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	Wastewater infrastructure				Wastewater treatment				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Environmental constraints
Kirk Hammerton WwTW expansion	700 m from terminal pumping station	- Pumping required 2 outlying pump stations and 1 terminal pumping station	- Crossing of railway line required. Railway line is on a slight embankment at this point with a level crossing serving the road.	- Landscape is flat around terminal pumping station. There may be opportunity to rationalise design at later detail design stage to enable gravity flows to WwTW. - The 2 outlying pump stations are needed due to topography of the land.	- Small WwTW with limited treatment capacity available, and thus require a major upgrade. The location is suitable for potential expansion.	No	- Additional land is not required	Yes	- Close to existing residential receptors	- The WwTW is 300m from the Kirk Hammerton Conservation Area
Pool Lane WwTW (new)	1.1 km from terminal pumping station	- Pumping required 2 outlying pump stations and 1 terminal pumping station	- No major crossings required.	- The pump stations are needed due to topography of the land. The terminal pumping station is needed due to the topography and distance to the new WwTW site.	New WwTW for Great Hammerton and other new developments	Yes (lagoon option only)	- Land purchase required	No	- Around 1,000m away from existing and proposed residential receptors	- Public footpath nearby, may require visual screening

Option	Wastewater infrastructure				Wastewater treatment				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Environmental constraints
Transfer to Knaresborough	>10 km from pumping station	- Pumping required	River Nidd crossing required.		The plant has insufficient headroom to take additional flows, without upgrade works being carried out.	No	- Additional land is not required	Yes	- Close to existing residential receptors	- WwTW located in Flood Zone 2
Cattal and Old Chapel Cattal	>2km from nearest point of site	- Pumping required	Crossing of railway line required.		These WwTWs are small package plants and therefore will have insufficient treatment capacity available to take any additional flows.	No	- Land purchase required	Yes	- Close to existing residential receptors	- WwTW located close to Flood Zone 2

The Kirk Hammerton WwTW expansion option and a new WwTW off Pool Lane were shortlisted for further investigation.

6 Clean water infrastructure solutions

6.1 Supply from Boroughbridge WSS

It is proposed to provide water supply to the Green Hammerton development from the Whixley SRE located just north of the site. Figure 7 shows the locations of the development site and the Whixley SRE.

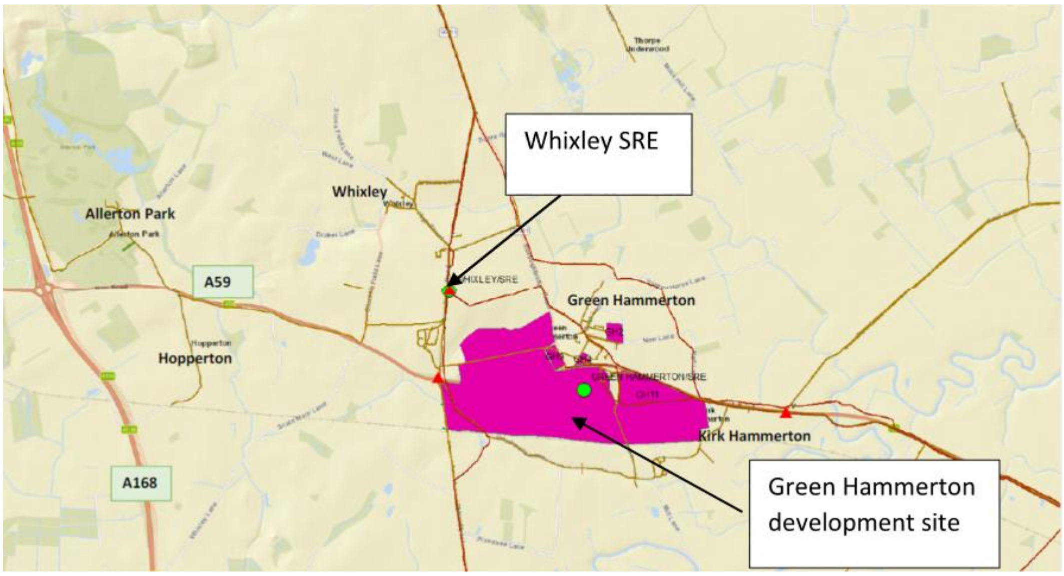


Figure 7: Green Hammerton location plan showing Whixley SRE

As previously mentioned, the solutions to provide water supply to the housing development have been developed taking into account the developer's proposed phasing plans.

In the initial phase of the development, expected in AMP 7, the proposed works will include the following:

- Upgrading the Whixley SRE from the current 550m^3 to 1,300m^3.
- Diverting a 5-inch asbestos cement pipe currently running west to east across the site. The main is to be replaced with a new 150mm internal diameter main running along the A59.
- 100mm diameter connection to the 12-inch (300mm) diameter Whixley SRE outlet main and laying approximately 350m long main along the Harrogate Road.
- 100mm diameter connection to the 12-inch (300mm) diameter Whixley SRE outlet main and laying approximately 350m long main along the A59 York Road.

The proposed works are illustrated in Figure 8:

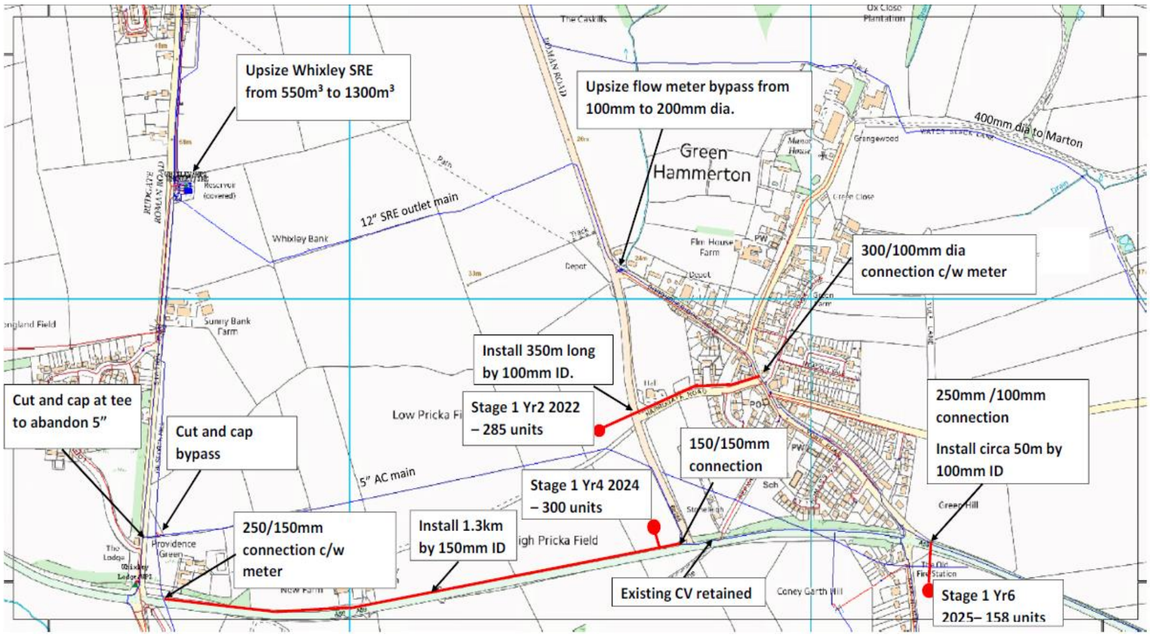


Figure 8: Summary of proposed works in AMP 7

Results of network hydraulic modelling have indicated excessively high head loss at the Green Hammerton supply flow meter. Investigation works undertaken as part of this scheme have identified that the flow meter is on a 100mm diameter bypass, shown in Figure 9. This does not provide adequate capacity for the projected flows; therefore, it is recommended that this is upsized 200mm as part of the AMP7 works.

Figure 9: Green Hammerton inlet flow meter and bypass to be upsized to 200mm

The following works will be required to allow connection for the future phases of the development:

- AMP 8 – 100mm diameter connection to the existing 250mm main on Kirk Hammerton Lane and laying approximately 100m long main along across field.
- AMP 10 - 100mm diameter connection to the 150mm diameter main installed along the A59 York Road as part of the early phase of this scheme.

Refer to Figure 10 for the summary of works.

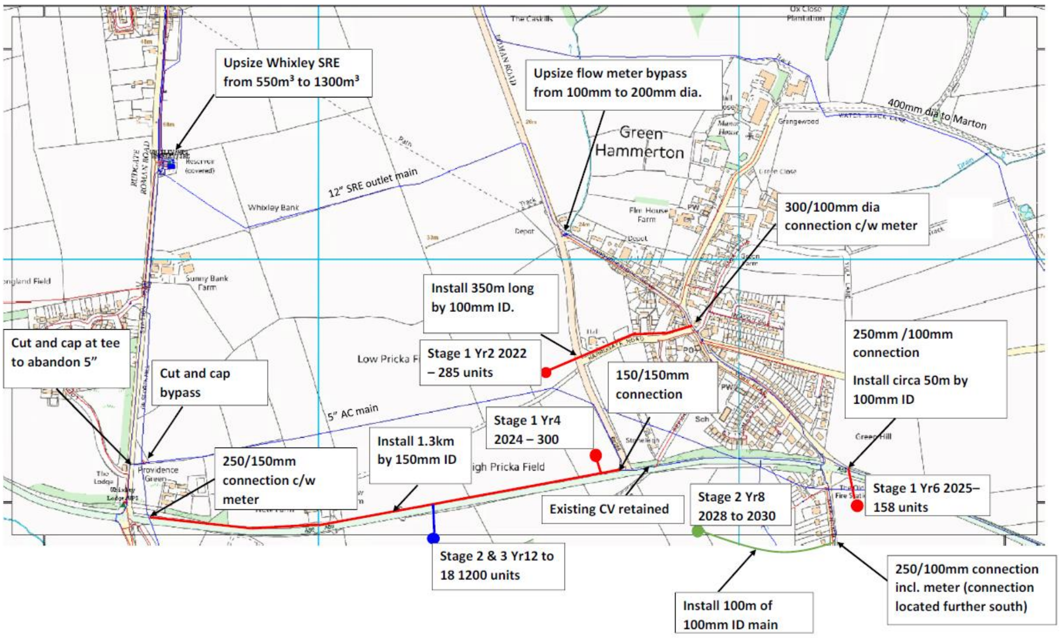


Figure 10: Summary of works including AMP 8 and AMP 10 connections

7 Wastewater treatment solutions

Outline designs were developed for the new WwTW option. It is noted that no storm tanks were incorporated in the design because all surface water from the new development will be dealt through sustainable drainage systems provided by the developer.

7.1 Conventional solutions (New location)

Two main options considered for a traditional solution:

- A trickling filter (TF) process with humus tanks (HTs)
- An activated sludge plant (ASP) with final settlement tanks (FSTs)

Both designs have been based on the assumed working consent of 20mg/l BOD, 5mg/l NH3-N and 30mg/l SS for the whole development. The designs are for complete new works based on asset standards current at the time.

For both of these processes, the inlet works and primary settlement tanks (PSTs) are the same for each AMP. The load onto the secondary process has been assumed to be the same, however the sludge production is higher for the ASP than the equivalent trickling filter. Each design includes ten days sludge storage in a single tank. Sludge thickening has been included for ASP sites to avoid tankering excessively thin sludge around. It has been assumed that sludge is transported to Esholt STF for processing via Ripon WwTW for dewatering line with the current YWS sludge logistics strategy for Kirk Hammerton WwTW.

Storm tanks are not included in the assessment as only foul flows are to be received by the new works.

Odour control has been assumed for the sludge storage tank only.

7.1.1 Trickling Filters

The unit sizes for the trickling filters for AMP7 to AMP10 are shown in Table 7.

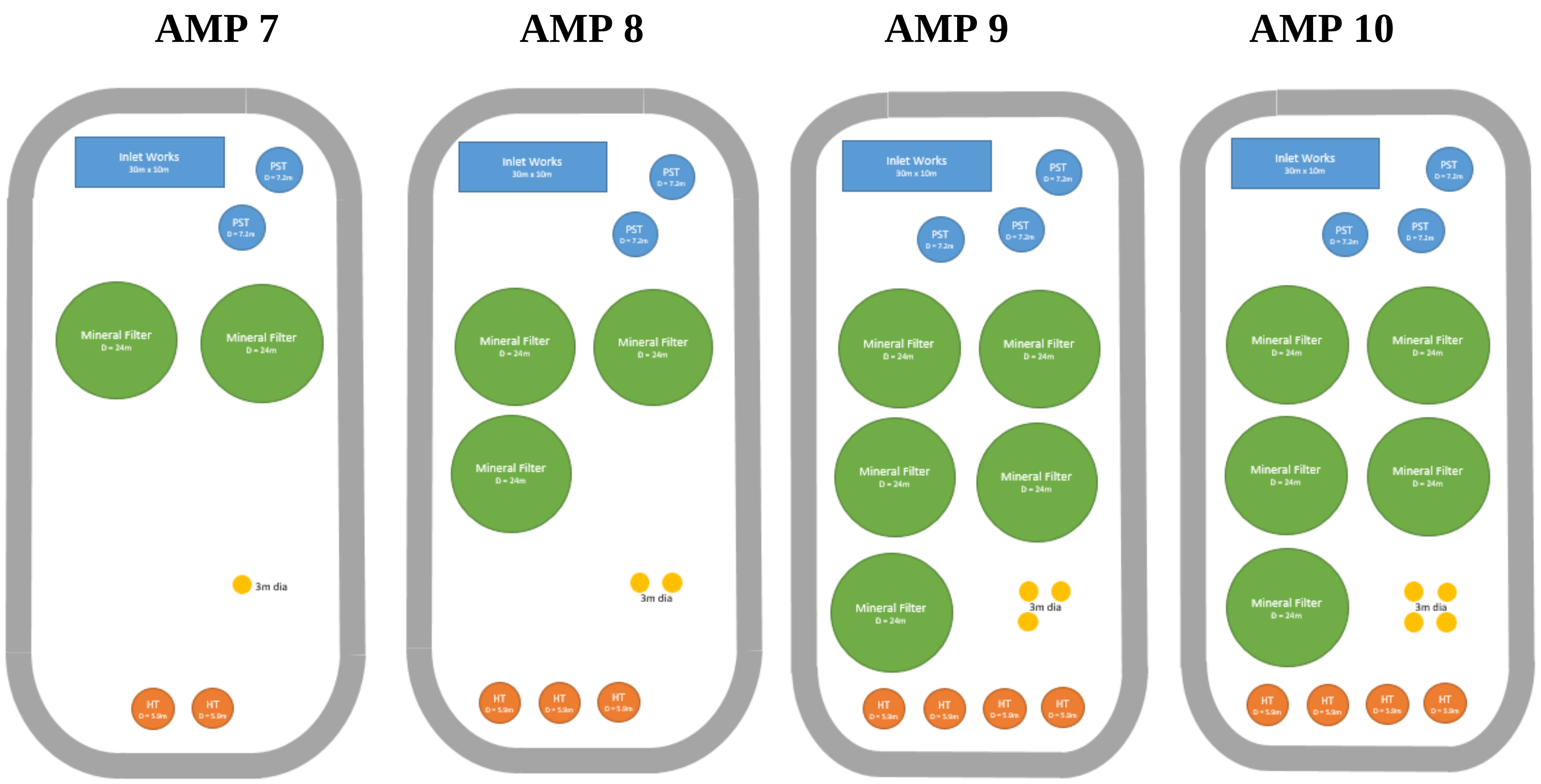
Table 7. Green Hammerton trickling filters design summary

	AMP7	AMP8	AMP9	AMP10
P.E.	2,017	3,778	5,540	6,499
FFT, m^3/d	882	1,652	2,423	2,885
No. PSTs @ 7.2 m	2	2	3	3
No. Mineral Filters @ 24 m	2	3	5	5
No. Humus Tanks @ 5.9 m	2	3	4	4
Sludge storage, m^3	66	124	182	217

As the asset standard requires a minimum of two units for all process units so that one can be removed from service, AMP7 is slightly oversized.

The unit sizes have been selected to optimise unit sizes for AMP10, maintain unit sizing throughout the development for ease of hydraulic split while still meeting asset standards.

The whole site for AMP10 is estimated to require a footprint of 140 m x 70 m.

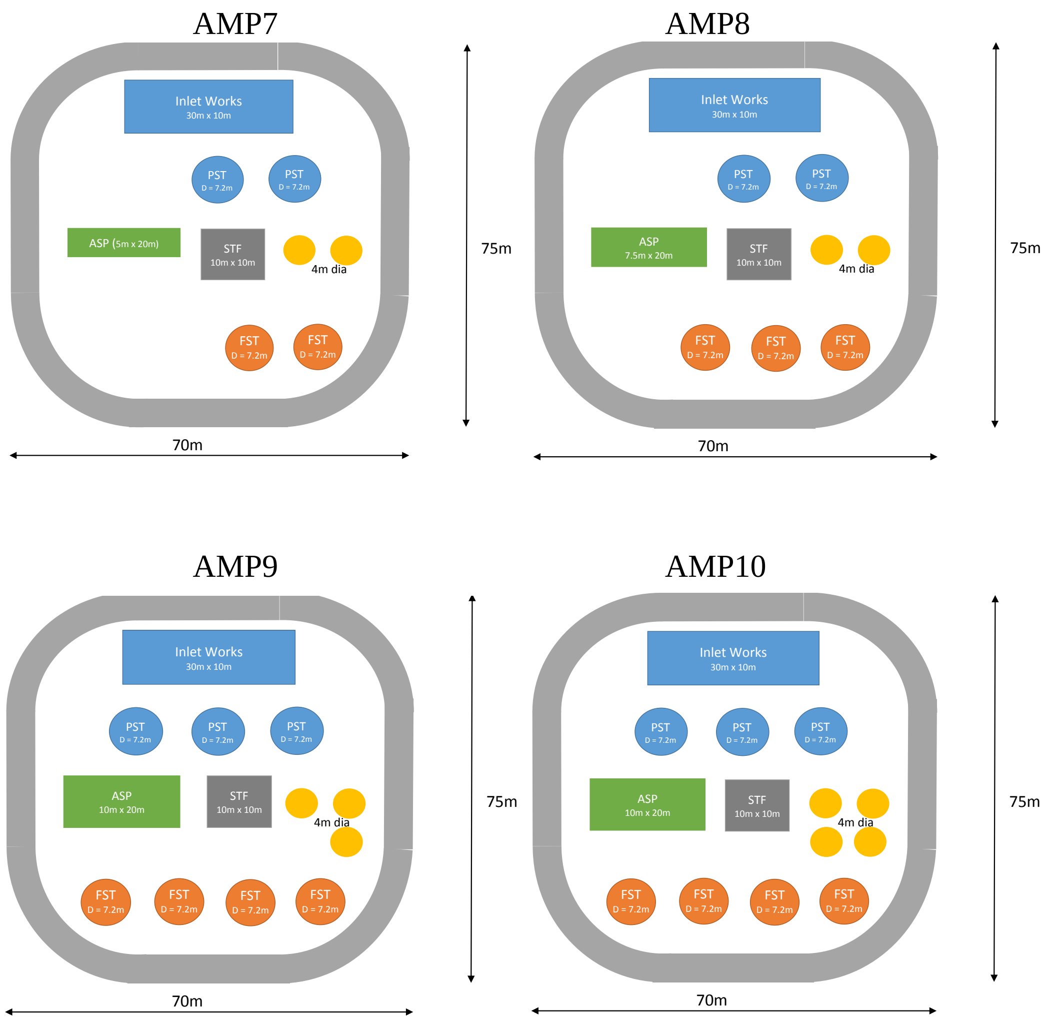


7.1.2 Activated sludge plant

The ASP has been sized in line with the current standards but with changing mixed liquor suspended solids (MLSS) levels and number of ASP lanes as the loads to the plant increase through the AMP periods. The unit sizes for the ASP for AMP7 to AMP10 are shown in Table 8. The whole site for AMP10 is estimated to require a footprint of 75m x 70m.

Table 8 – Green Hammerton ASP design summary

Parameter	**AMP7**	**AMP8**	**AMP9**	**AMP10**
P.E.	2,017	3,778	5,540	6,499
FFT, m^3/d	882	1,652	2,423	2,885
No. PSTs @ 7.2 m	2	2	3	3
No. ASP lanes @ 2.4 m width, 20m long	2	3	4	4
No. FSTs @ 7.2 m	2	3	4	4
Sludge storage (thickened), m^3	25	47	69	82



7.2 Low carbon solutions

Only proven wastewater treatment solutions were considered in this study. For example, reed beds can be used for wastewater treatment but they have not been commonly used in the UK either at the scale required to carry out the full treatment required (often as a tertiary treatment polishing stage). There are also concerns over their cold weather performance in the North of England and it is also not a process recognised by the YW Asset Standards.

Taken the above into account, the alternative to traditional options for the WwTW design is that of a lagoon.

7.2.1 Lagoons

The lagoon option has been considered due to its sustainability, lower power requirement and simplicity of operation. The draft Asset Standard for lagoons (YWS Facultative Lagoons Guidance Note V1) by YWS refers to partial-mix lagoons as it involves the use of floating aerators and mixers to accelerate the process and thus reduce the footprint.

The foul flows are directed to the lagoons, require no screening or primary processing, and are simply held in a series of two lagoons for between 41 and 108 days. The sludge produced stays in the lagoon with little risk of carry-over therefore no requirement for removal. Final effluent may require coarse filtration prior to discharge to a local water course.

Guidance from the supplier suggests that there is no requirement for inlet screening, however there has been some odour issues at a comparable lagoon installation in Scotland which is not fully understood yet and may be as a result of debris in the sewage. As a precaution, the cost of an asset standard inlet works has been included for this option. This may be removed if it is considered to be surplus to requirements following investigations.

The design is based on a series of two lagoons in accordance with the draft Asset Standard, with the area in the standard is primarily based on population equivalent, and the design depth is 4.6m. It has been assumed that there will be an ammonia consent like for the conventional solutions, therefore media and aeration grids would be placed in the second lagoon for ammonia removal, in line with the requirements for a SAF design.

A lagoon has been approved by YWS for installation at Withernsea. It is noted that if the lagoon is designed to hold over 25,000m^3 above ground level, it will need to be registered as a reservoir and be subject to additional requirements.

Based on the design guidance, the unit sizes for AMP7-10 would be as follows:

Table 9 - Green Hammerton lagoon design summary

Parameter	AMP7	AMP8	AMP9	AMP10
No. lagoons in series	2	4	5	6
Footprint, m	134 x 67	134 x 134	134 x 168	134 x 201
Total area, m^2	8,978	17,956	22,445	26,934

Parameter	AMP7	AMP8	AMP9	AMP10
Total volume, m^3	37,116	69,523	101,929	119,590

7.3 Kirk Hammerton expansion

As part of the options appraisal process, Kirk Hammerton was reviewed with a view to expanding the works to accommodate additional flows from the Green Hammerton developments. The works was reviewed on the basis of converting the site to an ASP process as opposed to adding more trickling filter capacity; this is on the basis that to cater for an AMP10 scenario, the process would need to be more compact to fit within the existing site boundary.

The current footprint of the Kirk Hammerton WwTW has been estimated at approximately 85m x 75m which indicates that it could accommodate the AMP10 scenario (75m x 70m).

The works was assessed against process unit sizing from YWS asset inventory database. The existing units, additional units and comments are presented in Table 10. Where process unit sizing is not available on AI, an estimation has been made.

Table 10 – Kirk Hammerton ASP main process unit capacity

Process unit	2025 Additional Works	Comments
Inlet works	882 m^3/d	New side stream inlet works to take development alone
PSTs	2 No. new @ 9m dia.	As the existing tanks no longer comply with asset standards, new PSTs have been included.
ASP	1 No. 3 lane ASP @ 370 m^3 each	
FSTs	2 No new @ 10 m dia.	Humus tanks cannot be converted to act as FSTs
Sludge storage (thickened), m^3	51	

The expansion of Kirk Hammerton WwTW will require the decommissioning and demolition of the existing PSTs, trickling filters and FSTs. The associated write off costs have been included in the totex calculation.

8 Sewerage solutions

Following the assessment of wastewater treatment options, two options have been identified for further development. Firstly, the expansion of the Kirk Hammerton WwTW and secondly, the construction of a new WwTW in Pool Lane, east of the Green Hammerton Development sites.

Only foul flows from the Green Hammerton developments were assessed as the developments will discharge surface water separately.

8.1.1 Kirk Hammerton

The first option is expanding or upgrading the current works in Kirk Hammerton. The wastewater network needed to serve Kirk Hammerton site is irrespective of the chosen treatment process, therefore the proposed networks are described below. The networks described here are for the full AMP10 proposed housing development. Figure 11 shows the proposed network.

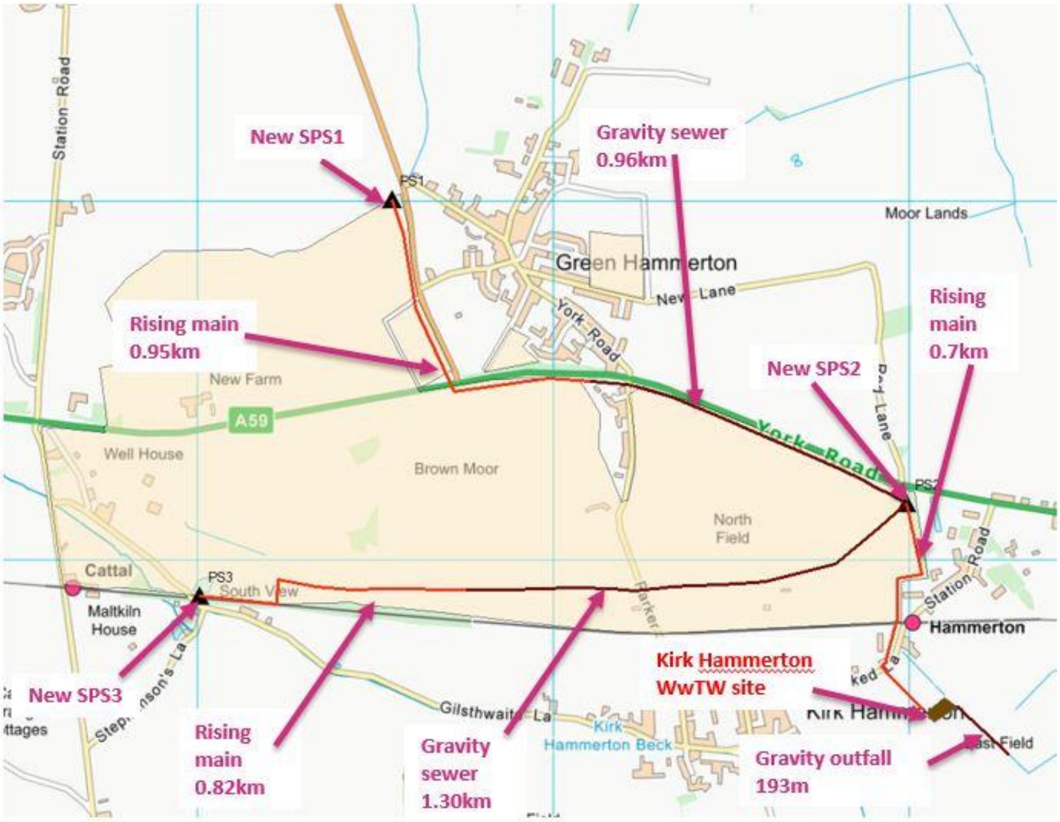


Figure 11 Proposed wastewater network required to serve expanded Kirk Hammerton WwTW site

The foul flows from the proposed development will be collected at three new sewage pumping stations (SPS) at the three lowest points of the site. The first and the third pumping stations (SPS1 and SPS3) each will be collecting 1/3rd of the flows coming from development sites and pumping them across to the second pumping station (SPS2). This terminal pumping station (SPS2), placed in the lowest point of the site, will be pumping flows from the entire site to a new works adjacent to Kirk Hammerton WwTW. All SPSs will include emergency storage, in line with Sewers for Adoption guidance, although once the development proposals have been fixed it may be found that some of the emergency storage volume can be reduced by accounting for this in the upstream network. Until the network is known the emergency storage needs to be accounted for as storage at the SPS.

Following treatment, the final effluent will gravitate via a new sewer, through the fields south of Kirk Hammerton WwTW, adjacent to the existing works effluent sewer, to a new outfall into the field ditch feeding to River Nidd.

8.1.2 Pool Lane

The second option is delivering flows to the new WwTW in Pool Lane. The wastewater network needed to serve Pool Lane site is irrespective of the chosen treatment process, therefore the proposed networks are described below. The networks described here are for the full AMP10 proposed housing development. Figure 12 shows the proposed network.

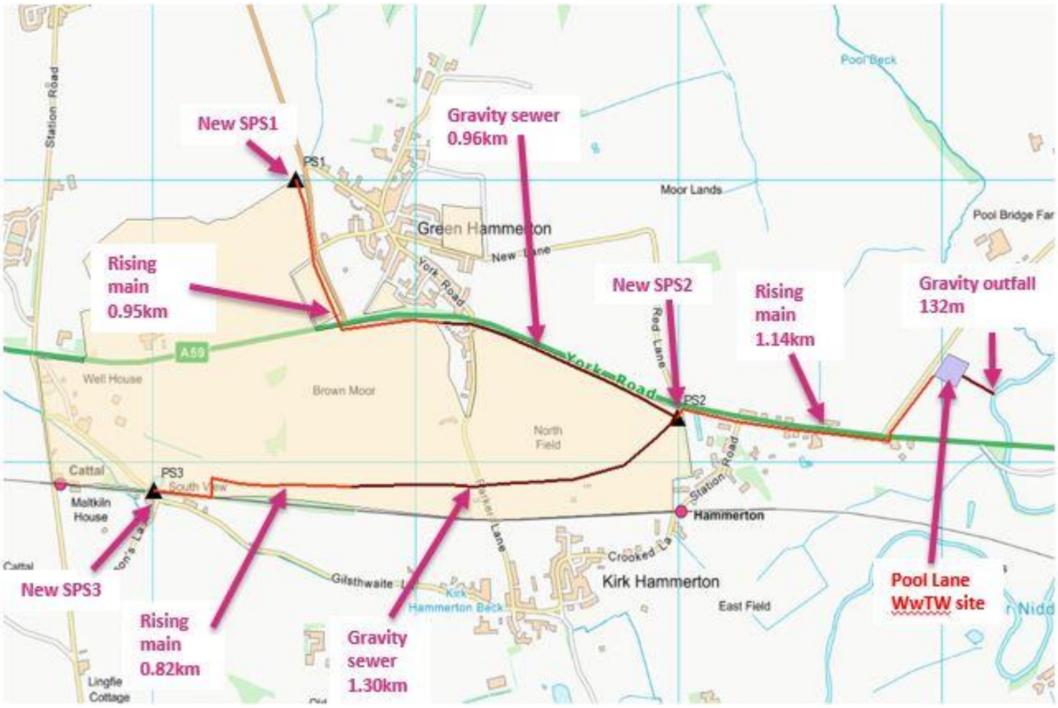


Figure 12 Proposed wastewater network required to serve new Pool Lane WwTW site

As in the case of previous option (transferring flows to the new Kirk Hammerton WwTW), the foul flows from the proposed development will be collected at three new sewage pumping stations (SPS) at the three lowest points of the site. The first and the third pumping stations (SPS1 and SPS3) each will be collecting 1/3rd of the flows coming from development sites and pumping them across to the second pumping station (SPS2). This terminal pumping station (SPS2), placed in the lowest point of the site, will be pumping flows from the entire site to the new Pool Lane WwTW site. All SPSs will include emergency storage, in line with Sewers for Adoption guidance, although once the development proposals have been fixed it may be found that some of the emergency storage volume can be reduced by accounting for this in the upstream network. Until the network is known the emergency storage needs to be accounted for as storage at the SPS.

Following treatment, the final effluent will gravitate via a new pipeline, through the field to the east, to a new outfall on the River Nidd.

9 IWM opportunities

Integrated Water Management (IWM) is the management of the water cycle (water efficiency, potable water demands, non-potable water demands, surface water, wastewater and water supply) in harmony with the built environment through planning and urban design. Within this approach the water cycle is considered from the outset and throughout the planning and design process for developments.

Water management approaches are also consistent with the designs for successful places and consider:

- Understanding of the local constraints, such as local environment, infrastructure capacity and space availability.
- Making the best use of existing infrastructure and delaying or minimising the need for reinforcements and upgrades.
- Provision of resource security and greater resilience in the future.

The IWM approaches can deliver multiple benefits, including reduced cost of water abstraction and treatment, reduced pumping of potable water and wastewater, increased headroom in water supply and drainage networks, and reduced footprint of wastewater treatment plants.

Meeting the demands for water that can be satisfied by non-potable quality water is one of the central parts of the IWM approach and included measures such as rainwater harvesting.

The non-potable water supply system (rainwater, stormwater, or greywater) can take three primary forms, which are outlined in the image below:

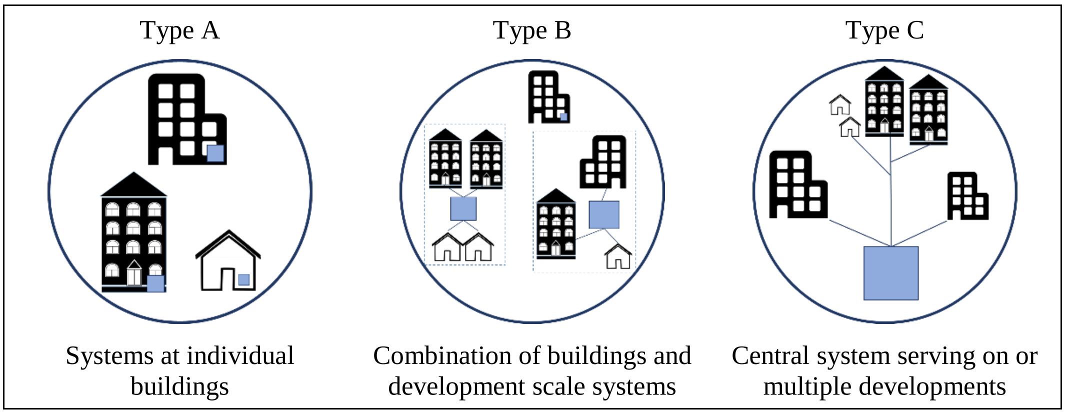


Figure 13 Typologies of non-potable reuse systems

The selection of most suitable system configuration will be dependent on the development type, layout, phasing, as well as local constraints.

9.1 Review of IWM options

There are a number of processes at work within IWM. The approaches considered in the options appraisal for Green Hammerton include:

- Higher water efficiency measures
- Rainwater Harvesting
- Stormwater Harvesting
- Greywater Reuse

The higher water efficiency estimates are based on Building Regulations Part G and assume water demand of 105 l/d per person. The potential supply of rainwater (from rooftops) and stormwater (from catchment surfaces) has been estimated assuming plot area of 250 m^2 and a building footprint of 70 m^2. The potential supply of greywater is estimated using British Standard as well as micro-component breakdown of water uses within homes.

Table 11 Demand reduction potential of IWM options

	Reduction in potable demand ^	**Non-potable demand satisfied**
Rainwater	14%	48%
Rainwater + Stormwater	29%	100%
Greywater	29%	100%

^ compared to Part G 'high efficiency'
** over 25 years and assuming simple payback*

The impact of different IWM options on water demand and wastewater discharge were estimated and presented in Figure 14 and Figure 15. These are based on the growth estimates presented in Table 1.

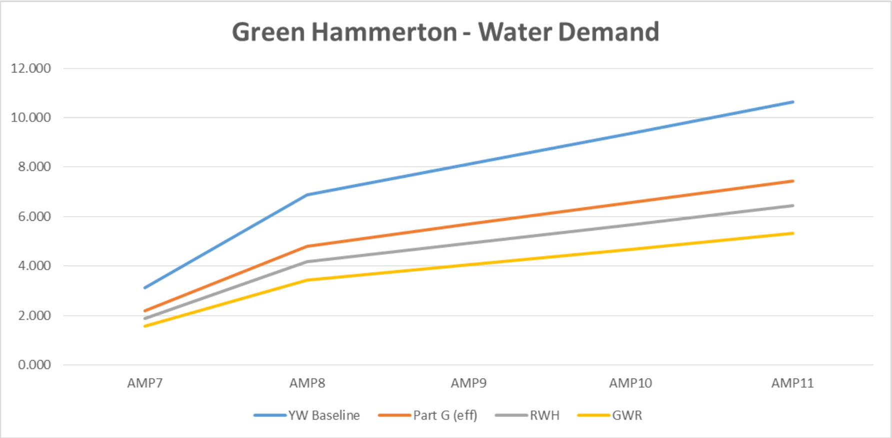


Figure 14 Comparison of water demand projections

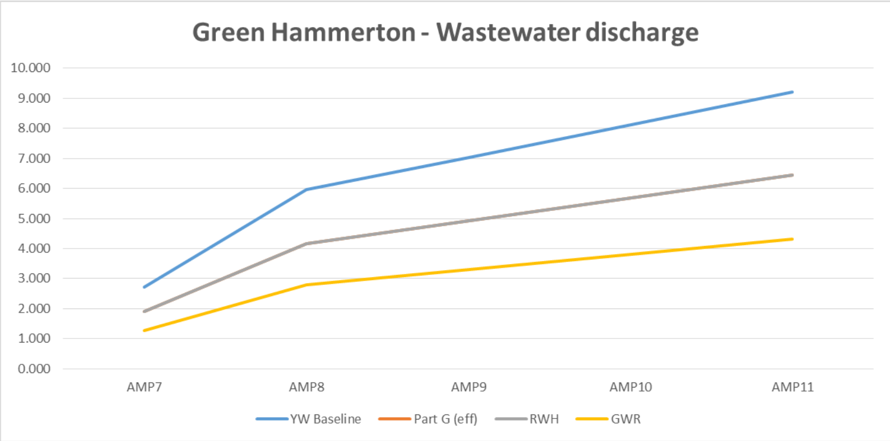


Figure 15 Comparison of wastewater discharge projections

9.2 Impact on clean water infrastructure solutions

The reduced potable water demand associated with the IWM option has the potential to reduce the required Whixley SRE upgrade from 550m^3 to 900m^3 instead of 1,300m^3 required for conventional systems. However, YWS have expressed reservations with pursuing this option, as they would require the system to be failure proofed by a conventional system. Consequently, this would mean that a reduced size SRE would not be acceptable.

There is also potential to reduce pipe sizes with the IWM option but this has not been assessed in any detail.

9.3 Impact on wastewater treatment solutions

The IWM option involves a reduced potable water consumption and grey water recycling, which results in a revised sewage flow of 75 l/d per person. This is a conservative figure, as the flows can be reduced up to 60 l/d per person based on the industry standard ‘water calculator’.

The reduced flow has an impact on all hydraulic processes, namely settlement stages and pumping costs. It does not impact on the secondary treatment process capacity as this is based on load per person and this does not change from implementing IWM.

The revised trickling filter and ASP designs for Pool Lane WwTW and at Kirk Hammerton with reductions shown in red are as follows:

Table 12 – Green Hammerton Trickling Filter summary - IWM design @ 75 l/hd.d

Parameter	AMP7	AMP8	AMP9	AMP10
P.E.	2,017	3,778	5,540	6,499
FFT, m^3/d	552 (-330)	1,033 (-619)	1,515 (-908)	1,804 (-1,081)
No. PSTs @ 5.6 (-1.6) m	2	2	3	3
No. TFs @ 24 m	2	3	5	5
No. HTs @ 4.7 (- 1.2) m	2	2	3	3
Sludge storage, m^3	66	124	182	217

Table 13 - Green Hammerton ASP summary - IWM design @ 75 l/hd.d

Parameter	AMP7	AMP8	AMP9	AMP10
P.E.	2,017	3,778	5,540	6,499
FFT, m^3/d	552 (-330)	1,033 (-619)	1,515 (-908)	1,804 (-1,081)
No. PSTs @ 5.6 (-1.6) m	2	2	3	3
No. ASP lanes @ 2.4 m width, 20m long	2	3	4	4
No. FSTs @ 7.5 (-2.2) m	2	3	4	4
Sludge storage (thickened), m^3	25	47	69	82

Table 14 - Kirk Hammerton Expansion - IWM design @ 75 l/hd.d

Parameter	AMP7	AMP8	AMP9	AMP10
P.E.	3,976	5,701	7,426	8,461
FFT, m^3/d	1,493 (-326)	1,928 (-611)	2,328 (-895)	2,602 (-1,066)
No. PSTs @ 7.8 (-1.2) m	2	2	3	3
No. ASP lanes @ 2.7 m width, 23m long	3	3	4	4
No. FSTs @ 9.0 (-1) m	2	3	3	3
Sludge storage (thickened), m^3	51	73	95	108

9.4 Impact on sewerage solutions

The proposed IWM options may result in reduced foul flows reaching the sewers. As such there may be opportunity to reduce the size of some of the proposed wastewater assets by either reducing pipe, storage or pump sizes. In particular, the sizing of the emergency storage may be able to be reduced significantly if a lower volume per dwelling is agreed from the figure of 160l per dwelling given by Sewers for Adoption.

9.5 IWM cost basis and assumptions

The cost estimates are based on the approach devised and agreed for Old Oak Common Integrated Water Management Study and the Thames Water study on Non Potable Water Reuse as a Demand Management Option for WRMP19.

The cost estimates utilise the New Rules of Measurement (NRM) and Building Cost Information Service (BCIS) from Royal Chartered Institute of Surveyors (RCIS), and are suitable for initial cost estimates at masterplanning stage.

The energy cost of pumping for local non-potable supply have been based on research by University of Exeter on energy consumption in RWH systems.

More detail costing would be possible once there is greater level of understanding of site and building layouts and designs. This would also enable optimisation of costs and finding cost efficiencies.

It is assumed that the necessary storage in pre-treatment stage for rainwater and stormwater will be met by the storm attenuation that will be required to comply with surface water runoff constraints.

Although passive treatment systems are available, to ensure a guaranteed non-potable water quality it is assume the surface water harvesting will be required similar type of membrane treatment systems as used in greywater reuse.

Table 15 IWM system costs breakdown

	#	Cost Item	Cost borne by	Rainwater Harvesting	Rainwater + Stormwater	Greywater
CAPEX	1	Dual plumbing (supply)	Developer	£0.44 mil	£0.44 mil	**£0.44 mil**
	2	Dual plumbing (greywater drainage)	Developer	-	-	**£0.44 mil**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	-	£130 k	**£145 k**
	4	Membrane replacement	Facility Management	-	£14,400	**£14,400**

	#	Cost Item	Cost borne by	Rainwater Harvesting	Rainwater + Stormwater	Greywater
		(every 10 years)	(FM) or iWaSCo			
	5	Pump renewal / replacement (15 years)	Householder, FM or iWaSCo	£97,500 (pumps at individual house)	£17,300 (communal pumps)	**£8,700 (communal pumps)**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	-	£16,800 / year	**£8,400 / year**
	7	Non-potable supply – annual energy cost for pumping water	Householder, FM or iWaSCO	£3,200 / year	£6,100 / year	**£6,700 / year**

- The capital costs for dual plumbing will be borne by the developer in the first instance as the infrastructure will need to be implemented at the time of construction.
- The capital cost of the treatment plant may be borne by developer or an independent operator (WaSCo) if developer enters into such an agreement.
- The operating costs for non-potable system (treatment plant and pumping system) and will be borne by the site Facilities Management or WaSCo.
- For rainwater harvesting, the pump renewal / replacement costs will be borne directly by the householder, as the systems will be at individual households.
- Some or all of these additional costs for others may be recouped through a charging mechanism (service charge or a volumetric charge for non-potable supply).

In Olympic Park in London, the non-potable water supply is charged at a rate below potable water supply charges. In some office buildings where greywater systems are employed, the cost of their operation are included within the service charges for tenants. It is noted that the reduced YW revenue has not been included in the calculations.

9.6 Preferred IWM option

The primary external driver for IWM at this location is the potential impacts to the provisions at wastewater treatment plants as well as on the sewerage network.

Of the options under consideration, only the Greywater Reuse IWM option provides the reduction in foul flows, thus is the preferred option.

10 Totex calculations

10.1 Data and assumptions

The capex for the options has been estimated by YWS using the Yorkshire Water Unit Cost Database (UCD). Any items that are not covered in the UCD have been costed by Arup and/or suppliers. The source of the costing information for each work element is presented in Appendix A.

The opex of all options has been estimated by Arup and is presented in Appendix C. The totex has been calculated over a 40-year period.

The assumptions used for the design and costing exercise are summarised below:

Area	Capex assumptions	Opex assumptions
Land requirements	AMP10 footprint	n/a
Sewerage	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	
Wastewater treatment	AMP7 requirements	Estimate is based on the AMP7 solution only
Clean water infrastructure	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	

10.2 Costed options

The options costed in this study are listed below.

ID	Option	ID	Sub-options
1	Expansion of Kirk Hammerton WwTW	a	ASP solution
		b	ASP solution + IWM intervention
2	New WwTW at Pool Lane	a	ASP solution
		b	ASP solution + IWM
		c	Trickling filter solution
		d	Trickling filter solution + IWM
		e	Lagoon solution

10.3 Costs

The option costs (capex, opex and totex) over a 40-year period (NPV) are summarised below.

Option ID	Sewerage / wastewater treatment		Clean water infrastructure		Write off costs (£m)	Totex (£m)	Additional cost borne by others (£m)	
	Capex (£m)	Opex (£m)	Capex (£m)	Opex (£m)			Capex (£m)	Opex (£m)
1a	12.52	0.55	1.83	-	0.26	15.15	-	-
1b	12.42	0.53	1.58	-	0.26	14.80	0.52	0.12
2a	11.80	0.53	1.83	-	-	14.16	-	-
2b	11.68	0.51	1.58	-	-	13.77	0.52	0.12
2c	11.78	0.46	1.83	-	-	14.06	-	-
2d	11.48	0.46	1.58	-	-	13.52	0.52	0.12
2e	11.09	0.25	1.83	-	-	13.16	-	-

The solutions with the lowest totex are:

1. Option 2e: New WwTW at Pool Lane – Lagoon solution (£13.16m)
2. Option 2d: New WwTW at Pool Lane – IWM trickling filter solution (£13.52m)
3. Option 2b: New WwTW at Pool Lane – IWM ASP solution (£13.77m)

Options 2d and 2b will require additional £0.65m of costs to be borne by others (such as the developer, facilities manager or an independent Water Service Company).

It is estimated that the combination of IWM options and a lagoon solution at Pool Lane could reduce the totex of option 2e by a further £0.3m.

If IWM options are excluded from the assessment, the top three solutions with the lowest totex are:

1. Option 2e: New WwTW at Pool Lane – Lagoon solution (£13.16m)
2. Option 2c: New WwTW at Pool Lane – Trickling filter solution (£14.06m)
3. Option 2a: New WwTW at Pool Lane – ASP solution (£14.16m)

The redevelopment of Kirk Hammerton WwTW to treat future flows within the current site boundary is the most expensive option (£15.15m).

11 Environmental and social appraisal

A five capital approach has been developed to qualitatively appraise the environmental and social impact of the shortlisted options. The assessment framework provides scoring criteria against 21 aspects as listed in the table below, from high negative impact (-3) to high positive impact (+3). The detailed scoring criteria can be found in Appendix E.

The score under each of the aspects were summed to provide a total for each of the options. Equal weighting has been assumed for all aspects considered.

Table 16: Five capital appraisal summary for all Green Hammerton options

Option ID	Natural												Social			Human				F&M		Total score
	Crops and Livestock	Fisheries	Energy	Water supply	Global climate	Air quality	Flood Regulation	Water quality	Pollination	Recreation	Amenity	Non-Use Value	Physical activity	Quality of place	Trust	Employment	Skills	Health & Safety	Local economy	Private costs	Private benefits	
1a	-1	0	-3	-2	-2	-3	0	0	0	0	0	0	0	-2	0	1	2	0	2	1	3	-4
1b	-1	0	-2	-1	-2	-3	0	0	0	0	0	0	0	-2	0	1	2	0	2	1	3	**-2**
2a	-1	0	-3	-2	-2	-2	0	0	0	0	0	0	0	-2	0	1	2	0	2	1	3	-3
2b	-1	0	-2	-1	-2	-2	0	0	0	0	0	0	0	-2	0	1	2	0	2	1	3	-1
2c	-1	0	-1	-2	-2	-2	0	0	0	0	0	0	0	-1	0	1	2	0	2	1	3	**0**
2d	-1	0	-1	-1	-2	-2	0	0	0	0	0	0	0	-1	0	1	2	0	2	1	3	**1**
2e	-2	0	-2	-2	0	-2	0	0	0	0	0	0	0	-1	0	1	1	0	2	1	2	**-2**

As shown in Table 16, the top three options ranked by their overall impact on the five capital, in descending order are:

- **2d.** New WwTW at Pool Lane – Trickling filter solution with IWM
- **2c.** New WwTW at Pool Lane – Trickling filter solution
- **2e.** New WwTW at Pool Lane – Lagoon solution
- **1b.** Expansion of the existing Kirk Hammerton WwTW – ASP solution with IWM

12 Conclusions and recommendations

Excluding the IWM solutions, Option 2e 'New WwTW at Pool Lane – Lagoon solution' has the lowest totex cost over a 40-year period (£13.16m).

Although a lagoon solution has been approved by YWS for construction at Withernsea, YWS does not have extensive experience with such a process. Depending on the design solution, there may also be risks around the classification of the lagoon as a reservoir. These will need to be investigated further once the location of the WwTW is confirmed.

Option 2c 'New WwTW at Pool Lane – Trickling filter solution' has the second lowest totex (£14.06m). This is a low risk option as it is a well-established technology and YWS has operated trickling filters for many years. An alternative solution is an ASP with a significantly smaller footprint but higher totex (£14.16m).

The redevelopment of Kirk Hammerton WwTW from trickling filters to an ASP could accommodate the flows and loads for AMP7 and AMP8 within the current YW site boundary. This solution has the highest totex (£15.15m) but it is likely to be the most desirable option for the Great Hammerton developer.

With regard to clean water infrastructure, the future water demand could be met from Boroughbridge WSS.

The IWM options are comparatively more costly than traditional options (if costs borne by others are included). Implementing IWM solutions in this location will reduce YWS totex between £0.3-£0.5m, but will result in additional costs (up to £0.65m totex) for others (developers, non-potable reuse system installers) through provision of additional on-site infrastructure required to enable non-potable use.

The costs of the non-potable reuse system and supply of non-potable water are likely to be recouped through a charging scheme. This could be as a flat service charge or metered charges for non-potable supply. The end users (e.g. homeowners) are likely to save on their water bills, provided the non-potable water is supplied at rate below the potable water supply.

Appendix A

List of items for Options Costing

A1 Options

ID	Option	ID	Sub-options
1	Expansion of Kirk Hammerton WwTW	a	ASP solution
		b	ASP solution + IWM intervention
2	New WwTW at Pool Lane	a	ASP solution
		b	ASP solution + IWM
		c	Trickling filter solution
		d	Trickling filter solution + IWM
		e	Lagoon solution

A1.1 Option 1a

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural &	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	22	kW
Sewerage	Power supply (PS2)		ZY1355	Power	22	kW
Sewerage	Pumping station to works (PS1)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS1) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS1) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergency	ZY1601	Total internal volume	160	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		storage				
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.135km, 225mm dia, urban	ZY7312	Length	135	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.54km, 225mm dia, rural	ZY7311	Length	540	m
Sewerage	Pipeline crossing beneath railway embankment. Directional drilling	0.025km, 225mm dia, directional drilled	ZY7306	Length	25	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.193km, 300mm dia, rural	ZY7294	Length	193	m
Sewerage	River Outfall	300mm dia, rural	ZY1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil including bypass	Duty/standby	ZY6000	Flow	1764	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	882	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	882	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,764	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	64	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	64	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	64	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	64	m2
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	1110	m3
Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air Flow	560	m3/h
Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	78	m2
Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	78	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	78	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	78	m2
Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	9	m3
Wastewater Treatment	RAS pump 1	Duty (8l/s)	ZY1638	Power	4	kW
Wastewater Treatment	RAS pump 2	Standby	ZY1638	Power	4	kW
Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	2	kW
Wastewater Treatment	SAS pump 2	Standby	ZY1638	Power	2	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	12	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Sludge tank 1 - unthickened - covered	1 no	ZY1650	Volume	33	m3
Wastewater Treatment	Sludge tank 2 - unthickened - covered	1 no	ZY1650	Volume	33	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	2	kW
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	2	kW
Wastewater Treatment	Sludge thickener - drum	Duty only	ZY1810	Through put	0.1	tds/h
Wastewater Treatment	Polymer system		ZY6243	Through put	0.1	tds/h
Wastewater Treatment	Thickener building		ZY1041	Area	80	m2
Wastewater Treatment	Thickener slab/base			Area	80	m2
Wastewater Treatment	Sludge tank - thickened - covered	1 no	ZY1650	Volume	51	m3
Wastewater Treatment	Sludge tanks mixing	Duty	ZY1260	Power	5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	8	kW
Wastewater Treatment	Odour control - single stage	Sludge storage tank	ZZ6025	Airflow	159	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	300	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no
Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Other	Earthworks/Landscaping		ZY1090	Volume	1500	m3
Other	Admin building with SCADA (STW)		ZY1040	Area	25	m2
Other	Land purchase		Steph Walden	Area	5,600	m2
Other	Power supply (STW)		ZY1355	Power	60	kW
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 1,300m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025–158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.2 Option 1b

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450	ZY1601	Total internal volume	460	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		m3 emergency storage				
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	9	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	9	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	18	kW
Sewerage	Power supply (PS2)		ZY1355	Power	18	kW
Sewerage	Pumping station to works (PS3)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.135km, 225mm dia, urban	ZY7312	Length	135	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.54km, 225mm dia, rural	ZY7311	Length	540	m
Sewerage	Pipeline crossing beneath railway embankment. Directional drilling	0.025km, 225mm dia, directional drilled	ZY7306	Length	25	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.193km, 300mm dia, rural	ZY7294	Length	193	m
Sewerage	River Outfall	300mm dia, rural	ZY1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civils including bypass	Duty/standby	ZY6000	Flow	1104	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	552	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	552	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,104	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	48	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	48	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	48	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	48	m2
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	1110	m3
Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air Flow	560	m3/hr
Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	64	m2
Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	64	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	64	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	64	m2
Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	9	m3
Wastewater Treatment	RAS pump 1	Duty (8l/s)	ZY1638	Power	3.5	kW
Wastewater Treatment	RAS pump 2	Standby	ZY1638	Power	3.5	kW
Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	1.5	kW
Wastewater Treatment	SAS pump 2	Standby	ZY1638	Power	1.5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
Wastewater Treatment	Sludge tank 1 - unthickened - covered	1 no	ZY1650	Volume	33	m3
Wastewater Treatment	Sludge tank 2 - unthickened - covered	1 no	ZY1650	Volume	33	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	2	kW
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	2	kW
Wastewater Treatment	Sludge thickener - drum	Duty only	ZY1810	Through put	0.1	tds/h

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Polymer system		ZY6243	Through put	0.1	tds/h
Wastewater Treatment	Thickener building		ZY1041	Area	80	m2
Wastewater Treatment	Thickener slab/base			Area	80	m2
Wastewater Treatment	Sludge tank - thickened - covered	1 no	ZY1650	Volume	51	m3
Wastewater Treatment	Sludge tanks mixing	Duty	ZY1260	Power	5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
Wastewater Treatment	Odour control - single stage	Sludge storage tank	ZZ6025	Airflow	159	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	300	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no
Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	1,500	m3
Other	Admin building with SCADA (STW)		ZY1040	Area	25	m2
Other	Land purchase		Steph Walden	Area	5,600	m2
Other	Power supply		ZY1355	Power	62	kW
IWM	Rainwater harvesting, non potable water system					

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 900m3	ZY4118	Volume	350	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.3 Option 2a

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	22	kW
Sewerage	Power supply (PS2)		ZY1355	Power	22	kW
Sewerage	Pumping station to works (PS1)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS1) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS1) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergency storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1.1km, 225mm dia, urban	ZY7312	Length	1,100	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.04km, 225mm dia, rural	ZY7311	Length	40	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.132km, 300mm dia, rural	ZY7294	Length	132	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil	Duty/standby	ZY6000	Flow	1764	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	882	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	882	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,764	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	41	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	41	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	41	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	41	m2
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	565	m3
Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air Flow	281	m3/h

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	41	m2
Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	41	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	41	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	41	m2
Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	9	m3
Wastewater Treatment	RAS pump 1	Duty (8l/s)	ZY1638	Power	4	kW
Wastewater Treatment	RAS pump 2	Standby	ZY1638	Power	4	kW
Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	2	kW
Wastewater Treatment	SAS pump 2	Standby	ZY1638	Power	2	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	12	kW
Wastewater Treatment	Sludge tank 1 - unthickened - covered	1 no	ZY1650	Volume	16	m3
Wastewater Treatment	Sludge tank 2 - unthickened - covered	1 no	ZY1650	Volume	16	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
Wastewater Treatment	Sludge thickener - drum	Duty only	ZY1810	Through put	0.1	tds/h
Wastewater Treatment	Polymer system		ZY6243	Through put	0.1	tds/h
Wastewater Treatment	Thickener building		ZY1041	Area	80	m2
Wastewater Treatment	Thickener slab/base			Area	80	m2
Wastewater Treatment	Sludge tank - thickened - covered	1 no	ZY1650	Volume	25	m3
Wastewater Treatment	Sludge tanks mixing	Duty	ZY1260	Power	2	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	8	kW
Wastewater Treatment	Odour control - single stage	Sludge storage tank	ZZ6025	Airflow	159	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	300	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no
Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	1500	m3
Other	Admin building with SCADA (STW)		ZY1040	Area	25	m2
Other	Site access roads	Off site roads	ZY1410	Area	100	m2
Other	Land purchase		Steph Walden	Area	5,600	m2
Other	Power supply (STW)		ZY1355	Power	60	kW
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 1,300m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.4 Option 2b

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	9	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	9	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	18	kW
Sewerage	Power supply (PS2)		ZY1355	Power	18	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station to works (PS3)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1.1km, 225mm dia, urban	ZY7312	Length	1,100	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.04km, 225mm dia, rural	ZY7311	Length	40	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.132km, 300mm dia, rural	ZY7294	Length	132	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil including bypass	Duty/standby	ZY6000	Flow	1104	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	552	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	552	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,104	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	28	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	28	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	28	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	28	m2
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	3	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	3	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	6	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	565	m3
Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air Flow	281	m3/hr
Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	44	m2
Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	44	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	44	m2

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	44	m2
Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	9	m3
Wastewater Treatment	RAS pump 1	Duty (8l/s)	ZY1638	Power	3.5	kW
Wastewater Treatment	RAS pump 2	Standby	ZY1638	Power	3.5	kW
Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	1.5	kW
Wastewater Treatment	SAS pump 2	Standby	ZY1638	Power	1.5	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
Wastewater Treatment	Sludge tank 1 - unthickened - covered	1 no	ZY1650	Volume	16	m3
Wastewater Treatment	Sludge tank 2 - unthickened - covered	1 no	ZY1650	Volume	16	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
Wastewater Treatment	Sludge thickener - drum	Duty only	ZY1810	Through put	0.1	tds/h
Wastewater Treatment	Polymer system		ZY6243	Through put	0.1	tds/h
Wastewater Treatment	Thickener building		ZY1041	Area	80	m2
Wastewater Treatment	Thickener slab/base			Area	80	m2
Wastewater Treatment	Sludge tank - thickened - covered	1 no	ZY1650	Volume	25	m3
Wastewater Treatment	Sludge tanks mixing	Duty	ZY1260	Power	2	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
Wastewater Treatment	Odour control - single stage	Sludge storage tank	ZZ6025	Airflow	159	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	300	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no
Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	1,500	m3
Other	Admin building with SCADA (STW)		ZY1040	Area	25	m2
Other	Site access roads	Off site roads	ZY1410	Area	100	m2
Other	Land purchase		Steph Walden	Area	5,600	m2
Other	Power supply		ZY1355	Power	62	kW
IWM	Rainwater harvesting, non potable water system					
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 900m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on	1 meter	ZY0059	Number	1	no

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	York Road - Connection 1					
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.5 Option 2c

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads	0.953km, 150mm dia, urban	ZY7312	Length	953	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	(T3/4 reinstatement)					
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	22	kW
Sewerage	Power supply (PS2)		ZY1355	Power	22	kW
Sewerage	Pumping station to works (PS1)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station (PS1) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS1) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1.1km, 225mm dia, urban	ZY7312	Length	1,100	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.04km, 225mm dia, rural	ZY7311	Length	40	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.132km, 300mm dia, rural	ZY7294	Length	132	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Inlet Works Civil including bypass	Duty/standby	ZY6000	Flow	1764	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	882	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	882	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,764	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	41	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	41	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	41	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	41	m2
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	Trickling filter 1		ZY6541	Area	452	m2
Wastewater Treatment	Trickling filter 2		ZY6541	Area	452	m2
Wastewater Treatment	Mineral media		ZY1903	Volume	1628	m3
Wastewater Treatment	Distributor 1 including motor drive		ZY6420	Area	452	m2
Wastewater Treatment	Distributor 2 including motor drive		ZY6420	Area	452	m2
Wastewater Treatment	Humus Tanks 1		ZY6920	Area	27	m2
Wastewater Treatment	Humus Tanks 2		ZY6920	Area	27	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	27	m2

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	27	m2
Wastewater Treatment	Final effluent recirculation chamber		ZY1065	Volume	8	m3
Wastewater Treatment	TF recirculation pump 1		ZY6100	Power	3	kW
Wastewater Treatment	TF recirculation pump 2		ZY6100	Power	3	kW
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	8	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
Wastewater Treatment	Sludge tanks		ZY1650	Volume	66	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	2	kW
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	2	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	4	kW
Wastewater Treatment	Odour control	Sludge storage tank	ZY6025	m3/h	66	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	420	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	3	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	4	no

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Other	Measuring/monitoring chamber		ZY1065	Number	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	2,100	m3
Other	Admin building with SCADA (STW)		ZY1040	Volume	25	m2
Other	Site access roads	Off site roads	ZY1410	Area	100	m2
Other	Land purchase	90m x 80m	Steph Walden	Area	10,000	m2
Other	Power supply (STW)		ZY1355	Power	42	kW
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 1,300m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.6 Option 2d

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural &	0.957km, 300mm dia, urban	ZY7297	Length	957	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	9	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	9	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	Power supply (PS2)		ZY1355	Power	18	kW
Sewerage	New MCC (PS2)		ZY1255	Power	18	kW
Sewerage	Pumping station to works (PS1)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS1) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS1) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1.1km, 225mm dia, urban	ZY7312	Length	1,100	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.04km, 225mm dia, rural	ZY7311	Length	40	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland & verge, <2m depth to crown	0.132km, 300mm dia, rural	ZY7294	Length	132	m
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil including bypass	Duty/standby	ZY6000	Flow	1104	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	552	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	552	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,104	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	28	m2
Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	28	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	28	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	28	m2
Wastewater Treatment	Desludging pump 1		ZY1638	Power	1	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Desludging pump 2		ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	2	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	5	m3
Wastewater Treatment	Trickling filter 1		ZY6541	Area	452	m2
Wastewater Treatment	Trickling filter 2		ZY6541	Area	452	m2
Wastewater Treatment	Mineral media		ZY1903	Volume	1628	m3
Wastewater Treatment	Distributor motor drive 1		ZY6420	Area	452	m2
Wastewater Treatment	Distributor motor drive 2		ZY6420	Area	452	m2
Wastewater Treatment	Humus Tanks 1		ZY6920	Area	17	m2
Wastewater Treatment	Humus Tanks 2		ZY6920	Area	17	m2
Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	17	m2
Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	17	m2
Wastewater Treatment	Final effluent recirculation chamber		ZY1065	Volume	5	m3
Wastewater Treatment	TF recirculation pump 1		ZY6100	Power	1	kW
Wastewater Treatment	TF recirculation pump 2		ZY6100	Power	1	kW
Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	4	kW
Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	5	m3
Wastewater Treatment	Sludge tanks		ZY1650	Volume	66	m3
Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	4	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	4	kW
Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	8	kW
Wastewater Treatment	Odour control	Sludge storage tank	ZY6025	m3/h	66	m3/hr
Wastewater Treatment	Washwater booster package	@ 16.7 l/s ins flow, all mech plus elec	ZY1567	m3/h	194	m3/d
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
Other	Security site fencing		ZY1175	Length	340	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	3	no
Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	4	no
Other	Measuring/monitoring chamber		ZY1065	Number	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	2,200	m3
Other	Admin building with SCADA (STW)		ZY1040	Area	25	m2
Other	Site access roads	Off site roads	ZY1410	Area	100	m2
Other	Land purchase	90m x 80m	Steph Walden	Area	10,000	m2
Other	Power supply (STW)		ZY1355	Power	24	kW
IWM	Rainwater harvesting, non potable water system					
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 900m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1 Yr4 2024 – 300 units)	ZY7325	Length	50	m
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

A1.7 Option 2e

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Rising Main from PS1 to PS2 Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.953km, 150mm dia, urban	ZY7312	Length	953	m
Sewerage	Rising Main from PS3 to PS2 (Part 1) Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.288km (BC), 150mm dia, urban	ZY7312	Length	288	m
Sewerage	Rising Main from PS3 to PS2 (Part 2) Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.534km (BC), 150mm dia, urban	ZY7311	Length	534	m
Sewerage	Gravity sewer from PS3 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	1.306km, 300mm dia, urban	ZY7297	Length	1,306	m
Sewerage	Gravity sewer from PS1 to PS2 Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.957km, 300mm dia, urban	ZY7297	Length	957	m
Sewerage	Pumping station to works (PS2)	PS2 (eastern, downstream terminal PS), 10 m3 normal storage, 450 m3 emergency storage	ZY1601	Total internal volume	460	m3
Sewerage	Pumping station (PS2) - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
Sewerage	Pumping station (PS2) - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
Sewerage	Brick building (PS2)		ZY1040	Area	9	m2
Sewerage	New MCC (PS2)		ZY1255	Power	22	kW

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Power supply (PS2)		ZY1355	Power	22	kW
Sewerage	Pumping station to works (PS1)	PS1 (northern upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS1) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS1) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS1)		ZY1040	Area	9	m2
Sewerage	New MCC (PS1)		ZY1255	Power	11	kW
Sewerage	Power supply (PS1)		ZY1355	Power	11.0	kW
Sewerage	Pumping station to works (PS3)	PS3 (south western upstream PS), 10 m3 normal storage, 150 m3 emergancy storage	ZY1601	Total internal volume	160	m3
Sewerage	Pumping station (PS3) - centrifugal submersible pump 1	Duty	ZY5050	Power	5.5	kW
Sewerage	Pumping station (PS3) - centrifugal submersible pump 2	Standby	ZY5050	Power	5.5	kW
Sewerage	Brick building (PS3)		ZY1040	Area	9	m2
Sewerage	New MCC (PS3)		ZY1255	Power	11	kW
Sewerage	Power supply (PS3)		ZY1355	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1.1km, 225mm dia, urban	ZY7312	Length	1,100	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	0.04km, 225mm dia, rural	ZY7311	Length	40	m
Sewerage	Outfall pipeline Sewerage: Open Cut/Plastic/Grassland &	0.132km, 300mm dia, rural	ZY7294	Length	132	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	verge, <2m depth to crown					
Sewerage	River Outfall	300mm dia, rural	Z1215	Diameter of outfall pipe	300	mm
Other	Security site fencing		ZY1175	Length	720	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Earthworks/Landscaping		ZY1090	Volume	1,500	m3
Other	Brick building (STW)		ZY1040	Area	25	m2
Other	New MCC (STW)		ZY1255	Power	68	kW
Other	On site roads		ZY1405	Area	1,800	m2
Other	Site access roads		ZY1410	Area	100	m2
Other	Land purchase		Steph Walden	Area	32,500	m2
Other	Power supply (STW)		ZY1355	Power	68	kW
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil including bypass	Duty/standby	ZY6000	Flow	1764	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	882	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	882	m3/d
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	1,764	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Lagoon M&E plus civils supply to site (includes ammonia removal media)		From supplier	Flow / load	2,000	p.e.
Wastewater Treatment	Lagoon construction services, M&E		From supplier	Flow / load	2,000	p.e.
Wastewater Treatment	Lagoon earthworks and lining		From supplier	Flow / load	2000	p.e.

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Lagoon site civil services		From supplier	Flow / load	2000	p.e.
Clean Water	Construction of service reservoir upgrades	Upgrade from 550m3 to 1,300m3	ZY4118	Volume	750	m3
Clean Water	300/100mm connection c/w valve and meter on Boroughbridge Road.	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 350m of 125mm HDPE in road verge including 1 No. major crossing of the B6265	Main to be laid along Harrogate Road	ZY7326	Length	300	m
Clean Water	125mm diameter HDPE road crossings	Harrogate Road and B6265	ZY7329	Length	50	m
Clean Water	250/100mm connection c/w valve and meter on York Road - Connection 1	1 meter	ZY0059	Number	1	no
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 50m of 125mm HDPE in fields including one crossing of the A59	Main to development area Stage 1 Yr6 2025– 158 units	ZY7325	Length	50	m
Clean Water	Install 200mm diameter flow meter on bypass including chamber	Upsize from 100mm bypass and meter	ZY0059	Number	1	no
Clean Water	Install 200mm diameter valves on flow meter bypass including chambers	Upsize from 100mm bypass and meter		Number	2	no
Clean Water	Install 200mm diameter flow meter bypass ductile iron pipework in road verge	Upsize from 100mm bypass and meter	ZY7322	Length	15	m
Clean Water	250/100mm connection c/w valve and meter near Whixley Lodge	1 meter	ZY0059	Number	1	No.
Clean Water		Meter Chamber	ZY1065	Volume	2	m3
Clean Water	Lay 1.3km of 180mm HDPE pipe in road verge	Main to be laid along the A59	ZY7325	Length	1,300	m
Clean Water	150/150mm connection on A59					
Clean Water	Lay 50m of 125mm HDPE main in fields	To development area (Stage 1	ZY7325	Length	50	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Yr4 2024 – 300 units)				
Clean Water	Land purchase	50m x 50 m	Steph Walden	Area	0.62	acres

Appendix B

Operating costs

B1 Options

ID	Option	ID	Sub-options
1	Expansion of Kirk Hammerton WwTW	a	ASP solution
		b	ASP solution + IWM intervention
2	New WwTW at Pool Lane	a	ASP solution
		b	ASP solution + IWM
		c	Trickling filter solution
		d	Trickling filter solution + IWM
		e	Lagoon solution

B1.1 Option 1A

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station (PS1) - centrifugal submersible pump 1	Duty	3.52	kW	5.5 kW	8	28.2 kWh/d	1,035 £/yr
Pumping station (PS1) - centrifugal submersible pump 2	Standby	3.52	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.52**	**KvA**	**5.5 kW**		**28.2 kWh/d**	
Power supply		**3.52**	**kW**	**5.5 kW**		**28.2 kWh/d**	**1,035 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	6.20	kW	11 kW	8	49.6 kWh/d	1,822 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	6.20	kW	11 kW	0	0 kWh/d	- £/yr
MCC		**6.20**	**KvA**	**11 kW**		**49.6 kWh/d**	
Power supply		**6.20**	**kW**	**11 kW**		**49.6 kWh/d**	**1,822 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	3.09	kW	5.5 kW	8	24.8 kWh/d	910 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	3.09	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.09**	**KvA**	**5.5 kW**		**24.8 kWh/d**	
Power supply		**3.09**	**kW**	**5.5 kW**		**24.8 kWh/d**	**910 £/yr**
Sewerage Pumping Station instrumentation		0.1	kW	0.75 kW	24	2.4 kWh/d	88 £/yr
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standby	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
ASP plant mixing, diffusers, blowers (M&E)		7.40	kW	12 kW	24 hrs/day	177.6 kWh/d	6,525 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
RAS pump 1		3.2	kW	4 kW	24 hrs/day	76.8 kWh/d	2,822 £/yr
RAS pump 2		3.2	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
SAS pump 1	Duty	1	kW	2 kW	8 hrs/day	8 kWh/d	294 £/yr
SAS pump 2	Standby	1	kW	2 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	2.54	kW	4 kW	8 hrs/day	20.35 kWh/d	748 £/yr
Sludge tanks mixing 2	Standby	2.54	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge storage tank	1	kW	3 kW	24 hrs/day	24 kWh/d	882 £/yr
Autosampler	Final effluent	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 4no	PST sludge(common), RAS (per FST), SAS	0.2	kW	1 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Dry solids monitor, 2 No	MLSS, RAS, PST desludge (common)	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 No	PSTs (each), FSTs (each)	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 3 No.	RAS chamber, FFT flowmeter, Sludge storage tank	0.15	no	2 kW	24 hrs/day	3.6 kWh/d	132 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0.18 £/yr
New MCC		**23.9**	**kW**	**48.8 kW**			
Power supply		**23.9**	**kVA**	**48.8 kW**		**445.6 kWh/d**	**16,371**
Existing PSTs/humus tanks		-2	lW	-2 kW	24 hrs/day	-48 kWh/d -	1,764 £/yr
Existing TFs recirc		-1.6	no	-2 kW	24 hrs/day	-38.4 kWh/d -	1,411 £/yr
Misc		-1	no	-2 kW	24 hrs/day	-24 kWh/d -	882 £/yr
				-6 kW		**-110.4 kWh/d -**	**4,056 £/yr**
Total power		**36.71**		**64.8**		**437.7 kWh/d**	**16,081 £/yr**
Odour media - Activated carbon							**4 £/kg**
Volume per year (assumes 75% media spent)		68	m3	ZY6035			**272 £/kg**
Sludge disposal							
Sludge for disposal							3 m3/d
							5.50% DS
							60.2 tds/year
							1095 m3/yr
Cost for treatment and disposal							305 £/tonne
Total cost							**18,369 £/yr**
Polymer use							1.7 **kg/d**
							1.9 **£/kg**
							1178.95 **£/year**
Manpower							
Annual salary							35,000 £/yr
Operational Hours/week							hrs/wk
							0 hrs/yr
Additional callouts							4 hrs/month
							48 hrs/yr
Maintenance hours							4 hrs/month
							48 hrs/yr
hours/yr							96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)							5%
Cost / yr							**1,697 £/yr manpower**
Total Opex costs							**37,597 £/year**

B1.2 Option 1B

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station - centrifugal submersible pump 1	Duty	2.956	kW	5.5 kW	8	23.6 kWh/d	869 £/yr
Pumping station - centrifugal submersible pump 2	Standby	2.956	kW	5.5 kW	0	0.0 kWh/d	- £/yr
Power supply		**5.91**	**kW**	**11 kW**		**23.6 kWh/d**	**869 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	4.37	kW	9 kW	**8**	34.9 kWh/d	1,284 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	4.37	kW	9 kW	0	0 kWh/d	- £/yr
					0		
MCC		**4.37**	**KvA**	**9 kW**		**34.9 kWh/d**	
Power supply		**4.37**	**kW**	**9 kW**		**34.9 kWh/d**	**1,284 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	2.60	kW	5.5 kW	**8**	20.8 kWh/d	763 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	2.60	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**2.60**	**KvA**	**5.5 kW**		**20.8 kWh/d**	
Power supply		**2.60**	**kW**	**5.5 kW**		**20.8 kWh/d**	**763 £/yr**
Sewerage Pumping Station instrumentation, 2 No		0.1	kW	0.75 kW	24	2.4 kWh/d	88 £/yr
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standby	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
ASP plant mixing, diffusers, blowers (M&E)		7.40	kW	12 kW	24 hrs/day	177.6 kWh/d	6,525 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
RAS pump 1	Duty (8 l/s)	2.6	kW	3.5 kW	24 hrs/day	62.4 kWh/d	2,293 £/yr
RAS pump 2	Standby (8 l/s)	2.6	kW	3.5 kW	0 hrs/day	0 kWh/d	- £/yr
SAS pump 1	Duty (5l/s)	1	kW	1.5 kW	8 hrs/day	8 kWh/d	294 £/yr
SAS pump 2	Standby (5l/s)	1	kW	1.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	2.544	kW	5 kW	8 hrs/day	20.352 kWh/d	748 £/yr
Sludge tanks mixing 2	Standby	2.544	kW	5 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge storage tank	1	kW	3 kW	24 hrs/day	24 kWh/d	882 £/yr
Autosampler	Final effluent	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 4 no	PST sludge(common), RAS (per FST), SAS	0.2	kW	1 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Dry solids monitor, 2 No	MLSS, RAS, PST desludge (common)	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 No	PSTs (each), FSTs (each)	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 3 No.	RAS chamber, FFT flowmeter, Sludge storage tank	0.15	no	2 kW	24 hrs/day	3.6 kWh/d	132 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0.18 £/yr
New MCC		**221**	**kW**	**49 kW**			
Power supply		**221.3**	**kVA**	**48.8 kW**		**431.2 kWh/d**	**15,842 £/yr**
Existing PSTs/humus tanks		-2	lW	-2 kW	24 hrs/day	-48 kWh/d	- 1,764 £/yr
Existing TFs recirc		-1.6	no	-2 kW	24 hrs/day	-38.4 kWh/d	- 1,411 £/yr
Misc		-1	no	-2 kW	24 hrs/day	-24 kWh/d	- 882 £/yr
				-6 kW		**-110.4 kWh/d**	**- 4,056 £/yr**
		227.2		**53.8**		**344.4**	**£ 14,701 £/yr**
Odour media - Activated carbon							**4 £/kg**
Volume per year (assumes 75% media spent)		68	m3				**272 £/kg**
Sludge disposal							
Sludge volume							3 m3/d
							5.50% DS
							60.2 tds/year
							1095 m3/yr
Treatment and disposal cost							305 £/tonne
	TDS/yr sludge						**18,369 £/yr**
Polymer use							1.7 **kg/d**
							1.9 **£/kg**
							1178.95 **£/year**
Manpower							
Annual salary							35,000 £/yr
Operational Hours/week							hrs/wk
							0 hrs/yr
Additional callouts							4 hrs/month
							48 hrs/yr
Maintenance hours							4 hrs/month
							48 hrs/yr
hours/yr							96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)							5%
Cost / yr							**1,697 £/yr manpower**
Total Opex costs							**36,218 £/year**

B1.3 Option 2A

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station (PS1) - centrifugal submersible pump 1	Duty	3.52	kW	5.5 kW	8	28.2 kWh/d	1,035 £/yr
Pumping station (PS1) - centrifugal submersible pump 2	Standby	3.52	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.52**	**KvA**	**5.5 kW**		**28.2 kWh/d**	
Power supply		**3.52**	**kW**	**5.5 kW**		**28.2 kWh/d**	**1,035 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	6.20	kW	11 kW	8	49.6 kWh/d	1,822 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	6.20	kW	11 kW	0	0 kWh/d	- £/yr
MCC		**6.20**	**KvA**	**11 kW**		**49.6 kWh/d**	
Power supply		**6.20**	**kW**	**11 kW**		**49.6 kWh/d**	**1,822 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	3.09	kW	5.5 kW	8	24.8 kWh/d	910 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	3.09	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.09**	**KvA**	**5.5 kW**		**24.8 kWh/d**	
Power supply		**3.09**	**kW**	**5.5 kW**		**24.8 kWh/d**	**910 £/yr**
Sewerage Pumping Station instrumentation, 2 No		0.1	kW	0.75 kW	24	2.4 kWh/d	88 £/yr
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standby	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
ASP plant mixing, diffusers, blowers (M&E)		3.70	kW	12 kW	24 hrs/day	88.8 kWh/d	3,263 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
RAS pump 1		1.6	kW	4 kW	24 hrs/day	38.4 kWh/d	1,411 £/yr
RAS pump 2		1.6	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
SAS pump 1	Duty	1	kW	2 kW	8 hrs/day	8 kWh/d	294 £/yr
SAS pump 2	Standby	1	kW	2 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	2.54	kW	4 kW	8 hrs/day	20.35 kWh/d	748 £/yr
Sludge tanks mixing 2	Standby	2.54	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge storage tank	1	kW	3 kW	24 hrs/day	24 kWh/d	882 £/yr
Autosampler	Final effluent	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 4 no	PST sludge(common), RAS (per FST), SAS	0.2	kW	1 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Dry solids monitor, 2 No	MLSS, RAS, PST desludge (common)	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 No	PSTs (each), FSTs (each)	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 3 No.	RAS chamber, FFT flowmeter, Sludge storage tank	0.15	no	2 kW	24 hrs/day	3.6 kWh/d	132 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0.18 £/yr
New MCC		**18.6**	**kW**	**48.8 kW**			
Power supply		**18.6**	**kVA**	**48.8 kW**		**318.4 kWh/d**	**11,697**
Total power		**31.41**		**70.8**		**420.9 kWh/d**	**15,463 £/yr**

Odour media - Activated carbon		**4 £/kg**
Volume per year (assumes 75% media spent)	68 m3	**272 £/kg**
Sludge disposal		
Sludge for disposal		3 m3/d
		5.50% DS
		60.2 tds/year
		1095 m3/yr
Cost for treatment and disposal		305 £/tonne
Total cost		**18,369 £/yr**
Polymer use		0.8 **kg/d**
		1.9 **£/kg**
		554.8 **£/year**
Manpower		
Annual salary		35,000 £/yr
Operational Hours/week		hrs/wk
		0 hrs/yr
Additional callouts		4 hrs/month
		48 hrs/yr
Maintenance hours		4 hrs/month
		48 hrs/yr
hours/yr		96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)		5%
Cost / yr		**1,697 £/yr manpower**
Total Opex costs		**36,356 £/year**

B1.4 Option 2B

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station - centrifugal submersible pump 1	Duty	2.956	kW	5.5 kW	8	23.6 kWh/d	869 £/yr
Pumping station - centrifugal submersible pump 2	Standby	2.956	kW	5.5 kW	0	0.0 kWh/d	- £/yr
Power supply		**5.91**	**kW**	**11 kW**		**23.6 kWh/d**	**869 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	4.37	kW	9 kW	**8**	34.9 kWh/d	1,284 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	4.37	kW	9 kW	0	0 kWh/d	- £/yr
MCC		**4.37**	**KvA**	**9 kW**		**34.9 kWh/d**	
Power supply		**4.37**	**kW**	**9 kW**		**34.9 kWh/d**	**1,284 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	2.60	kW	5.5 kW	**8**	20.8 kWh/d	763 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	2.60	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**2.60**	**KvA**	**5.5 kW**		**20.8 kWh/d**	
Power supply		**2.60**	**kW**	**5.5 kW**		**20.8 kWh/d**	**763 £/yr**
Sewerage Pumping Station instrumentation, 2 No @		0.1	kW	0.75 kW	24	2.4 kWh/d	88 £/yr
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standby	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
ASP plant mixing, diffusers, blowers (M&E)		3.70	kW	12 kW	24 hrs/day	88.8 kWh/d	3,263 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24 hrs/day	19.2 kWh/d	705 £/yr
RAS pump 1	Duty (8 l/s)	1.1	kW	3.5 kW	24 hrs/day	26.4 kWh/d	970 £/yr
RAS pump 2	Standby (8 l/s)	1.1	kW	3.5 kW	0 hrs/day	0 kWh/d	- £/yr
SAS pump 1	Duty (5l/s)	1	kW	1.5 kW	8 hrs/day	8 kWh/d	294 £/yr
SAS pump 2	Standby (5l/s)	1	kW	1.5 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	2.544	kW	5 kW	8 hrs/day	20.352 kWh/d	748 £/yr
Sludge tanks mixing 2	Standby	2.544	kW	5 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge storage tank	1	kW	3 kW	24 hrs/day	24 kWh/d	882 £/yr
Autosampler	Final effluent	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 4 no	PST sludge(common), RAS (per FST), SAS	0.2	kW	1 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Dry solids monitor, 2 NO	MLSS, RAS, PST desludge (common)	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 NO.	PSTs (each), FSTs (each)	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 3 No.	RAS chamber, FFT flowmeter, Sludge storage tank	0.15	no	2 kW	24 hrs/day	3.6 kWh/d	132 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0.18 £/yr
New MCC		**216**	**kW**	**49 kW**			
Power supply		**216.1**	**kVA**	**48.8 kW**		**306.4 kWh/d**	**11,256 £/yr**
		222.0		**59.8**		**330.0**	**£ 14,172 £/yr**

Odour media - Activated carbon				**4 £/kg**
Volume per year (assumes 75% media spent)		68 m3	ZY6035	**272 £/kg**
Sludge disposal				
Sludge volume				3 m3/d
				5.50% DS
				60.2 tds/year
				1095 m3/yr
Treatment and disposal cost				305 £/tonne
	TDS/yr sludge			**18,369 £/yr**
Polymer use				1 **kg/d**
				1.9 **£/kg**
				693.5 **£/year**
Manpower				
Annual salary				35,000 £/yr
Operational Hours/week				hrs/wk
				0 hrs/yr
Additional callouts				4 hrs/month
				48 hrs/yr
Maintenance hours				4 hrs/month
				48 hrs/yr
hours/yr				96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)				5%
Cost / yr				**1,697 £/yr manpower**
Total Opex costs				**35,203 £/year**

B1.5 Option 2C

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station - centrifugal submersible pump 1	Duty	3.52	kW	5.5 kW	8	28.1586 kWh/d	1,035 £/yr
Pumping station - centrifugal submersible pump 2	Standby	3.52	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.52**	**KvA**	**5.5 kW**		**28.2 kWh/d**	
Power supply		**3.52**	**kW**	**5.5 kW**		**28.2 kWh/d**	**1,035 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	6.20	kW	11 kW	8	49.6 kWh/d	1,822 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	6.20	kW	11 kW	0	0 kWh/d	- £/yr
MCC		**6.20**	**KvA**	**11 kW**		**49.6 kWh/d**	
Power supply		**6.20**	**kW**	**11 kW**		**49.6 kWh/d**	**1,822 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	3.09	kW	5.5 kW	8	24.8 kWh/d	910 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	3.09	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**3.09**	**KvA**	**5.5 kW**		**24.8 kWh/d**	
Power supply		**3.09**	**kW**	**5.5 kW**		**24.8 kWh/d**	**910 £/yr**
Sewerage Pumping Station instrumentation, 2 No		0.1	kW	0.75 kW	24	2.4 kWh/d	88 £/yr
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standb	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
TF recirculation pump 1		0.7	kW	3 kW	12 hrs/day	8.4 kWh/d	309 £/yr
TF recirculation pump 2		0.7	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
Desludging pump 1	Duty	0.02	kW	1 kW	8 hrs/day	0.16 kWh/d	6 £/yr
Desludging pump 2	Standby	0.02	kW	1 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	0.896	kW	2 kW	8 hrs/day	7.168 kWh/d	263 £/yr
Sludge tanks mixing 2	Standby	0.896	kW	2 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge stor.	1	kW	3 kW	24 hrs/day	24	882
Autosampler	Final efflue	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 2 no	sludge(co	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Dry solids monitor, 2 NO	RAS, PST	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 NO.	PSTs	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 2 No.	chamber,	0.1	no	2 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0 £/yr
New MCC		**11**	**kW**	**33 kW**			
Power supply		**11**	**kVA**	**33 kW**		**175 kWh/d**	**6,427 £/yr**
Total power		**24**	**kW**	**55 kW**		**277 kWh/d**	**10,194 £/yr**

Odour media - Activated carbon			**4 £/kg**
Volume per year (assumes 75% media spent)	39.6 m3	ZY6035	**158 £/kg**
Sludge disposal			
Sludge for disposal			7 m3/d
			2.50% DS
			63.9 tds/year
			2555 m3/yr
Cost for treatment and disposal			305 £/tonne
Total cost			**19,482 £/yr**
Manpower			
Annual salary			35,000 £/yr
Operational Hours/week			hrs/wk
			0 hrs/yr
Additional callouts			4 hrs/month
			48 hrs/yr
Maintenance hours			4 hrs/month
			48 hrs/yr
hours/yr			96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)			5%
Cost / yr			**1,697 £/yr manpower**
Total Opex costs			**31,531 £/year**

B1.6 Option 2D

Item	No	Power consumption	Unit	Installed	Hours run	Power /day	Opex cost/yr
Pumping station - centrifugal submersible pump 1	Duty	2.956	kW	5.5 kW	8	23.648 kWh/d	869 £/yr
Pumping station - centrifugal submersible pump 2	Standby	2.956	kW	5.5 kW	0	0.000 kWh/d	- £/yr
MCC		**5.91**	**KvA**	**11 kW**		**23.6 kWh/d**	
Power supply		**5.91**	**kW**	**11 kW**		**23.6 kWh/d**	**869 £/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	4.37	kW	9 kW	8	34.9 kWh/d	1,284 £/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	4.37	kW	9 kW	0	0 kWh/d	- £/yr
MCC		**4.37**	**KvA**	**9 kW**		**34.9 kWh/d**	
Power supply		**4.37**	**kW**	**9 kW**		**34.9 kWh/d**	**1,284 £/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	2.60	kW	5.5 kW	8	20.8 kWh/d	763 £/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	2.60	kW	5.5 kW	0	0 kWh/d	- £/yr
MCC		**2.60**	**KvA**	**5.5 kW**		**20.8 kWh/d**	
Power supply		**2.60**	**kW**	**5.5 kW**		**20.8 kWh/d**	**763 £/yr**
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3 kW	0	0 kWh/d	- £/yr
Grit classification package plant	Duty/standby	1.5	kW	3 kW	8	12 kWh/d	441 £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Desludging pump 1	Duty	1	kW	3 kW	8 hrs/day	8 kWh/d	294 £/yr
Desludging pump 2	Standby	1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
Half bridge scraper 1		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
Half bridge scraper 2		0.8	kW	1.5 kW	24	19.2 kWh/d	705 £/yr
TF recirculation pump 1		1	kW	3 kW	12 hrs/day	12 kWh/d	441 £/yr
TF recirculation pump 2		1	kW	3 kW	0 hrs/day	0 kWh/d	- £/yr
Desludging pump 1	Duty	0.06	kW	1 kW	8 hrs/day	0.48 kWh/d	18 £/yr
Desludging pump 2	Standby	0.06	kW	1 kW	0 hrs/day	0 kWh/d	- £/yr
Sludge tanks mixing 1	Duty	2.58	kW	4 kW	8 hrs/day	20.608 kWh/d	757 £/yr
Sludge tanks mixing 2	Standby	2.58	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Odour control	Sludge storage tank	1	kW	3 kW	24	24 kWh/d	882
Autosampler	Final effluent	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Flowmeter, 2 no	PST sludge(common), RAS (per FST), SAS	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Dry solids monitor, 2 NO	MLSS, RAS, PST desludge (common)	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Sludge blanket monitor, 4 NO.	PSTs (each), FSTs (each)	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Level transmitters, 2 No.	RAS chamber, FFT flowmeter, Sludge storage tank	0.1	no	2 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Actuated valves, 6 No		0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0 £/yr
New MCC		**16**	**kW**	**39.5 kW**			
Power supply		**15.7**	**kVA**	**39.5 kW**		**210.7 kWh/d**	**6,977 £/yr**
		28.61		**65.00**		**290.02**	**9,893 £/yr**

Odour media - Activated carbon			**4 £/kg**
Volume per year (assumes 75% media spent)	39.6 m3	ZY6035	**158 £/kg**
Sludge disposal			
Sludge for disposal			7 m3/d
			2.50% DS
			63.9 tds/year
			2555 m3/yr
Cost for treatment and disposal			305 £/tonne
Total cost			**19,482 £/yr**
Manpower			
Annual salary			35,000 £/yr
Operational Hours/week			hrs/wk
			0 hrs/yr
Additional callouts			4 hrs/month
			48 hrs/yr
Maintenance hours			4 hrs/month
			48 hrs/yr
hours/yr			96 hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)			5%
			£/yr
Cost / yr			**1,697 manpower**
Total Opex costs			**31,230 £/year**

B1.7 Option 2E

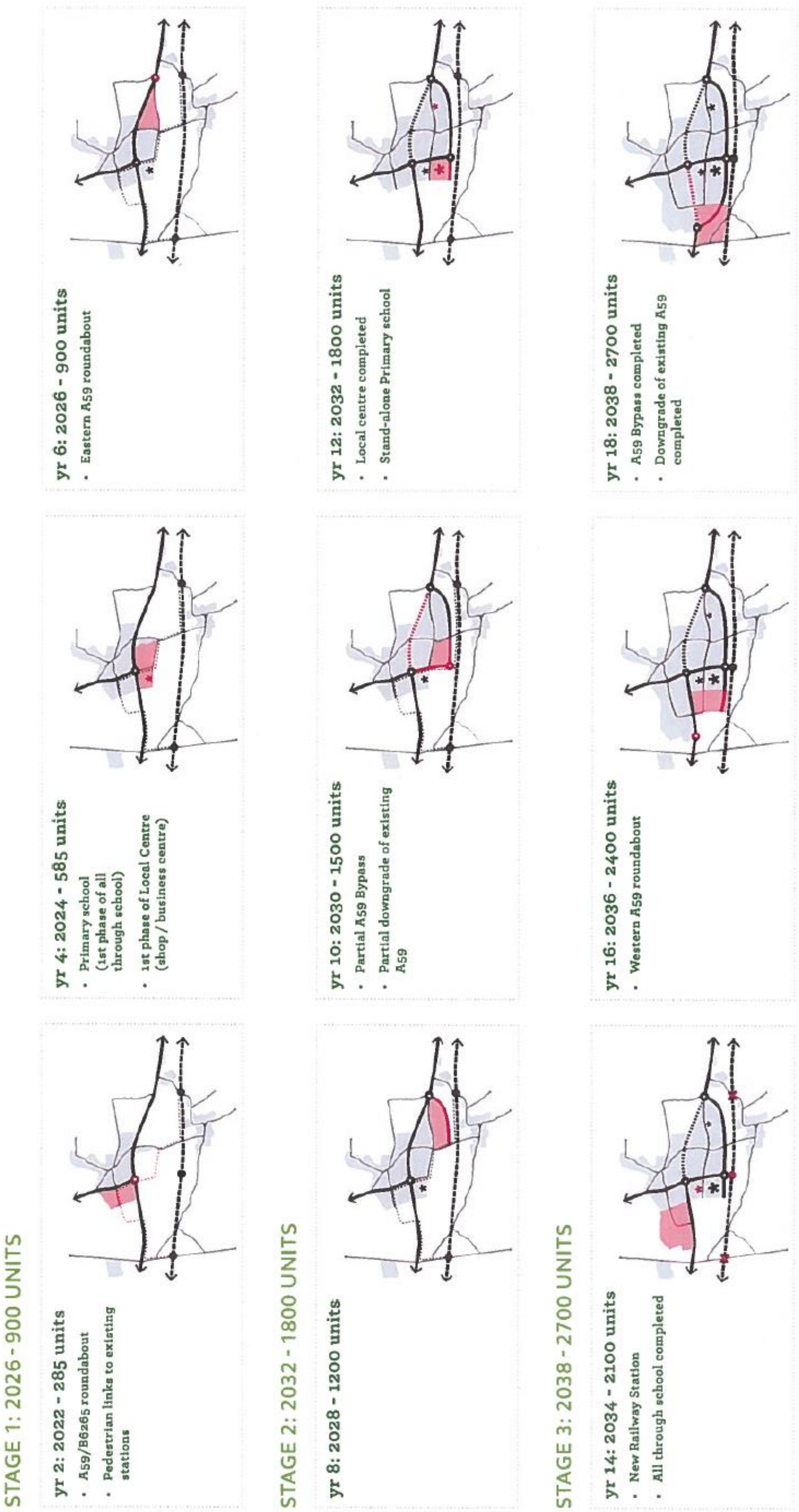
Item	No	Power consumption	Unit	Installed		Hours run	Power /day		Opex cost/yr	
Pumping station - centrifugal submersible pump 1	Duty	3.52	kW	5.5	kW	8	28.1586	kWh/d	1,035	£/yr
Pumping station - centrifugal submersible pump 2	Standby	3.52	kW	5.5	kW	0	0	kWh/d	-	£/yr
MCC		**3.52**	**KvA**	**5.5**	**kW**		**28.2**	**kWh/d**		
Power supply		**3.52**	**kW**	**5.5**	**kW**		**28.2**	**kWh/d**	**1,035**	**£/yr**
Pumping station (PS2) - centrifugal submersible pump 1	Duty	4.13	kW	7.5	kW	8	33.1	kWh/d	1,215	£/yr
Pumping station (PS2) - centrifugal submersible pump 2	Standby	4.13	kW	7.5	kW	0	0	kWh/d	-	£/yr
MCC		**4.13**	**KvA**	**7.5**	**kW**		**33.1**	**kWh/d**		
Power supply		**4.13**	**kW**	**7.5**	**kW**		**33.1**	**kWh/d**	**1,215**	**£/yr**
Pumping station (PS3) - centrifugal submersible pump 1	Duty	3.09	kW	5.5	kW	8	24.8	kWh/d	910	£/yr
Pumping station (PS3) - centrifugal submersible pump 2	Standby	3.09	kW	5.5	kW	0	0	kWh/d	-	£/yr
MCC		**3.09**	**KvA**	**5.5**	**kW**		**24.8**	**kWh/d**		
Power supply		**3.09**	**kW**	**5.5**	**kW**		**24.8**	**kWh/d**	**910**	**£/yr**
Sewerage Pumping Station instrumentation		0.1	kW	1	kW	24 Other	2.4		88	
Autosampler	Final effluent	0.5	kW	1	kW	24	12.0		441	
Inlet Screens and Screens handling package 1	Duty	1.5	kW	3	kW	8	12.0	kWh/d	-	£/yr
Inlet Screens and Screens handling package 2	Standby	1.5	kW	3	kW	0	0.0	kWh/d	-	£/yr
Grit classification package plant	Duty/standby	1.5	kW	3	kW	8	12.0	kWh/d	-	£/yr
Aeration fans	Primary cell blower	13.5	kW	22.5	kW	12	162.0		5,952	
	Secondary cell blower	6.6	kW	11	kW	8	52.8		1,940	
	Nitro-Fac system	11.1		18.5		12	133.2		4,894	
New MCC		**36**	**kW**	**60**	**kW**					
Power supply		**36**	**kVA**	**60**	**kW**		**386**	**kWh/d**	**13,315**	**£/yr**
Total power		**47**	**kW**	**79**	**kW**		**472**	**kWh/d**	**16,474**	**£/yr**

Manpower		
Annual salary	35,000	£/yr
Operational Hours/week		hrs/wk
	0	hrs/yr
Additional callouts	1	hrs/month
	12	hrs/yr
Maintenance hours	2	hrs/month
	24	hrs/yr
hours/yr	36	hrs/yr
% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)	2%	
		£/yr
Cost / yr	**636**	**manpower**
Total Opex costs	**17,111**	**£/year**

Appendix C

Great Hammerton development phasing plans

C1


STAGE 1: 2026 - 900 UNITS
yr 2: 2022 - 285 units
A59/B6265 roundabout
Pedestrian links to existing stations
yr 4: 2024 - 585 units
Primary school (1st phase of all through school)
1st phase of Local Centre (shop / business centre)
yr 6: 2026 - 900 units
Eastern A59 roundabout
STAGE 2: 2032 - 1800 UNITS
yr 8: 2028 - 1200 units
yr 10: 2030 - 1500 units
Partial A59 Bypass
Partial downgrade of existing A59
yr 12: 2032 - 1800 units
Local centre completed
Stand-alone Primary school
STAGE 3: 2038 - 2700 UNITS
yr 14: 2034 - 2100 units
New Railway Station
All through school completed
yr 16: 2036 - 2400 units
Western A59 roundabout
yr 18: 2038 - 2700 units
A59 Bypass completed
Downgrade of existing A59 completed

Appendix D

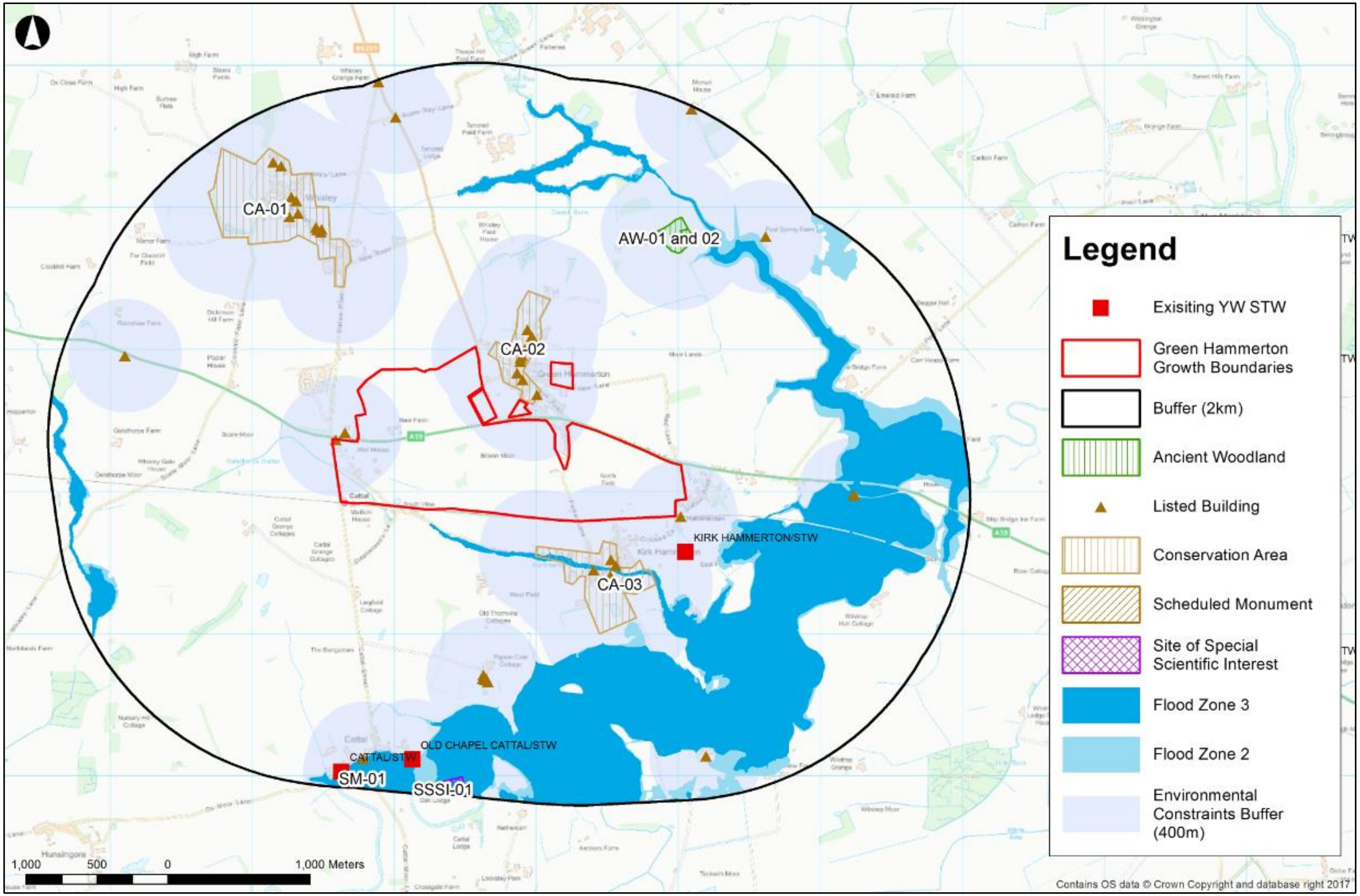
List of Environmental Features

This Appendix provides a full list of environmental and social features identified by the desk-top research (Table 17) and a reference map showing the locations of these features (Figure 16).

Table 17: List of environmental and social features with map reference

Aspects	Map reference	Feature of interest	Location in relation to site
Ecology			
SSSI	SSSI-01	Aubert Ings	1.8km to the south
Ancient woodland	AW-01	Great Wood – Ancient and Semi-Natural Woodland	1.4km to the north east
	AW-02	Great Wood – Ancient Replanted Woodland	1.4km to the north east
Heritage			
Conservation Areas	CA-01	Whixley village	750m to the north west
	CA-02	Green Hammerton	Immediately north
	CA-03	Kirk Hammerton	200m to the south
Scheduled Monument	SM-01	Grade II listed Cattal Bridge	1.7km to the south

Figure 16: Green Hammerton environmental and social features of interest



Appendix E

Five Capital Appraisal Framework

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	Medium negative impact (-2)	Low negative impact (-1)	No impact (0)	Low positive impact (+1)	Medium positive impact (+2)	High positive impact (+3)
Natural	Crops and Livestock	What is the make up of agricultural land in the area e.g. quality/grade and type of food produced? Does the proposed option require land take of high quality agricultural land?	Permanent land take of Grade 1 agricultural land or other agricultural land of more than 5ha	Permanent land take of between 1ha and 5ha agricultural land of Grade 2 or below	Permanent land take of less than 1ha agricultural land of Grade 2 or below	Not relevant / negligible positive or negative impact	Minor positive impact on the ability of the affected land to support crops and livestock	Some positive impact on the ability of the affected land to support crops and livestock	Substantial positive impact on the ability of the affected land to support crops and livestock
	Fisheries	Are there fisheries (commercial or otherwise) which provide a food resource? (Avoid double counting with more recreational-based angling i.e. coarse fishing or catch and release). Are shellfish harvested in the area?	Substantial negative impact on the ability of the affected land to support fisheries	Some negative impact on the ability of the affected land to support fisheries	Minor negative impact on the ability of the affected land to support fisheries		Minor positive impact on the ability of the affected land to support fisheries	Some positive impact on the ability of the affected land to support fisheries	Substantial positive impact on the ability of the affected land to support fisheries
	Energy	Does the option allow energy production from water resources? What's the energy consumption during operation? Does it come from a sustainable source?	Operational energy consumption of over 0.7kWh/m3	Operational energy consumption of between 0.5 and 0.7kWh/m3	Operational energy consumption of less than 0.5kWh/m3		Minor net decrease in energy consumption during construction and/or operation	Some net decrease in energy consumption during construction and/or operation	Substantial net increase in energy consumption during construction and operation
	Water supply	How would the option change the quality or quantity of freshwater left in the environment? Does it include demand reduction measures?	Substantial negative impact on the availability of freshwater left in the environment, water demand increase of more than 5Ml/d	Some negative impact on the availability of freshwater left in the environment, water demand increase of between 1 and 5Ml/d, or options without demand reduction measures	Minor negative impact on the availability of freshwater left in the environment, water demand increase of less than 1Ml/d, or options which include demand reduction measures		Minor positive impact on the availability of freshwater left in the environment	Some positive impact on the availability of freshwater left in the environment	Substantial positive impact on the availability of freshwater left in the environment
	Global climate	Will the option affect any major peat deposits or large lakes and are these capturing carbon or releasing it? What is the whole life carbon associated with the option?	Substantial negative impact on the ability of affected land to sequester carbon. Large net increase in carbon emissions	Some negative impact on the ability of affected land to sequester carbon. Some net increase in carbon emissions	Minor negative impact on the ability of affected land to sequester carbon. Small net increase in carbon emissions		Minor positive impact on the ability of affected land to sequester carbon. Small net decrease in carbon emissions	Some positive impact on the ability of affected land to sequester carbon. Some net decrease in carbon emissions	Substantial positive impact on the ability of affected land to sequester carbon. Large net decrease in carbon emissions
	Air quality	Are there any known issues associated with car use and industry? Are there any nearby AQMA that will be affected by the option? Are there any nearby receptors? Will there be odour issues?	Site located within AQMA, or sensitive receptors within 200m	Site located adjacent to AQMA, or sensitive receptors within 400m	Site located within 400m of AQMA, or no sensitive receptors within 400m		Minor positive impact on air quality and odour	Some positive impact on air quality and odour	Substantial positive impact on air quality and odour
	Flood Regulation	Will the option require land take in Flood Zones 2 and 3? Consider how the option will impact on run-off and flood risk.	Land take within Flood Zone 2 or 3 of more than 10ha	Land take within Flood Zone 2 or 3 of between 5ha and 10ha	Land take within Flood Zone 2 or 3 of less than 5ha		Minor positive impact on the attenuation of water	Some positive impact on the attenuation of water	Substantial positive impact on the attenuation of water
	Water quality	Will the option positively or negatively affect water quality? Will the option improve the resilience of the YW operation that ensures the provision of quality water to users?	Substantial pollution of water quality with drop in WFD class or creating new red DWSP risk	Some pollution of water quality	Minor pollution of water quality with no drop in WFD class or element, slight impact on DWSP risk		Minor water quality improvement within WFD class or element. No impact on DWSP risks.	Some water quality improvement	Substantial water quality improvement, resulting in WFD class removal or avoidance of a DWSP risk.
	Pollination	Will the option impact on land which provide habitat for insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds?	Substantial negative impact on pollination, land take of woodland or grassland of more than 5ha	Some negative impact on pollination, land take of woodland or grassland of between 1 and 5ha	Minor negative impact on pollination, land take of woodland or grassland of less than 1ha		Minor positive impact on pollination	Some positive impact on pollination	Substantial positive impact on pollination
	Recreation	Does the option temporarily or permanently affect the use of recreational site and facilities e.g. country park, footpath along rivers and lakes, PRoWs? Does the option enhance the water environment for recreational use?	New infrastructure that permanently impact on recreation land	New pipeline of more than 1km, intersecting PRoW or national trails	New pipeline of less than 1km, intersecting PRoW		Minor positive impact on the recreational offering provided by affected land	Some positive impact on the recreational offering provided by affected land	Substantial positive impact on the recreational offering provided by affected land

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	Medium negative impact (-2)	Low negative impact (-1)	No impact (0)	Low positive impact (+1)	Medium positive impact (+2)	High positive impact (+3)
	Amenity	Consider the presence of designated landscapes (National Parks, Heritage Coasts, AONBs), city scapes and areas of high visual amenity, will these be affected by the option?	Substantial negative impact on amenity	Some negative impact on amenity	Minor negative impact on amenity		Minor positive impact on amenity	Some positive impact on amenity	Substantial positive impact on amenity
	Non-Use Value	This is the value people place on simply knowing that something exists, often associated with valued habitats, flora and fauna, landscape or heritage assets. Does the option affect any nationally or internationally important areas or designations?	Substantial negative impact on areas or designations that are likely to provide a non-use value	Some negative impact on areas or designations that are likely to provide a non-use value	Minor negative impact on areas or designations that are likely to provide a non-use value		Minor positive impact on areas or designations that are likely to provide a non-use value	Some positive impact on areas or designations that are likely to provide a non-use value	Substantial positive impact on areas or designations that are likely to provide a non-use value
Social	Physical activity	Does the option promote physical activities and wellbeing? Does the option provide new green/blue infrastructure that will encourage active lifestyle of citizens?	Substantial negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Minor negative impact or net decrease in green/blue infrastructure or assets that promote physical activities		Minor positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Substantial positive impact or net decrease in green/blue infrastructure or assets that promote physical activities
	Quality of place	Does the option improve the quality of place in the local community? Does it provide new or improved community space/facilities?	High volume of traffic during construction and operation, down-wind receptors within 100m of new WWTW	Medium volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW	Low volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW		Minor positive impact on quality of place	Some positive impact on quality of place	Substantial positive impact on quality of place
	Trust	Does the option have the potential to damage YW's reputation and stakeholder trust? Does it disbenefit the local community?	Substantial negative impact on stakeholder trust or national media coverage and very high social media activity. Cited as laggard organisation	Some negative impact on stakeholder trust or regional media coverage and medium social media activity	Minor negative impact on stakeholder trust or local media coverage and very low social media activity		Minor positive impact on stakeholder trust or local media coverage and very low social media activity	Some positive impact on stakeholder trust or regional media coverage and medium social media activity	Substantial positive impact on stakeholder trust or national media coverage and very high social media activity. Cited as leading organisation
Human	Employment	Does the option offer employment opportunities? Are there policies to encourage the employment of local work force?	Loss of 50 or more existing FTE.	Loss of between 6 and 49 existing FTE	Loss of up to 5 existing FTE.		Enabling up to 15 new FTE.	Enabling between 15 and 49 FTE.	Enabling 50 or more FTE.
	Skills	Does the option offer the opportunity to upskill YW employees? Does it offer the opportunity for training and/or apprentice of the local labour force?	No opportunity for upskilling or training				Minor positive impact on upskilling and training, potential to support up to 0.5 apprenticeship by the scheme	Some positive impact on upskilling and training, potential to support up to 1 apprenticeship by the scheme	Substantial positive impact on upskilling and training, potential to support more than 1 apprenticeship by the scheme
	Health & Safety	Does the option pose a health and safety risk?	Creation of new Red business risk or escalation of existing business risk to Red threshold (strategic risk scale)	Creation of new Amber business risk or escalation of existing business risk to Amber threshold (strategic risk scale)	Creation of new Green business risk (strategic risk scale)		Removal of existing Green business risk (strategic risk scale)	Removal of existing Amber business risk or reduction of existing business risk to remove it from Amber threshold (strategic risk scale)	Removal of existing Red business risk or reduction of existing business risk to remove it from Red threshold (strategic risk scale)
	Local economy	Does the option benefit local economy? Does it create employment opportunities for local work force? Does it affect existing dwellings?	Loss of existing homes of more than 50 units	Loss of existing homes of between 10 and 50 units	Loss of existing homes of less than 10 units		Creating new homes of less than 1000 units	Enabling new homes of between 1000 and 5000 units	Creating new homes of over 5000 units
F&M	Private costs	Does the option impact on the long term financial viability of YW? Does it reduce YW's financial income or operational cost?	Loss of existing financial income or increased operating costs of £1m per year or more	Loss of existing financial income or increased operating costs of between £400k and £1m per year	Loss of existing financial income or increased operating costs of up to £400k per year		Creation of new financial income or reduced operating costs of up to £400k per year	Creation of new financial income or reduced operating costs of between £400,000 and £1m per year	Creation of new financial income or reduced operating costs of £1m per year or more
	Private benefits	Does the option expend on existing assets? Does it create new assets? Does it make any YW's assets redundant?	No private benefits				Increased asset value by up to £2m or Capital receipt of up to £2m	Increased asset value by between £2m and £10m or Capital receipt of	Increased asset value by £10m or more Capital receipt of £8m or more

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	Medium negative impact (-2)	Low negative impact (-1)	No impact (0)	Low positive impact (+1)	Medium positive impact (+2)	High positive impact (+3)
								between £2m and £10m	

Part of Appendix 8I:
v. AMP7 Growth Planning, Parlington
Author: Arup

YorkshireWater

Yorkshire Water Services Ltd

AMP7 Growth Planning

Parlington

001

Issue | 16 March 2018

Job number 256398-00

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Document Verification

ARUP

Job title		AMP7 Growth Planning			**Job number** 256398-00
Document title		Parlington			**File reference**
Document ref		001			
Revision	**Date**	**Filename**	Parlington Report draft v0.docx		
Draft 1	21 Aug 2017	**Description**	First draft		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue	9 Jan 2018	**Filename**	Parlington Report Issue.docx		
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue	16 Mar 2018	**Filename**	Parlington Report Issue_rev2.docx		
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

Appendices

1 Introduction

Local authorities are required to allocate land for housing development within their Local Plans for housing development to meet demand needs for population growth in the future. The Yorkshire Water Land Use Planning Team has received the latest population data to 2035 from Edge Analytics that combines Local Plan information and trend based projections.

A new settlement on the Parlington Estate (grid ref SE4236) to serve the development of up to 5,000 houses (with approximately 4,000 new houses being a more realistic capacity) has been identified as a major future site that could have a significant impact on YW assets and operations (wastewater infrastructure and treatment and clean water infrastructure).

Discussions with the developer's agent (AECOM) have suggested that development will commence in Q3/Q4 2022 with the first houses being occupied in Q1 2024. An indicative delivery of 185 houses per annum is envisaged (resulting in the delivery of 1,850 houses by the end of 2033). Early planning for AMP7 and AMP8 is a key requirement as the site is not currently served by wastewater or water infrastructure.

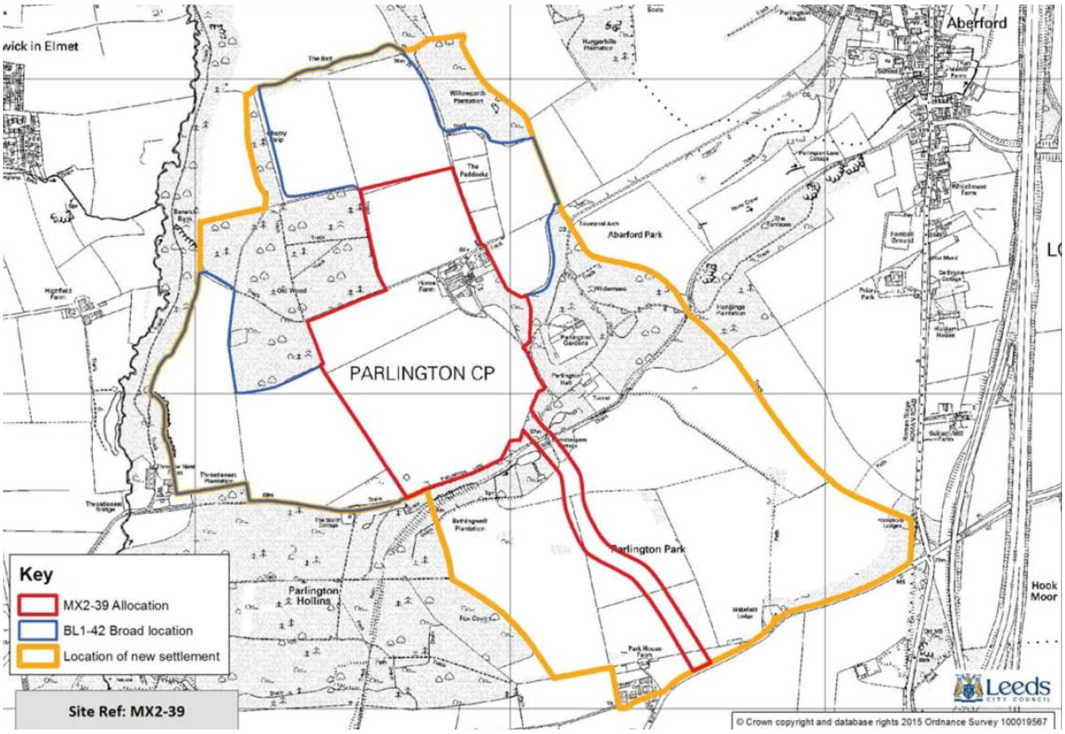
This report evaluates the risks and opportunities of the various options available to mitigate the impact of the new development and develops a number of costed solutions that can be considered in the PR19 business plan. Opportunities to reduce capital and operational carbon have also been considered as part of this study.

2 Future growth

2.1 Location

The site has been agreed as an allocation by the Council within its Site Allocations Plan which will be the subject of an Examination during summer 2018. The site is captured by the Leeds Site Allocations Plan (January 2018) within three boundaries as shown in Figure 1.

Figure 1: Parlington development location



2.2 Phasing

Information on the Parlington development was made available by AECOM, the developer's agent, during meetings on 6th July 2017 and 6th March 2018. This was used to define the location, quantum and phasing of the development for this study.

The following documents have also been referred to:

- Parlington Masterplan Studies (November 2016)[1]
- Parlington – A submission to the Leeds Site Allocation Plan (March 2016)[2]
- Parlington representations [3]

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[1] AECOM (2016) Parlington Masterplan Studies. Available from: http://www.parlingtonvillage.co.uk/submission/ [accessed 30/08/2017]

[2] AECOM (2016) Parlington: a submission to the Leeds Site Allocation Plan. Available from: http://www.parlingtonvillage.co.uk/submission/ [accessed 30/08/2017]

[3] http://www.leeds.gov.uk/council/Pages/Site-Allocations-Plan-Publication-Draft-Representations.aspx [accessed on 12 March 2018]

The delivery of Parlington can be summarised as follows:

1. 792 units (including 5ha of employment and various community infrastructure) to be delivered by March 2028 (within the ‘MX2-39 Allocation’ boundary);
2. 1,058 units (including 6.5ha of employment) to be delivered between April 2028 and December 2033 (within the ‘BL1-42 Broad location’ if approved in a subsequent Local Plan review)
3. Up to a further 2,150 units to be delivered beyond 2033. subject to allocation following a further Local Plan review.

Development of the land identified as “Broad Location” will be subject to a review of the Local Plan to permit further release of Green Belt land.

Table 1 shows the projected cumulative development phasing for Parlington in 2033. Units to be delivered over each AMP were calculated from linear extrapolated annual figures.

Table 1: Parlington development phasing

Item	**AMP7**				**AMP8**					**AMP9**					**AMP10**		
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**
Units (cumulative)*	-	-	-	-	-	-	-	-	-	-	-	1,850	-	-	-	-	-
Units (annual)**	-	-	185	185	185	185	185	185	185	185	185	185	-	-	-	-	-
Units (per AMP)	370				925					555					-		

*Cumulative phasing figures as provided by AECOM during the meeting on 6th March 2018
**Linear extrapolated annual residential units from cumulative phasing figures

An additional 2% of the total population has been assumed as employment. This is based on YW guidelines of 40 jobs/hectare as a worst case scenario, rather than the assumptions provided by AECOM during the meeting on 6th July 2017, which equate to 0.5%.

An additional 5.2% of the total population has been assumed as school growth. This is in line with the assumptions provided by AECOM during the meeting on 6th July 2017.

3 Assessment of impacts to YW assets

3.1 Water demand

A high-level water demand assessment was undertaken taking into account the developer's proposed phasing plans and on the basis of the following parameters:

- Per capita water demand of 140l/d per person;
- Household occupancy rate of 2.3 people.

The projected water demand up to year 2045 is summarised in Table 2.

Table 2: Parlington development site projected water demand

Item	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	Total Demand
	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45	
Housing units	-	370	925	555	-	-	1,850
Average Day Average Demand (Domestic) l/s	-	1.91	4.77	2.86	-	-	9.54

3.2 Flows and Loads

The sewage flows and loads have been calculated based on the information provided in the Parlington development with some figures selected from YWS guidelines where applicable. Key assumptions are as follows:

- Per capita sewage discharge of 130 l/d per person as per Asset Standard
- Household occupancy rate of 2.3 people.
- Infiltration for new residents of 40 l/d per person (in line with the YW Flow Calculation Asset Standard)
- As requested by the YW brief, only foul flows from the Parlington development were assumed as the development will discharge surface water separately (surface water to be addressed by the developer)

The projected cumulative sewage flows and loads over the next four AMPs, assuming no trade or imports, are as follows:

Table 3 - Parlington sewage flows and loads

Item	AMP7	AMP8	AMP9	AMP10
	2020-25	2025-30	2030-35	2035-40
Housing units	370	925	555	-
Cumulative housing units	370	1,295	1,850	1,850
Population equivalent, p.e.	851	2,979	4.225	4,225
Dry weather flow (DWF), m^3/d	155	516	728	728
Flow to Full Treatment (FFT), m^3/d	396	1,311	1,847	1,847
BOD load, kg/d	36	125	177	177

Item	AMP7	AMP8	AMP9	AMP10
	2020-25	2025-30	2030-35	2035-40
Suspended solids load, k/d	42	274	323	323
Ammonia load, kg/d	7	23	33	33

3.3 Discharge consents

As an initial check, the consents of the local Wastewater Treatment Works (WwTWs) were reviewed on the basis that the discharge for Parlington would enter the same watercourse as a local works. The local works are as follows:

- Aberford WwTW
- Barwick in Elmet WwTW
- Micklefield WwTW

The working consents for the new works were assumed to be in line with the tightest consent detailed in the Mineral Media Filters Asset Standard in order to provide a worst case footprint; this corresponds to 20mg/l BOD and 5 mg/l ammonia on a 95%ile basis. The working consent has been agreed with the YWS Environmental Regulation team.

In the event that a tighter consent is set, it is expected that an Activated Sludge Plant (ASP) shall be the standard process selected for biological treatment. The discharge consent shall be set in discussion with the EA.

The local works consents, discharge locations, and the working consent for Parlington is summarised below:

Table 4 - Parlington and local works consent

Site	BOD consent (95%ile)	SS consent (95%ile)	Ammonia consent (95%ile)	Discharge watercourse
Aberford	25	50	15	Cock Beck
Barwick in Elmet	25	80	10	Cock Beck
Micklefield	22	60	10	Sheep Dike
Parlington	20	40	5	Cock Beck (proposed)

3.4 Identified risks and impacts

3.4.1 Water Supply

The Parlington development site is situated to the north east of Leeds. The Leeds High Level Water Supply System (WSS) is to the west, the Garforth and Elmet WSS to the south and the Wetherby WSS to the north.

Existing water supply infrastructure in the vicinity of the site includes:

- Two separate networks of small diameter mains in the Barwick in Elmet and Aberford villages. The two networks are linked via a 6-inch diameter main on Aberford Road which has a 3-inch diameter branch that runs through the Parlington site to supply a few existing properties. These mains, which are part of the Leeds High Level WSS, have no capacity to provide water supply to the proposed development site.
- Hook Moor Service Reservoir (SRE) to the south east of the site which is supplied from the Leeds Grid and Garforth WSS. The top water level in the SRE is 92m and Ground elevation within the development site is in the range of 65 to 90m. Therefore, the existing head from the SRE will not adequate to provide water supply to the higher elevation properties without the installation of booster pumps. YWS have indicated that this would not be preferred due to the associated recurring operational costs of pumping water and pump maintenance. In addition, YWS consider water supply from the Garforth WSS, which originates from the Leeds Grid, to be expensive.
- A 3-inch diameter from the Garforth and Elmet WSS terminating at Throstle Nest Farm to the west of the site (not annotated in Figure 2). As with the other small diameter mains discussed earlier, this main is too small to be considered for providing water supply to the Parlington site.

  A 12-inch and an 8-inch running in parallel in a north to south orientation on the eastern side of the proposed site. Both mains are linked to the Garforth WSS and the Hook Moor SRE. The option to supply the Parlington site using the 12" main has been considered and is discussed in Section 6.

  A 12-inch main along the A64/York Road from the Leeds High level which supplies a number of District Metered Areas (DMAs) and the Hazel Wood SRE. Refer to Section 6 on how this main and the associated system can be utilised to provide water supply to the proposed development site.

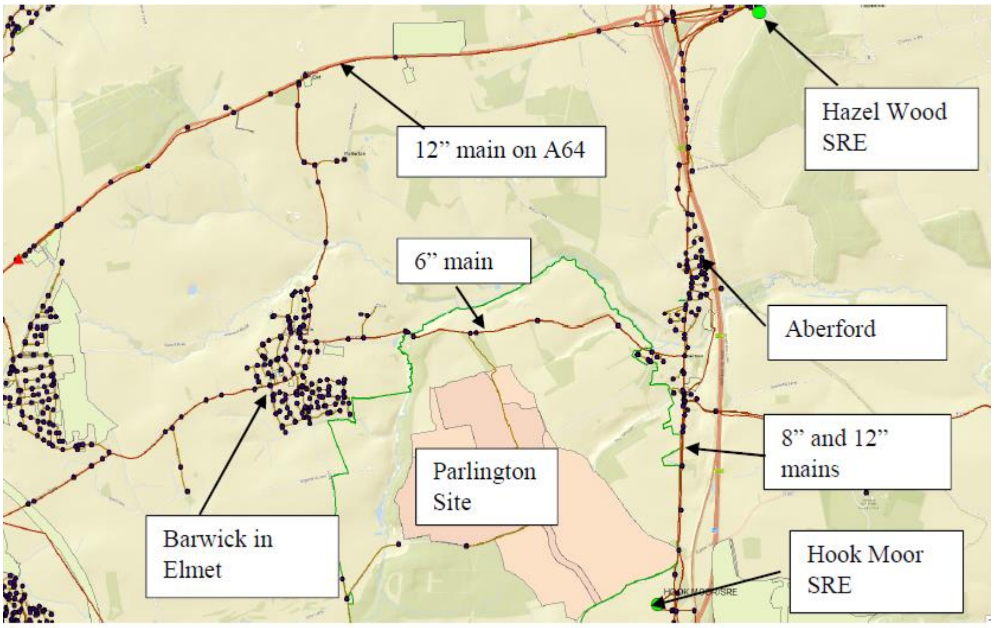


Figure 2: Existing water supply system near Parlington site

3.4.2 Wastewater treatment

Aberford WwTW, Barwick in Elmet WwTW and Micklefield WwTW are located within 4.0 km of the Parlington development. These works have been assessed for capacity by comparing the Full Flow to Treatment (FFT) consent and the measured flows, and by comparing the final effluent quality to the current consent. The results for each site are as follows:

Table 5 - Parlington local works capacity review (2012 – 2017)

Site	Aberford	Barwick in Elmet	Micklefield
Measured 95%ile flow, m^3/d	606	1,599	753
Measured maximum flow, m^3/d	1,542	2,280	1,315
Consented FFT, m^3/d	1,664 (All flow consent)	1,787	2,036
Current Population Equivalent	1,435	3,278	2,048

Table 6 - Parlington local works treatment capacity review (2012 – 2017)

Site	Aberford	Barwick in Elmet	Micklefield
No. samples	72	75	60
Measured average BOD, mg/l	10.6	6.2	6.4
Measured 95%ile BOD, mg/l	16	11	14
Consented 95%ile BOD, mg/l	25	25	22
Measured average Ammonia, mg/l	2.5	2.8	2.2
Measured 95%ile Ammonia, mg/l	5.3	6.3	5.25
Consented 95%ile Ammonia, mg/l	15	10	10
Measured average SS, mg/l	12.3	13.5	12.5
Measured 95%ile SS, mg/l	24	28.2	39.2
Consented 95%ile SS, mg/l	50	80	60

The Aberford sample data contained no consent breaches, Barwick in Elmet contained a single ammonia sample failure and Micklefield contained a single sample failure for both ammonia and solids.

As the existing works are small in size compared to the size of the proposed Parlington development, no significant spare capacity was identified and any upgrade to take the new flows would most likely result in a near complete rebuild of the existing works.

3.4.3 Sewerage

The Parlington site is located east of Leeds, between two smaller towns: Barwick-in-Elmet and Aberford, which have existing wastewater networks. According to

YW’s GIS database, the existing site is not currently served by a YW network. The nearest existing networks are as described below.

Barwick-in-Elmet’s existing network is upstream from the majority of the development, across the other side of the relatively steep sided Cock Beck and upstream from the Barwick-in-Elmet WwTW. As such, it is not suitable to use this network for the new development flows.

The existing Aberford wastewater network lies downstream from the majority of the new development. The layout is presented below in Figure 3. Blue pipelines represent the surface water pipes, brown pipelines the foul pipes and red pipelines the combined sewers. The location of WwTW is also presented on the figure as well as part of the new development site.

There is no existing hydraulic model in the Parlington area, therefore there is no model information about Aberford’s existing network’s hydraulic capacity. From discussion with Mark Russell, YW Modelling Manager, we have been advised that based on previous work, the sewer network in Aberford is known to already be operating at capacity, or above. Therefore, it is not recommended to connect the additional flows from the new development site into the existing network as this is likely to significantly increase risks to the YW network in Aberford.

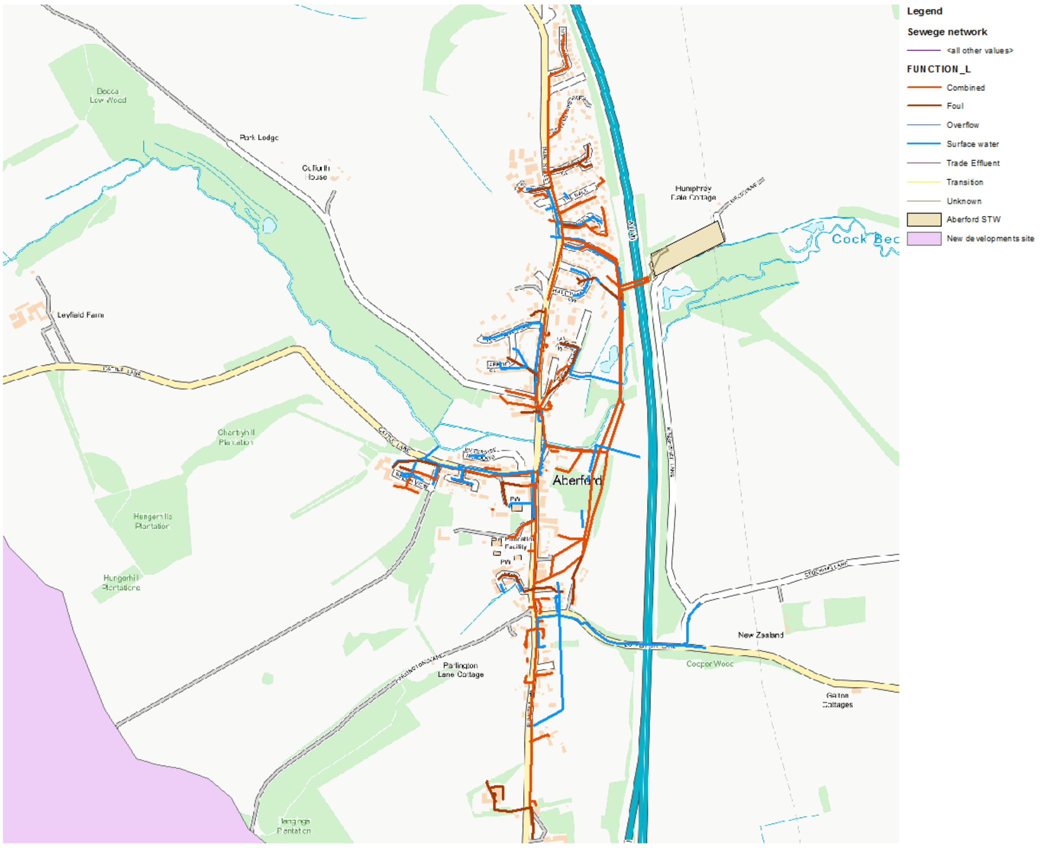


Figure 3: Aberford existing wastewater network layout

4 Environmental and social constraints

A desktop based study was undertaken to understand the existing environmental and social constraints at the growth location to inform the development of clean water and wastewater infrastructure solutions. The study area was defined by a two-kilometre radius measured from the development boundary. The search has returned a number of features of interest. A summary of these features are provided below and a full list are included in Appendix C.

4.1 Ecology

The search identified one statutory designation within the study area. Hook Moor, a Site of Special Scientific Interest (SSSI) is located along the road embankment at Junction 43 of the A1(M), approximately 120m to the east of the south-eastern corner of the site.

There are a number of non-statutory designations within the study area, including:

- *Sites of Ecological or Geological Interest (SEGI):* These are areas designated by LCC as of countywide importance for their flora, fauna, geological or physiological features. There are four SEGI within the study area, as shown in Figure 4.
- *Local Wildlife Sites (LWS):* These are areas designated by Leeds City Council which are of countywide importance for the conservation of wildlife. There are five LWS within the study area, as shown in Figure 4.
- *Leeds Habitat Network (LHN):* The LHN aims to protect the integrity and connectivity of areas in Leeds with nature conservation value.
- *Ancient woodland:* An inventory administrated by natural England of ancient woodland sites in England. There are three areas of ancient woodland within the study area as shown in Figure 4.

4.2 Heritage

There are nine Scheduled Monuments within the study area, the closest to site is an Iron Age and Romano-British Settlement south of Hungerhills Plantation to the west of Aberford village. Grade II listed Lotherton hall, a Registered Parks and Gardens, is located 1.6km east of the site. 47 Listed Buildings were identified within the study area, including four Grade II* listings and 43 Grade II listings. They are mostly concentrated in and around Aberford village. The locations of heritage features are shown in Figure 4.

4.3 Landscape and recreation

There is no nationally or regionally designated landscape areas within the study area. However, the study has highlighted some features of interest for landscape and recreation, including:

- *Country Park:* An inventory administrated by Natural England of public green spaces often at the edge of urban areas which provide places to enjoy the outdoors and experience nature in an informal semi-rural park setting. The Lotherton Hall Estate, registered as a country park, is located 1.2km to the east of the site.
- *National Cycle Network (NCN):* The NCN is a series of traffic-free paths and quiet, on-road cycling and walking routes that connect major towns and cities. The National Cycle route 66 runs through the study area, connecting Manchester to Spurn Head via Leeds.
- *Public Rights of Way (PRoW):* There are a number of Public Rights of Ways within the study area. Leeds City Council has not released under licence the data about their rights of ways, as such, the PRoW in the study area has not been mapped. However, PRoW is available from Ordnance Survey 1:25,000 Colour Raster map and have been given due consideration during option development.

4.4 Flood risk

Both Flood Zone 2 and 3 are present in the study area as shown in Figure 4, although the entire Phase 1 development is within Flood Zone 1. These Flood Zones refer to the probability of river and sea flooding without the presence of defences and are defined as below:

- *Flood Zone 2:* Medium probability. 1 in 100~1,000 annual probability of river flooding or 1 in 200~1,000 annual probability of sea flooding.
- *Flood Zone 3:* High probability. 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding.

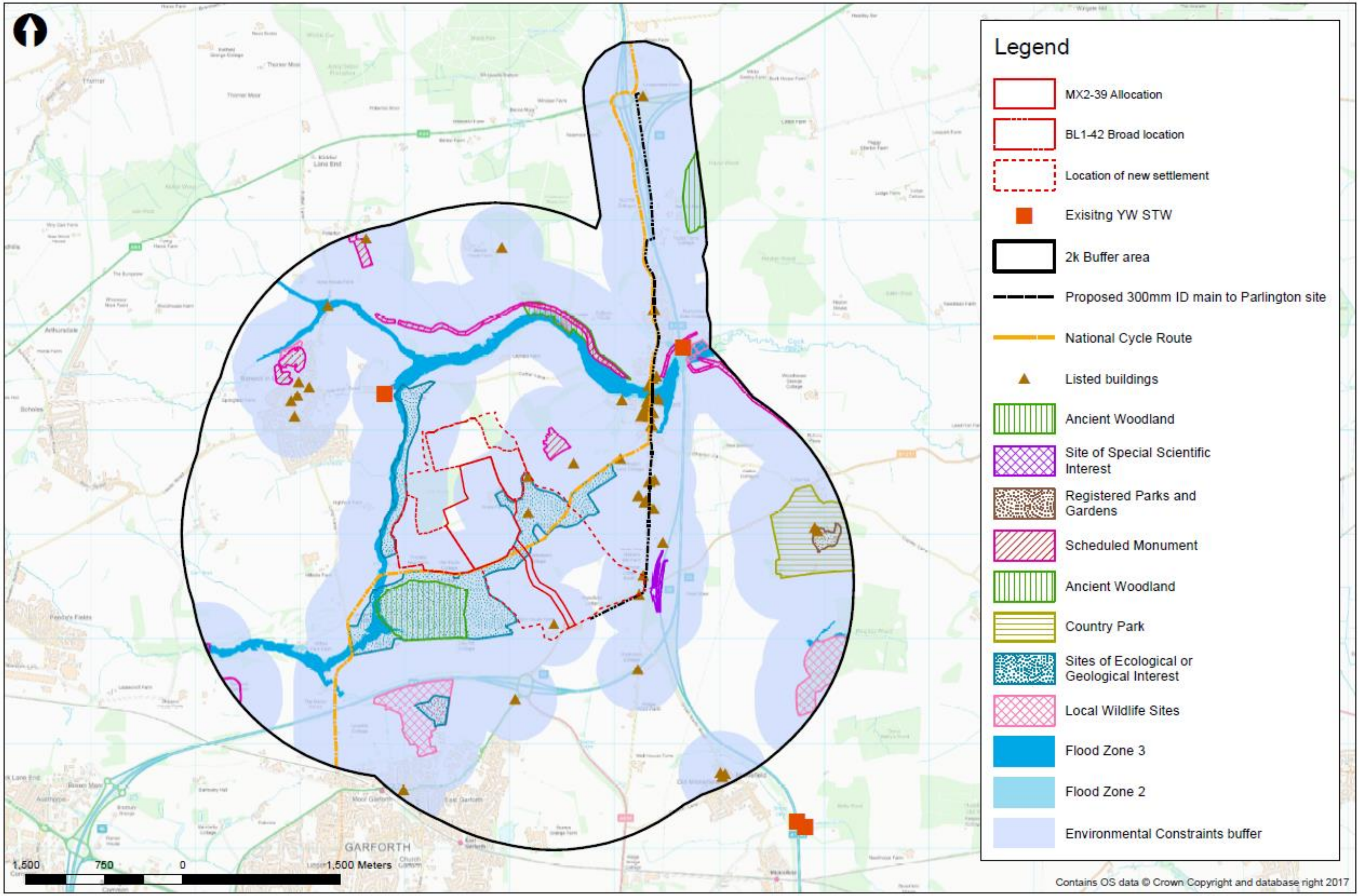
4.5 Sensitive receptors

Existing settlements in the vicinity of the site include Aberford circa 1km to the east, Barwick in Elmet circa 500m to the north west and Garforth circa 1.5km to the south. There are also a number of smaller clusters or individual dwellings scattered across the study area. Existing commercial and residential properties have been used to represent sensitive receptors.

4.6 Approach to constraints mapping

For the purpose of option development, a buffer of 400m has been applied to all the environmental and social constraints identified, with the exception of Flood Zones, to create a screening map highlighting the areas that are most suitable for new water and wastewater infrastructure from an environmental perspective. The mapping is used during option development to inform the siting and routing of new infrastructure. The screening map is shown in Figure 4.

Figure 4: Parlington environmental and social constraints



5 Initial option identification and appraisal

5.1 Clean water infrastructure options

5.1.1 AMP7 option

The ground levels around the locations of the proposed 370 units in AMP7 are estimated at 65-70mAOD. Hook Moor SRE to the south east of the site, which is fed from the Leeds Grid and Garforth WSS, could provide the required water supply in AMP7. However, this is not a long term solution and further works are required beyond AMP7. These are detailed in section 5.1.2 and later in this report.

It is noted that if the locations and/or the number of the AMP7 development change, the Hook Moor SRE option may not be feasible.

5.1.2 Future options

The main clean water infrastructure options are presented in Figure 5 and Figure 6.

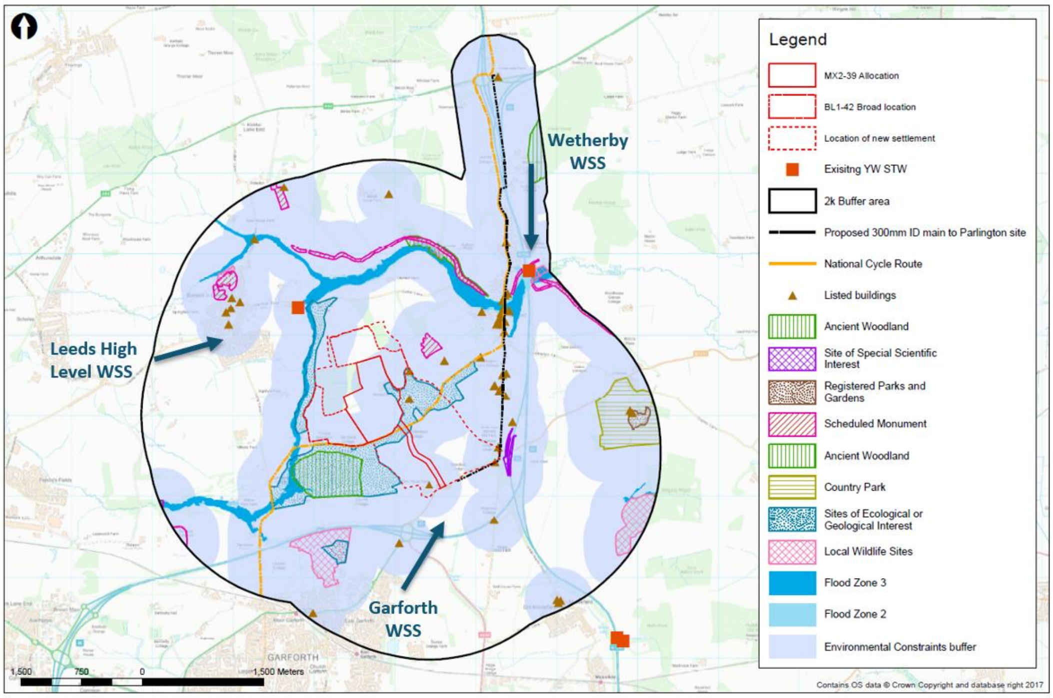


Figure 5: Water supply options for the Parlington development: Wetherby and Garforth

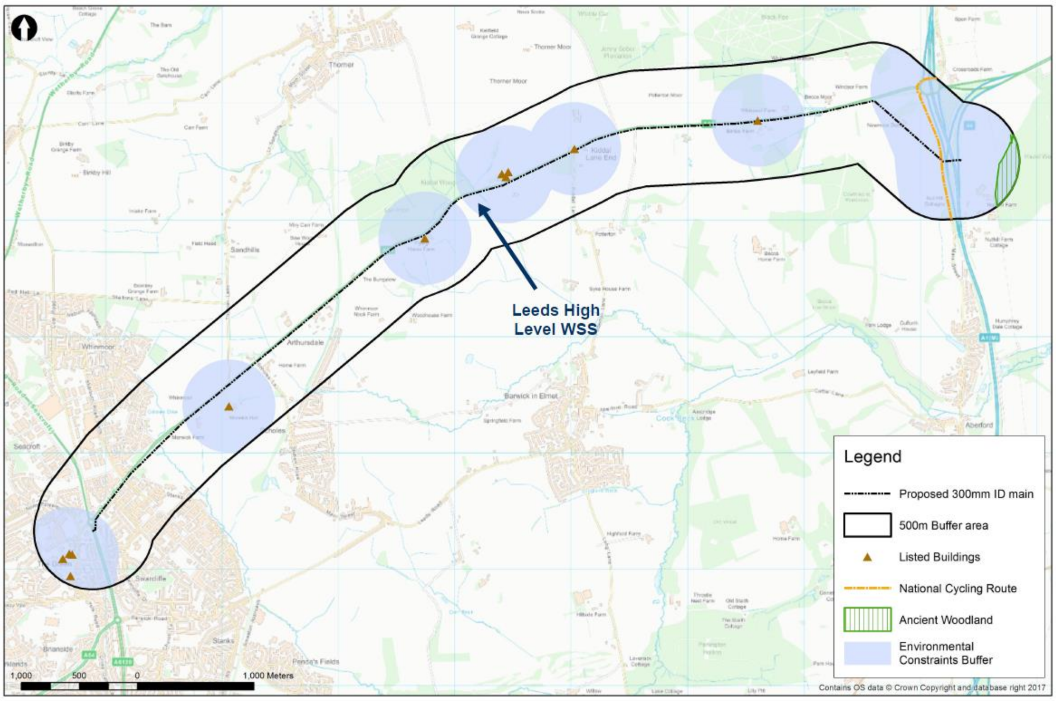


Figure 6: Water supply options for the Parlington development: Leeds HL

The options have been screened against clean water infrastructure criteria and environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	**Clean water infrastructure criteria**				
	Distance	**Pumping**	**Crossings**	**Commentary**	**Low Carbon potential**
Supply from Garforth WSS	Limited new pipework required	- new booster pumping station required	None	- Top water level in Hook Moor SRE is not adequate for the full development. Booster pumping station is required. - New SRE / upsizing of existing SRE will be required which would be costly - The existing reservoir is supplied from the Leeds Grid which is “expensive” water due to the level of upstream pumping required. - High OPEX solution not favourable to YWS due to the pumping required - Hydraulic distribution network model is not available.	No
Supply from Leeds High	9 km of 300mm dia pipe	- no pumping required	4 major road crossings A64 and	- 12 inch main from Leeds High Level WSS currently overloaded. - 9km of new 300mm dia. duplicate mains required.	Yes

Option	Clean water infrastructure criteria				
	Distance	**Pumping**	**Crossings**	**Commentary**	**Low Carbon potential**
Level WSS			A1(M)	- 2.2km of new 300mm dia. main required.	
Supply from Wetherby WSS	2.2km of 300mm dia pipe	- no pumping required	1 major road crossing A64	- Flushing of 4.4km 12-inch /300 dia main - Re-zoning of 2 DMAs - Installation of 2.2km 300 dia. main - Not capable of meeting the total demand for the fully developed site (AMP7 only).	Yes

The future options involving the supply of the Parlington site from the Leeds High Level WSS and Wetherby WSS were shortlisted for further investigation later in this report.

5.2 Wastewater treatment options

The main locations for additional wastewater treatment are listed below and shown in Figure 8.

ID	Option	ID	Option
A	Aberford WwTW expansion	E	Barwick Bank (new WwTW)
B	Barwick in Elmet WwTW expansion	F	Throstle Nest WwTW (new WwTW)
C	Micklefield WwTW expansion	G	Parlington Lane WwTW (new WwTW)
D	Off Cattle Lane WwTW (new WwTW)	H	Transfer to Knostrop WwTW

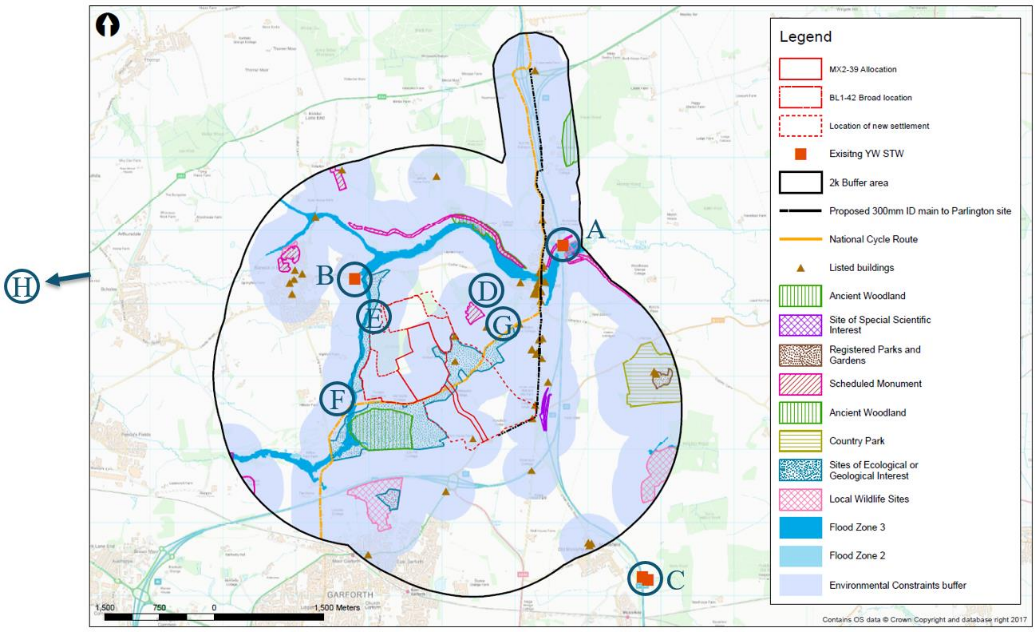


Figure 7: Possible locations for wastewater treatment

The locations have been screened against several wastewater infrastructure and treatment criteria as well as environmental and social constraints. Red shading indicates the criteria upon which an option has been discounted.

Option	Wastewater infrastructure criteria				Wastewater treatment criteria				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Constraints
Aberford WwTW expansion	2.0 km	- pumping required	- Crossing of a motorway: No information available on the existing 2 no sewer crossings. We have assumed that the existing culvert can not be utilised (even if there was space, running a foul pipe over a water body carries risks) so a new crossing would be needed. - Crossing beneath Cock Beck in Aberford.	- No model information of gravity sewers in Aberford. - Gravity sewers in Aberford have been known to have flooding/ capacity problems in recent past, therefore not possible to add additional flows.	The site has very limited additional capacity relative to the size of works: 1,435 current PE vs Parlington PE of 9,260. This would require a major rebuild of the works, with little benefit in trying to re-use any existing assets. The Aberford catchment may also be subject to some minor growth of its own that it will need to accommodate.	No	- Land purchase required	Yes	- Rural location next to motorway	- The WwTW is in close proximity to Aberford Dyke System (Scheduled Monument) possible archaeological constraints.
Barwick in Elmet WwTW expansion	1.5 km	- pumping required	- Cock Beck crossing required. Cock Beck is in a steep sided valley.	- Despite Cock Beck crossing, it is technically the closest existing works to new development.	The site has no spare capacity and it is small relative to the size of the proposed Parlington development. This would require a	No	- Land purchase required	Yes; consent is likely to be tighter than existing consent.	- Close to existing residential receptors	

Option	Wastewater infrastructure criteria				Wastewater treatment criteria				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Constraints
					major rebuild of the works, with little benefit in trying to re-use any existing assets. Additional land purchase, which may not be forthcoming, is also required.					
Micklefield WwTW expansion	5 km	- pumping required	- Crossing of two motorways	- Dosing to mitigate septicity may be required. - Variance of flows may result in multiple rising mains to meet asset standards.	This is the largest of the local WwTWs but would still involve a major expansion of the works.	No	- No land purchase required.	Yes	- Close to existing residential receptors	
Cattle Lane WwTW (new)	1.8 km	- pumping required - gravity discharge	- No major crossings required	- New separate wastewater infrastructure network. - Short outfall length	- New WwTW for Parlington development	No	- Land within M&G real estate boundary	No	- Located at a long distance (approx. 400m) from nearby receptors	

Option	Wastewater infrastructure criteria				Wastewater treatment criteria				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Constraints
Barwick Bank (new)	1 km	- pumping required - gravity discharge	- No major crossings required	- New separate wastewater infrastructure network. - Short outfall length	- New WwTW for Parlington development	No	- Land within M&G real estate boundary	No	- in close proximity and located upwind to future sensitive receptors	- Existing visual screening.
Throstle Nest WwTW (new)	1.8 km	- pumping required	- Cock Beck crossing required	- New separate wastewater infrastructure network. - Short outfall length	- New WwTW for Parlington development	No	- land within M&G real estate boundary	No; YW Enviromenta l Regulation advised that it would be challenging to obtain discharge consent for this location.	- Located within 400m of nearby receptors and upwind to future sensitive receptors.	
Parlington Lane WwTW (new)	Long outfall pipe (1 km)	- gravity feed - pumping discharge	- No major crossings required	- New separate wastewater infrastructure network - Local watercourse runs near proposed site. Too small to be able to be used as the effluent receptor, hence pumped	- New WwTW for Parlington development - Space for low carbon solution (lagoon solution). - current YW guidance allows the use of lagoons for up to 5,000PE. - large footprint.	Yes	- land within M&G real estate boundary	No	- Located near existing sensitive receptors	- existing visual screening - During a meeting on 19 September 2017, AECOM advised that this is the proposed location of a future Country Park between Aberford and

Option	Wastewater infrastructure criteria				Wastewater treatment criteria				Environmental and Social	
	Distance	Pumping	Crossings	Commentary	AMP7 headroom	Low carbon potential	Land Availability (AMP10 horizon)	Existing discharge	Proximity to receptors	Constraints
				discharge.						the site boundary (north of Parlington Lane).
Transfer to Knostrop WwTW	>5 km to Wyke Beck catchment	- pumping required	- A couple of tributaries will need to be crossed.	- YW face serious sewerage issues in the Wyke Beck catchment and additional sewerage flows are likely to worsen the existing flooding problems.	- There is available treatment capacity	No	- No land purchase required.	Yes	- Existing WwTW in large industrial estate	

The Cattle Lane WwTW option was shortlisted for further investigation later in this report.

6 Clean water infrastructure solutions

6.1 AMP7 solution

Water for the AMP7 development (370 units at an elevation of up to 70mAOD) could be obtained from Hook Moor SRE, which is supplied from the Leeds Grid and Garforth WSS.

The Top Water Level (TWL) in Hook Moor SRE is 92mAOD and a gravity feed should be possible without the need of a booster pumping station. This is not a long term solution as the water supply from the Garforth WSS, which originates from the Leeds Grid, is expensive.

We also recommend a second connection to the site from the 3-inch mains, which is running north-south across the site from Aberford Road to Parlington Lane, as an alternative supply to be utilised in the event of failure of the Hook Moor SRE supply.

6.2 Solutions beyond AMP7

Two options have been shortlisted for providing a water supply to the proposed Parlington development beyond AMP7.

6.3 Supply from Wetherby WSS

Supply from the Wetherby WSS via the Wetherby SRE and a 350mm /12-inch diameter main that is currently mothballed. Figure 8 is a schematic illustrating the proposed solution:

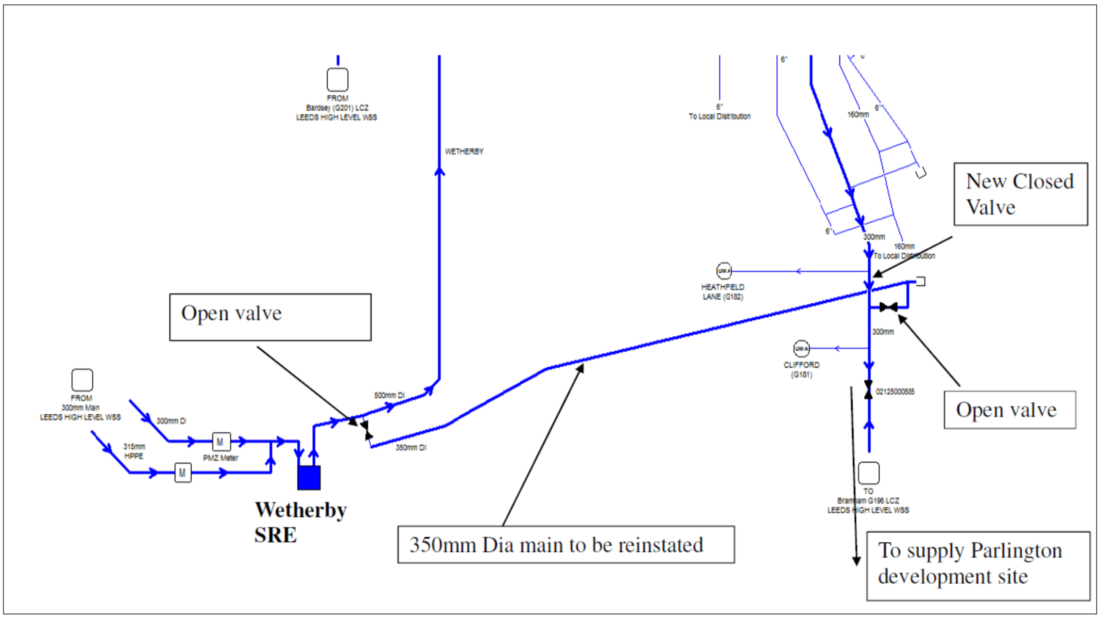


Figure 8: Schematic illustrating Solution 1 for Parlington site

Figure 9 through to Figure 12 further illustrates the proposal which in summary includes:

- Connecting the mothballed 12-inch water main at Wetherby SRE, flushing and disinfection;
- Opening the normal shut valve on the downstream end of the 12-inch main to bring the main back into service. A new kept shut valve will be required upstream of this cross connection.
- Installation of new valve on the 300mm main at approximate grid reference 442114, 445164 to enable rezoning.
- Installation of approximately 2.4km long 300mm diameter main from the A64 / A1 (M) junction 41 to the proposed Parlington site including crossing of the A1(M).
- Approximately 800m long 300mm diameter connection including meter to the Parlington site.

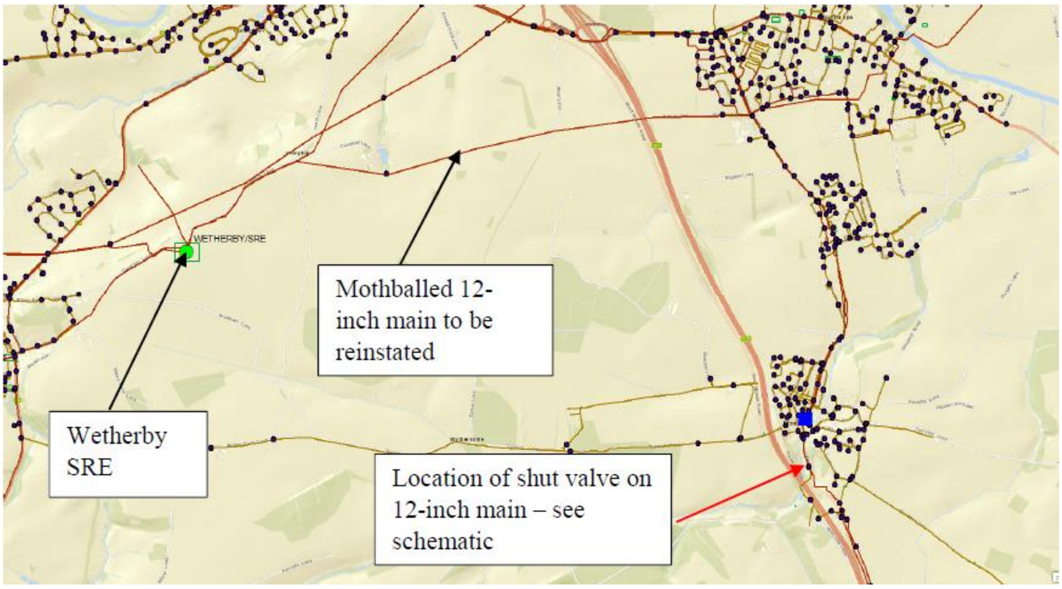


Figure 9: Mothballed 12-inch main from Wetherby SRE

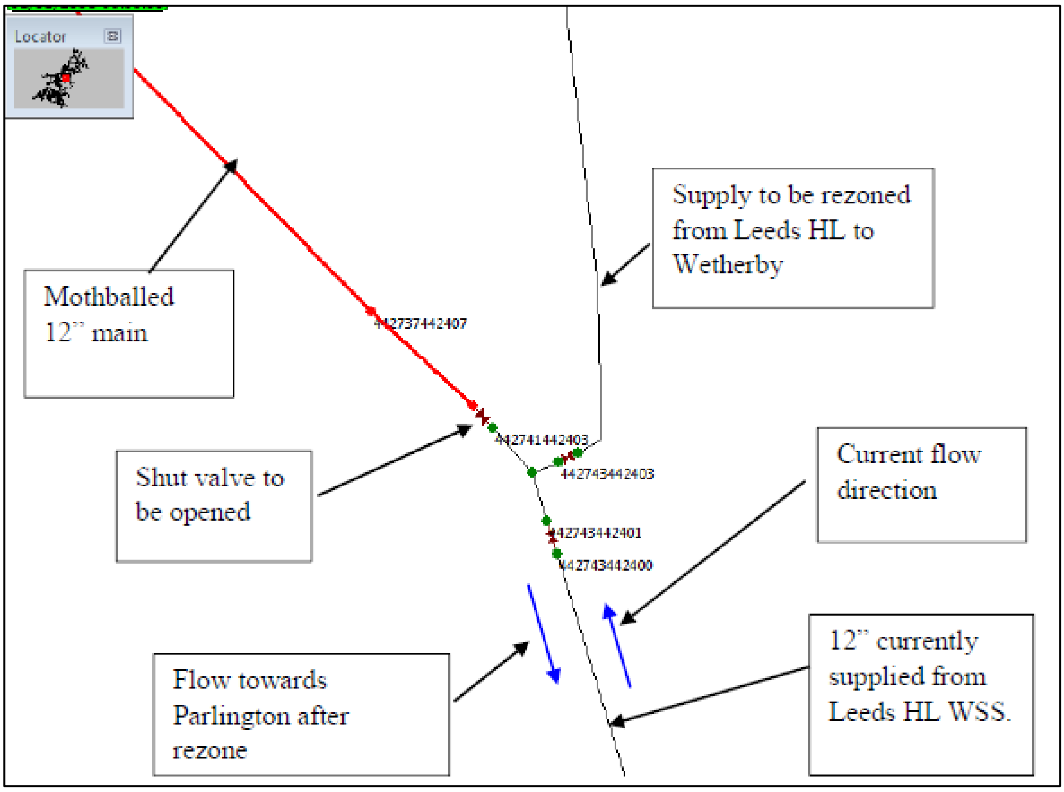


Figure 10: Schematic from hydraulic model showing proposed solution

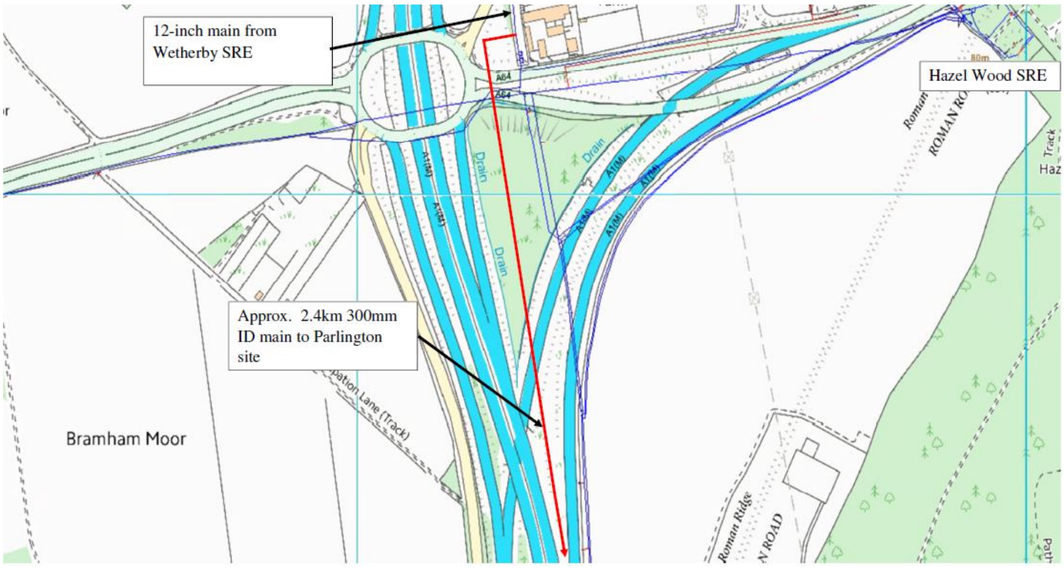


Figure 11: Connections required between the Wetherby WSS and Leeds HL WSS

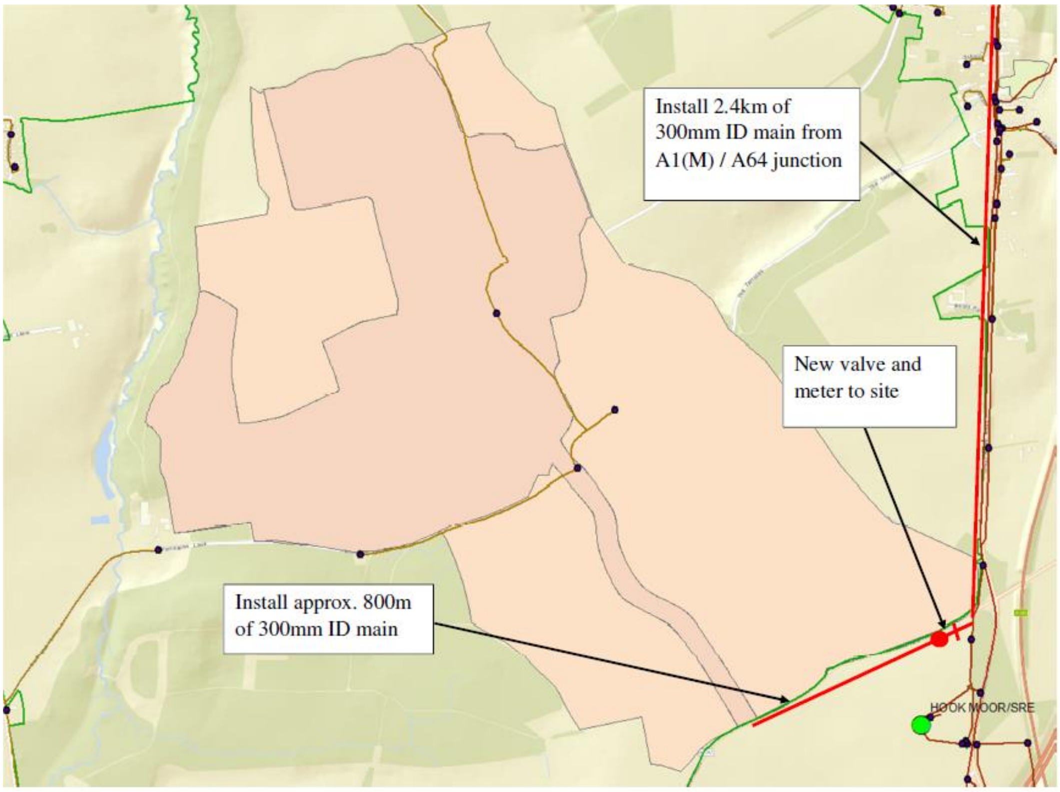


Figure 12: Water supply connection to proposed Parlington site

Hydraulic modelling results indicate that the proposed Solution 1 will not be able to provide a water supply with sufficient pressure to the development site with the site fully developed. Further investment or an alternative water supply would be required for a robust solution with the capability of providing water supply to the fully developed site.

6.4 Supply from the Leeds HL WSS

The proposed solution involves utilising the Leeds HL WSS by reinforcing the 12-inch diameter main that currently feeds Hazel Wood SRE and DMAs along the way.

The 12-inch main which runs along the A64 from west to east is currently fully utilised and operating beyond its hydraulic capacity. In addition, a number of housing development sites have been proposed which are likely to receive water supply from this main. Figure 13 shows the existing 12-inch main together with proposed development sites in close proximity:

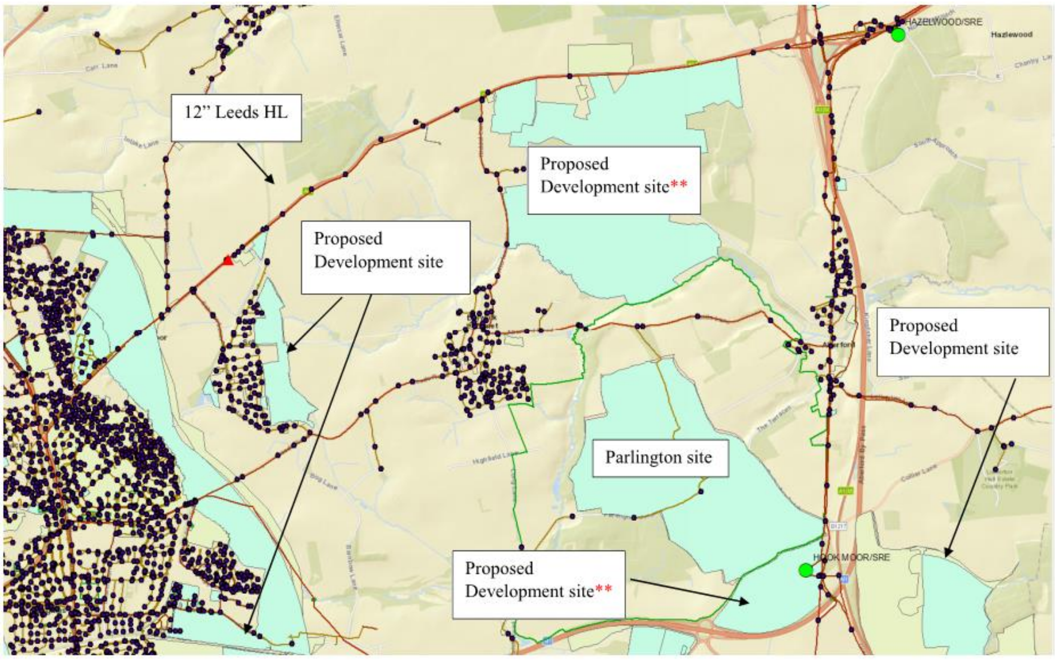


Figure 13: 12-inch Leeds High Level water main and nearby proposed development

Figure 14 is a graph from the hydraulic model run showing the pipeline unit head loss in the 12-inch Leeds HL water main which is well in excess of the YWS's maximum threshold of 3m/km during peak demand time.

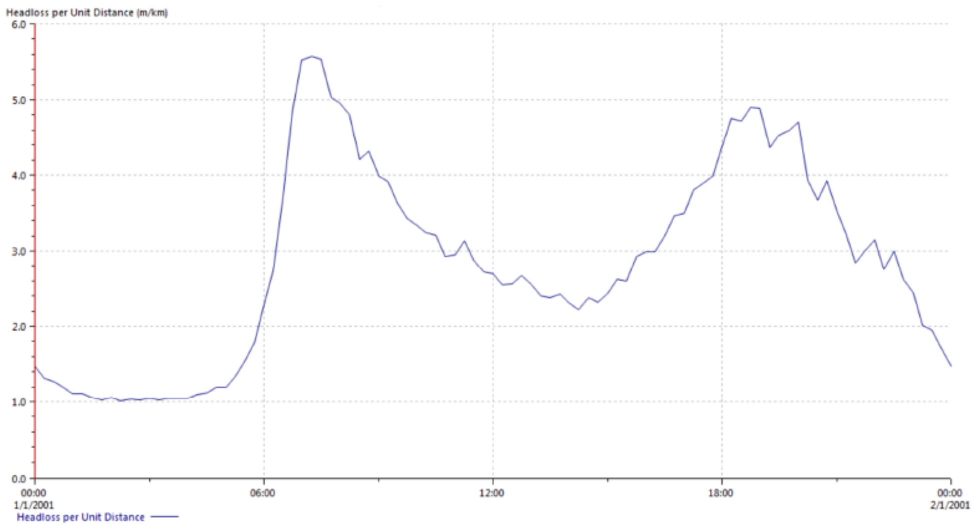


Figure 14: Head loss per unit legnth (m/km) in 12-inch Leeds HL main

The proposed solution will involve the laying of approximately 9km 300mm diameter duplicate following the route of the existing 12-inch diameter main along the A64.

Error! Reference source not found. to Figure 16 show the details of the proposed works which in summary includes:

- 300mm connection to an existing 21-inch main at the A64/A6120 round-about in Leeds.
- Laying approximately 9km of 300mm diameter main largely along the A64 with at least two road crossings to avoid structure in close proximity of the road.
- One major crossing of the A1(M) at the A64/A1(M) junction.
- Installation of approximately 2.4km of 300mm main from the A64/A1(M) junction towards the Parlington site.
- Installation of approximately 800m long 300mm diameter connection including meter to the Parlington site.

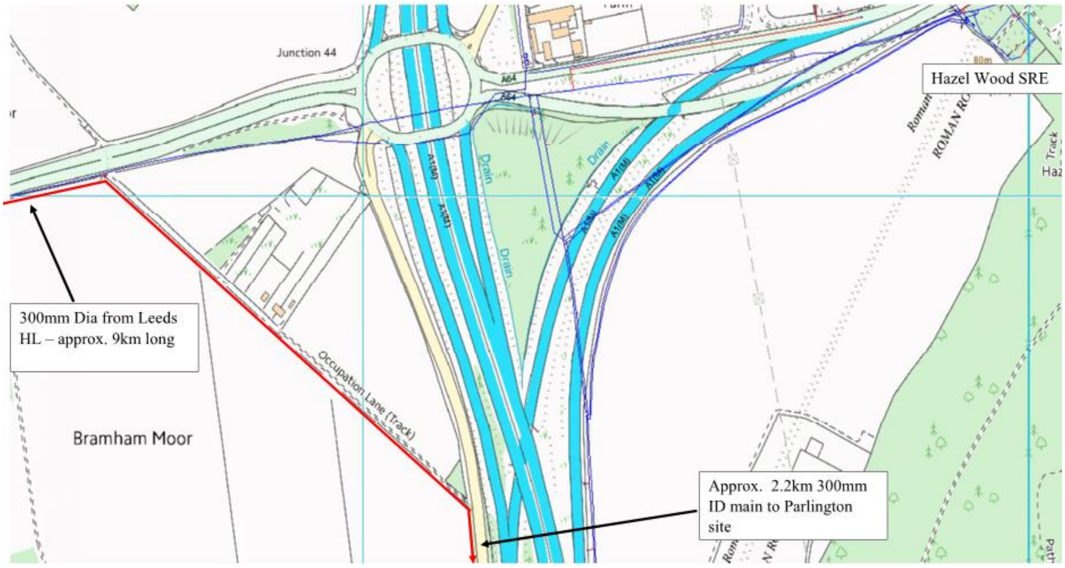


Figure 15: A64/A1(M) junction to Parlington site delivery main.

Figure 16: Connection at Parlington site

7 Wastewater treatment solutions

Temporary treatment was costed as the AMP7 solution. The future of future solutions was also estimated to inform Yorkshire Water about future land requirements.

It is noted that no storm tanks were incorporated in the design because all surface water from the new development will be dealt through sustainable drainage systems provided by the developer.

7.1 Temporary AMP7 solution

There is a requirement to have a solution in place to receive flows by 2024 and it is unlikely that a permanent treatment solution will be in place by then. Therefore, a temporary treatment solution has been considered with a FFT of 396 m^3/d or ca. 850 PE to achieve a consent of 20mg/l BOD, 5mg/l Ammonia and 40mg/l SS.

Several suppliers have been contacted and the option taken forward in costing is based on a proposal by WPL. WPL quoted for a small WwTW with primary lamella settlement and 4 No. SAF units for biological treatment and final lamella settlement. The plant, in addition, also requires a package inlet works, balance tank, a feed pumping station and a sludge tank.

The operating costs are expected to be similar to those of an ASP plant of a similar size (refer to Appendix B).

A footprint of 50m by 20m is likely to be required for the AMP7 solution.

7.2 Solutions beyond AMP7

7.2.1 Conventional solutions

Two main options considered for a conventional solution:

- A trickling filter (TF) process with humus tanks (HTs)
- An activated sludge plant (ASP) with final settlement tanks (FSTs)

A working consent of 20mg/l BOD, 5mg/l N and 40mg/l SS for the whole development has been assumed.

For both of these processes, the inlet works and settlement tank design will be identical for each AMP. The load onto the secondary process has been assumed to be the same, however the sludge production is higher for the ASP than the equivalent trickling filter. Each design includes ten days sludge storage in a single tank. Sludge thickening has been included for ASP sites to avoid tankering excessively thin sludge around. It has been assumed that thickened sludge is transported to Knostrop for processing in line with the current YWS sludge logistics strategy for Aberford WwTW.

Storm tanks are not included in the assessment as only foul flows are to be received by the new works.

Odour control has been assumed for the sludge storage tank only.

If trickling filters are used, a footprint of 130 x 70m will be required in 2035.

If an ASP is used, a footprint of 90m x 70m will be required at the same date.

7.2.2 Low carbon solutions

Only proven wastewater treatment solutions were considered in this study. For example, reed beds can be used for wastewater treatment but they have not been commonly used in the UK either at the scale required to carry out the full treatment required (often as a tertiary treatment polishing stage). There are also concerns over their cold weather performance in the North of England and it is also not a process recognised by the YW Asset Standards.

Taken the above into account, the alternative to traditional options for the WwTW design is that of a lagoon.

7.2.2.1 Lagoons

The lagoon option has been considered due to its sustainability, lower power requirement and simplicity of operation. The draft Asset Standard for lagoons (YWS Facultative Lagoons Guidance Note V1) by YWS refers to partial-mix lagoons as it involves the use of floating aerators and mixers to accelerate the process and thus reduce the footprint.

The foul flows are directed to the lagoons and are held in a series of two lagoons for between 41 and 108 days. The sludge produced stays in the lagoon with little risk of carry-over therefore no requirement for removal. Final effluent may require coarse filtration prior to discharge to a local water course.

Guidance from the supplier (Gurney Environmental Ltd) suggests that there is no requirement for inlet screening, however there has been some odour issues at a comparable lagoon installation in Scotland which is not fully understood yet and may be as a result of debris in the sewage. As a precaution, the cost of an asset standard inlet works has been included for this option. This may be removed if it is considered to be surplus to requirements following investigations.

The design is based on a series of two lagoons in accordance with the draft Asset Standard. The standard is primarily based on population equivalent and a design depth is 4.6m. It has been assumed that there will be a need for ammonia consent similar to the conventional solutions, therefore media and aeration grids would be placed in the second lagoon for ammonia removal, in line with the requirements for a SAF design.

A lagoon has been approved by YWS for construction at Withernsea. Currently, if the lagoon holds more than 25,000m^3 above lowest natural ground level, then it must be registered as a large raised reservoir and be subject to additional requirements. If Phase 2 of the Flood and Water Management Act is enacted, it would reduce this capacity to 10,000m^3.

Based on the design guidance, the unit sizes for AMPs 7 to 10 would be as follows:

Table 7 - Parlington lagoon design summary

Parameter	AMP7	AMP8	AMP9	AMP10
No. lagoons in series	2	4	6	6
Footprint (including inlet works and ancillaries), m	75 x 75	135 x 135	155 x 155	155 x 155
Total area (lagoon only), m^2	3,500	12,000	17,000	17,000
Total volume, m^3	15,700	54,800	77,750	77,750

8 Sewerage solutions

Following the assessment of the wastewater treatment options, a site off Cattle Lane site has been identified for the location of the new WwTW, as shown in Figure 17 below. There is flexibility on the exact location of the WwTW, as it could be sited north or south of the wooded area off Cattle Lane. The developer's preference is for the works to be located south of the wooded area with access from Parlington Drive.

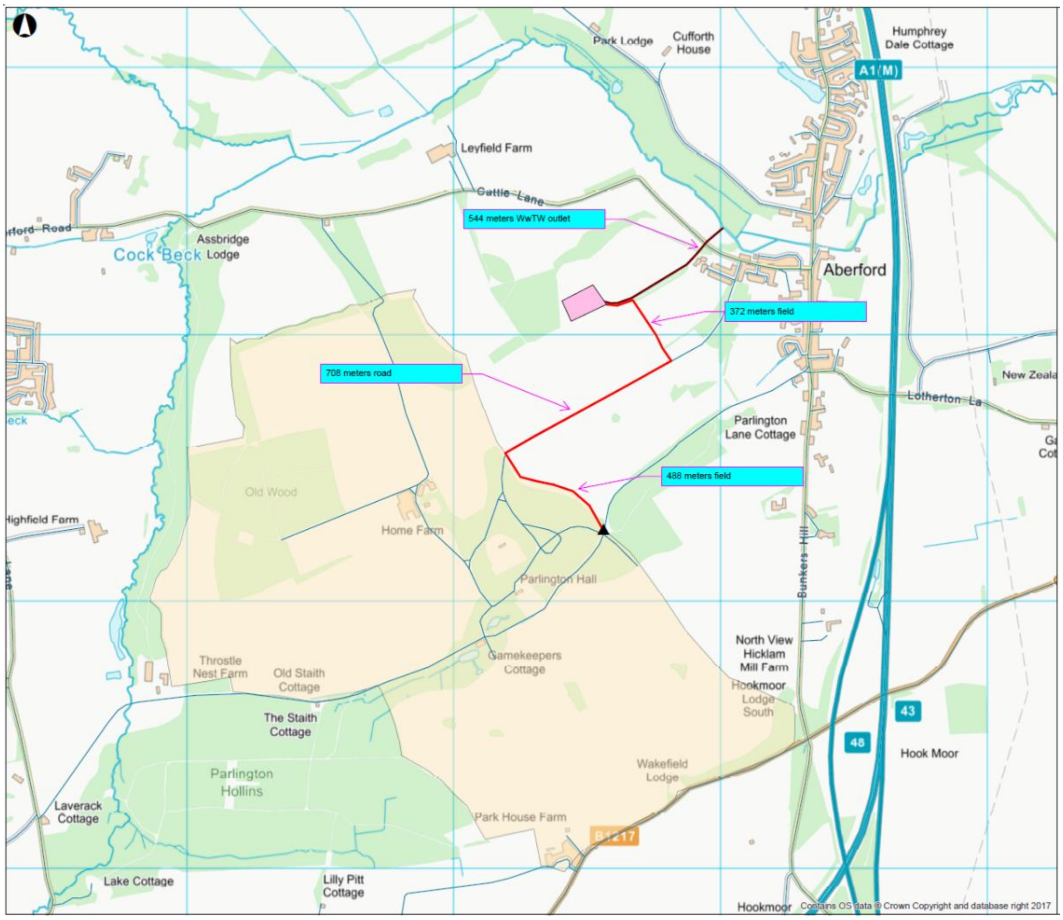


Figure 17: Proposed wastewater networks required to serve the new Cattle Lane WwTW site

It is noted that the location south of the wooded area is in closer proximity to a Scheduled Monument. There is a risk that archaeological findings may impact the pipeline route and the location of the WwTW, especially if lagoons are constructed in the future.

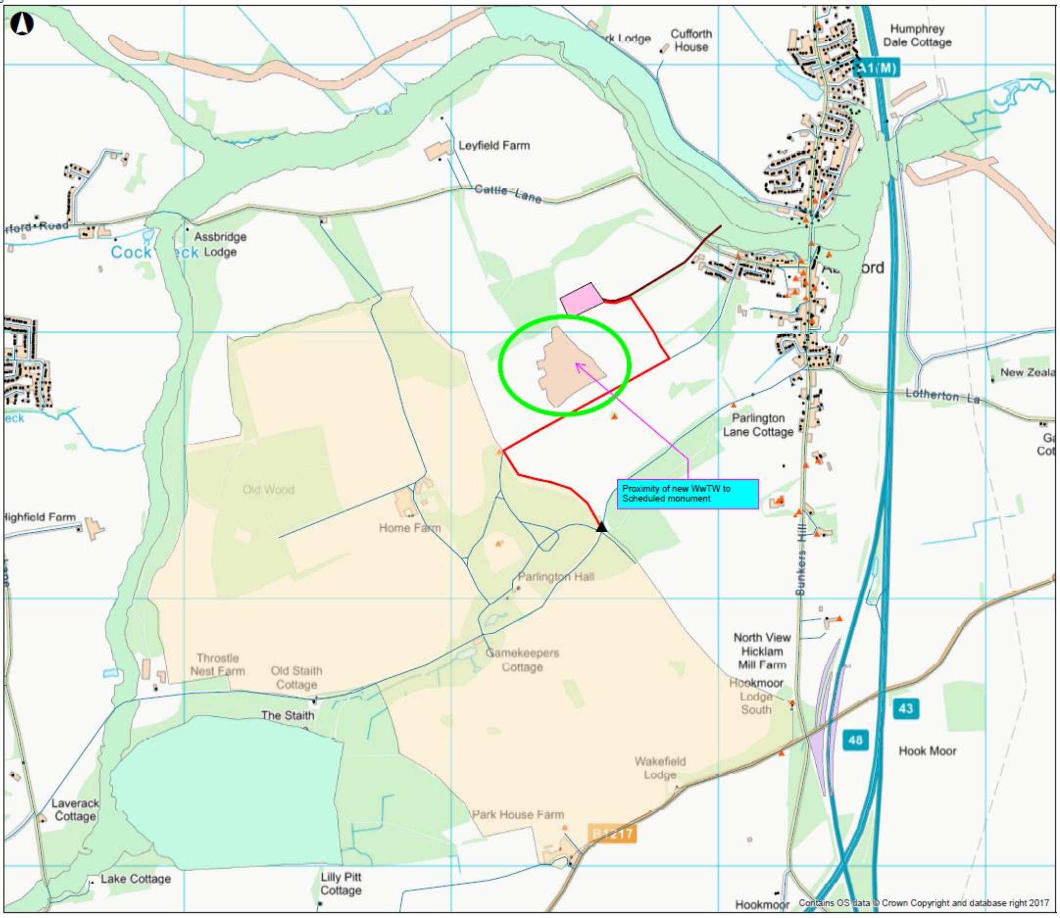


Figure 18: Proximity of proposed wastewater networks required to Scheduled Monument

8.1 Cattle Lane

The wastewater network needed to serve the Cattle Lane site is irrespective of the chosen treatment process, therefore the proposed networks are described below. The networks described here are for the full AMP9 proposed housing development.

The foul flows from the proposed development will be collected at a new sewage pumping station (SPS) at the lowest point of the site, just next to a crossroads in Parlington Lane. The SPS will include emergency storage, in line with Sewers for Adoption guidance, although once the development proposals have been fixed it may be found that some of the emergency storage volume can be reduced by accounting for this in the upstream network. Until the network is known, the emergency storage needs to be accounted for a storage at the SPS.

Sewage will then be pumped northwards, avoiding the Scheduled Monument and woodland, to the new Cattle Lane WwTW site.

Following treatment, the final effluent will gravitate via a new sewer, passing under Cattle Lane, to a new outfall into the Cock Beck, just upstream of Aberford.

9 IWM opportunities

Integrated Water Management (IWM) is the management of the water cycle (water efficiency, potable water demands, non-potable water demands, surface water, wastewater and water supply) in harmony with the built environment through planning and urban design. Within this approach the water cycle is considered from the outset and throughout the planning and design process for developments.

Water management approaches are also consistent with the designs for successful places and consider:

- Understanding of the local constraints, such as local environment, infrastructure capacity, available space, etc.
- Making the best use of existing infrastructure and delaying or minimising the need for reinforcements and upgrades.
- Provision of resource security and greater resilience in the future.

The IWM approaches can deliver multiple benefits, include reduced cost of water abstraction and treatment, reduced pumping of potable water and wastewater, increased headroom in water supply and drainage networks, and reduced footprint of wastewater treatment plants.

Meeting the demands for water that can be satisfied by non-potable quality water is one of the central parts of the IWM approach and included measures such as rainwater harvesting.

The non-potable water supply system (rainwater, stormwater, or greywater) can take three primary forms, which are outlined in the image below:

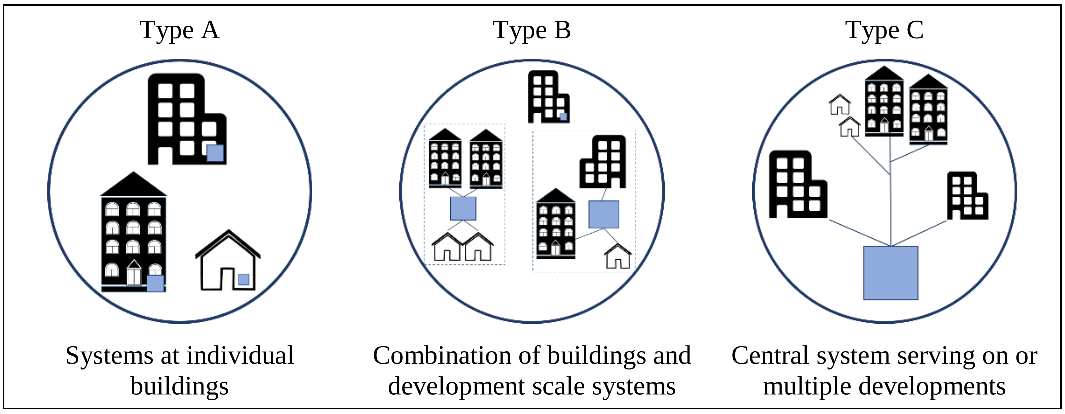


Figure 19 Typologies of non-potable reuse systems

The selection of most suitable system configuration will be dependent on the development type, layout, phasing, as well as local constraints.

9.1 Review of IWM options

There are a number of processes at work within IWM. The approaches considered in the options appraisal for Parlington are include:

- Higher water efficiency measures
- Rainwater Harvesting
- Stormwater Harvesting
- Greywater Reuse

The higher water efficiency estimates are based on Building Regulations Part G and assume water demand of 105 l/d per person. The potential supply of rainwater (from rooftops) and stormwater (from catchment surfaces) has been estimated assuming plot area of 250 m^2 and a building footprint of 70 m^2. The potential supply of greywater is estimated using British Standard as well as micro-component breakdown of water uses within homes.

Table 8 Demand reduction potential of IWM options

	Reduction in potable demand ^	**Non-potable demand satisfied**
Rainwater	14%	48%
Rainwater + Stormwater	29%	100%
Greywater	29%	100%

^ compared to Part G 'high efficiency'

** over 25 years and assuming simple payback*

9.2 Impact on clean water infrastructure solutions

The proposed IWM options do not have a significant impact on the long term clean water infrastructure solutions discussed earlier.

9.3 Impact on wastewater treatment solutions

The IWM option involves reduced potable water consumption and grey water recycling, which results in a revised sewage flow of 75 l/d per person. This is a conservative figure, as the flows can be reduced down to 60 l/d per person based on the industry standard 'water calculator'.

The reduced flow has an impact on all hydraulic processes, namely settlement stages and pumping costs. It does not impact on the secondary treatment process capacity as this is based on load per person and this does not change from implementing IWM. As an example, IWM's impact on the lagoon design is presented below with reductions shown in red:

Table 9 - Parlington Lagoon summary - IWM design @ 75 l/hd.d

AMP	7	8	9	10
P.E.	851	2,979	4,225	4,225
FFT, m^3/d	256 (-140)	819 (-492)	1,150 (-697)	1,150 (-697)
Total lagoon volume (m3)	10,100 (-5,600)	35,400 (-19,400)	50,200 (-27,550)	50,200 (-27,550)

9.4 Impact on sewerage solutions

The proposed IWM options may result in reduced foul flows reaching the sewers. As such there may be opportunity to reduce the size of some of the proposed wastewater assets by either reducing pipe, storage or pump sizes. In particular, the sizing of the emergency storage may be able to be reduced significantly if a lower volume per dwelling is agreed from the figure of 160l per dwelling given by Sewers for Adoption.

9.5 IWM Cost basis and assumptions

The cost estimates (refer to Tables 10 and 11) are based on the approach devised and agreed for Old Oak Common Integrated Water Management Study and the Thames Water study on Non Potable Water Reuse as a Demand Management Option for WRMP19. They are totex estimates over 40 years assuming a 6.25% discounting factor.

The cost estimates utilise the New Rules of Measurement (NRM) and Building Cost Information Service (BCIS) from Royal Chartered Institute of Surveyors (RCIS), and are suitable for initial cost estimates at masterplanning stage.

The energy cost of pumping for local non-potable supply have been based on research by University of Exeter on energy consumption in RWH systems.

More detail costing would be possible once there is greater level of understanding of site and building layouts and designs. This would also enable optimisation of costs and finding cost efficiencies.

It is assumed that the necessary storage in pre-treatment stage for rainwater and stormwater will be met by the storm attenuation that will be required to comply with surface water runoff constraints.

Although passive treatment systems are available, to ensure a guaranteed non-potable water quality it is assumed the surface water harvesting will require similar type of membrane treatment systems as used in greywater reuse.

Table 10 IWM system costs breakdown (2025 horizon)

	#	Cost Item	Cost borne by	Rainwater Harvesting	Rainwater + Stormwater	Greywater
CAPEX	1	Dual plumbing (supply)	Developer	£219,000	£219,000	**£219,000**
	2	Dual plumbing (greywater drainage)	Developer	-	-	**£219,000**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	-	£73,000	**£73,000**
	4	Membrane replacement (every 10 years)	Facility Management (FM) or iWaSCo	-	£8,000	**£8,000**
	5	Pump renewal / replacement (15 years)	Householder, FM or iWaSCo	£48,000 (pumps at individual house)	£8,500 (communal pumps)	**£8,500 (communal pumps)**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	-	£23,000 / year	**£23,000 / year**
	7	Non-potable supply – annual energy cost for pumping water	Householder, FM or iWaSCO	£220 / year	£1,200 / year	**£1,340 / year**

Table 11 IWM system costs breakdown (2033 horizon)

	#	Cost Item	Cost borne by	Rainwater Harvesting	Rainwater + Stormwater	Greywater
CAPEX	1	Dual plumbing (supply)	Developer	£1.04 mil	£1.04 mil	**£1.04 mil**
	2	Dual plumbing (greywater drainage)	Developer	-	-	**£1.04 mil**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	-	£0.40 mil	**£0.40 mil**
	4	Membrane replacement (every 10 years)	Facility Management (FM) or iWaSCo	-	£35,000	**£35,000**

	#	Cost Item	Cost borne by	Rainwater Harvesting	Rainwater + Stormwater	Greywater
	5	Pump renewal / replacement (every 15 years)	Householder, FM or iWaSCo	£240,000 (pumps at individual house)	£42,000 (communal pumps)	**£42,000 (communal pumps)**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	-	£39,000 / year	**£39,000 / year**
	7	Non-potable supply – annual energy cost for pumping water	Householder, FM or iWaSCO	£1,100 / year	£2,300 / year	**£2,300 / year**

- The capital costs for dual plumbing will be borne by the developer in the first instance as the infrastructure will need to be implemented at the time of construction.
- The capital cost of the treatment plant may be borne by developer or an independent operator (WaSCo) if developer enters into such an agreement.
- The operating costs for non-potable system (treatment plant and pumping system) and will be borne by the site Facilities Management or WaSCo.
- For rainwater harvesting, the pump renewal / replacement costs will be borne directly by the householder, as the systems will be at individual households.
- Some or all of these additional costs for others may be recouped through a charging mechanism (service charge or a volumetric charge for non-potable supply).

In Olympic Park in London, the non-potable water supply is charged at a rate below potable water supply charges. In some office buildings where greywater systems are employed, the cost of their operation are included within the service charges for tenants. It is noted that the reduced YW revenue has not been included in the calculations.

9.6 Preferred IWM option

The primary external driver for IWM at this location is the potential impacts to the provisions at wastewater treatment plants as well as on the sewerage network.

Of the options under consideration, only the Greywater Reuse IWM option provides the reduction in foul flows, thus is the preferred option.

10 Totex calculations

10.1 Data and assumptions

The capex for the costed AMP7 option has been estimated by YWS using the Yorkshire Water Unit Cost Database (UCD). Any items that are not covered in the UCD have been costed by Arup and/or suppliers. The source of the costing information for each work element is presented in Appendix A.

The opex of AMP7 option has been estimated by Arup and is presented in Appendix C. The totex has been calculated over a 40-year period.

The assumptions used for the design and costing exercise are summarised below:

Area	Capex assumptions	Opex assumptions
Land requirements	AMP9 footprint (1,850 units)	n/a
Sewerage	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	
Wastewater treatment	AMP7 requirements	Estimate is based on the AMP7 solution only
Clean water infrastructure	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	

10.2 Costed options

The following option has been costed for AMP7 implementation.

ID	Option
0	New temporary wastewater treatment solution off Cattle Lane Water supply from Hook Moor SRE

10.3 Costs

The option costs (capex, opex and totex) over a 40-year period (NPV) are summarised below.

Option ID	Sewerage / wastewater treatment		Clean water infrastructure		Totex (£m)
	Capex (£m)	Opex (£m)	Capex (£m)	Opex (£m)	
0	4.7	0.6	0.3	-	5.6

11 Environmental and social appraisal of future options

The future options assessed are listed below.

ID	Option	ID	Sub-options
1	New WwTW at Cattle Lane – ASP solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS
2	New WwTW at Cattle Lane – Trickling filter solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS
3	New WwTW at Cattle Lane – Lagoon solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS
4	New WwTW at Cattle Lane – IWM ASP solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS
5	New WwTW at Cattle Lane – IWM Trickling filter solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS
6	New WwTW at Cattle Lane – IWM Lagoon solution	A	Water supply from Wetherby WSS in AMP7
		B	Water supply from Leeds High Level WSS

A five capital approach has been developed to qualitatively appraise the environmental and social impact of the shortlisted options. The assessment framework provides scoring criteria against 21 aspects as listed in the table below, from high negative impact (-3) to high positive impact (+3). The detailed scoring criteria can be found in Appendix D.

The score under each of the aspects were summed to provide a total for each of the options. Equal weighting has been assumed for all aspects considered.

Table 12: Five capital appraisal summary for all Parlington options

Option ID	Natural												Social			Human				F&M		Total score
	Crops and Livestock	Fisheries	Energy	Water supply	Global climate	Air quality	Flood Regulation	Water quality	Pollination	Recreation	Amenity	Non-Use Value	Physical activity	Quality of place	Trust	Employment	Skills	Health & Safety	Local economy	Private costs	Private benefits	
1a	-1	0	-3	-2	-2	0	0	0	0	0	0	0	0	-2	0	1	2	0	2	2	3	0
1b	-1	0	-3	-2	-3	0	0	0	0	-2	0	0	0	-2	0	2	2	0	2	2	3	-2
2a	-2	0	-2	-2	-2	0	0	0	0	0	0	0	0	-1	0	1	2	0	2	2	3	1
2b	-2	0	-2	-2	-3	0	0	0	0	-2	0	0	0	-2	0	2	2	0	2	2	3	-2
3a	-2	0	-1	-2	-1	0	0	0	0	0	0	0	0	-1	0	1	1	0	2	2	2	1
3b	-2	0	-1	-2	0	0	0	0	0	-2	0	0	0	-2	0	1	2	0	2	2	3	1
4a	-1	0	-3	-1	-2	0	0	0	0	0	0	0	0	-2	0	1	2	0	2	1	3	0
4b	-1	0	-3	-1	-3	0	0	0	0	-2	0	0	0	-2	0	2	2	0	2	1	3	-2

Option	Natural												Social			Human				F&M		Total
5a	-2	0	-2	-1	-2	0	0	0	0	0	0	0	0	-1	0	1	2	0	2	1	3	1
5b	-2	0	-2	-1	-3	0	0	0	0	-2	0	0	0	-2	0	2	2	0	2	1	3	-2
6a	-2	0	-1	-1	-1	0	0	0	0	0	0	0	0	-1	0	1	2	0	2	1	3	3
6b	-2	0	-1	-1	0	0	0	0	0	-2	0	0	0	-2	0	1	2	0	2	1	3	1

As shown in Table 12, the most desirable future option from a five capital perspective is option **6a. New WwTW at Cattle Lane – IWM lagoon solution, with water supply from Wetherby WSS in AMP 7**.

A number of other options have scored second highest, ranked by their overall impact on the five capitals. These are 2a, 3a, 3b, 5a and 6b.

12 Conclusions and recommendations

Based on the latest phasing information, it has been agreed that temporary wastewater treatment off Cattle Lane is the preferred AMP7 option. The short term water supply requirements can be met from Hook Moor SRE. The totex has been estimated at £5.6m.

Longer term, a lagoon wastewater treatment solution is likely to have the lowest totex over 40 years. Although a lagoon solution has been approved by YWS for construction at Withernsea, YWS does not have extensive experience with such a process. Depending on the design solution, there may also be risks around the classification of the lagoon as a reservoir. These will need to be investigated further once the location of the WwTW is confirmed.

As significant growth is expected in the Wetherby WSS, water demand beyond AMP7 will have to be met from Leeds High Level WSS.

Implementing IWM solutions in this location will reduce YWS totex, but will result in additional costs for others (developers, non-potable reuse system installers) through provision of additional on-site infrastructure required to enable non-potable use.

The costs of the non-potable reuse system and supply of non-potable water are likely to be recouped through a charging scheme. This could be as a flat service charge or metered charges for non-potable supply. The end users (e.g. homeowners) are likely to save on their water bills, provided the non-potable water is supplied at rate below the potable water supply.

Appendix A

List of items for Option Costing

A1 Temporary Treatment Option

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Sewerage	Pumping station to works	15 m3 normal storage, 296 m3 emergency storage	ZY1601	Total internal volume	311	m3
Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11.0	kW
Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11.0	kW
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Grassland & verge	0.86 km length, 150mm dia, rural	ZY7311	Length	860	m
Sewerage	Pipeline to new works Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	0.708 km length, 150mm dia, urban	ZY7312	Length	708	m
Other	Brick building - pump station		ZY1040	Area	9	m2
Other	New pump station MCC		ZY1255	Power	22	kW
Other	Power supply (pump station)		ZY1355	Power	22	kW
Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	362	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	181	m3/d
Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	181	m3/d
Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
Wastewater Treatment	Grit separation and classification package plant	Duty/standby	ZY6780	Flow	362	m3/d
Wastewater Treatment	Balance tank, assumes 4 hours at FFT	Duty	ZY6781	Volume	60	m3
Wastewater Treatment	WPL wastewater treatment system			m3/d		
Wastewater Treatment	Sludge Tank, assumes 10 days storage at 5m3/d, 2% w/w DS	Duty	ZY6781	Volume	100	m3

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	50	m
Other	Security site fencing		ZY1175	Length	200	m
Other	Autosampler	Final effluent	ZY0122	Number	1	no
Other	Flowmeter	inlet	ZY0059	Number	1	no
Other	Dry solids monitor	Sludge	ZY1690	Number	1	no
Other	Level transmitters	FFT flowmeter	ZY0146	Number	1	no
Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
Other	Earthworks/Landscaping		ZY1090	Volume	400	m3
Other	Admin building with SCADA		ZY1040	Area	10	m2
Other	Site access roads	Off site roads	ZY1410	Area	600	m2
Other	Land purchase	550m2	Steph Walden	Area	0.55	acres
Other	Power supply		ZY1355	Power	40	kW
Wastewater Treatment	Outfall pipeline Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	0.524km, 225mm dia, rural, gravity	ZY7276	Length	524	m
Wastewater Treatment	Outfall pipeline Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	0.02km, 300mm dia, urban, gravity	ZY7279	Length	20	m
Wastewater Treatment	River Outfall	225mm dia, rural	ZY1215	Diameter of outfall pipe	300	mm
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	Flowmeter to development in chamber	On 100mm diameter ductile iron by pass c/w 2 No. bypass valves		Number	1	no
Clean Water	Lay 300mm diameter HDPE main in road verge		ZY7052	Length	800	m

Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Clean Water	Meter Chamber		ZY1065	Volume	2	m3
Clean Water	Flowmeter to development in chamber	On 100mm diameter ductile iron by pass c/w 2 No. bypass valves		Number	1	no

Appendix B

Operating costs

B1 Temporary Treatment Option

Discipline	Item	Measurement no	Unit	Installed	Hours run	Power /day	Opex cost/yr
Sewerage	Pumping station - centrifugal submersible pump 1	3.87	kW	11 kW	8 hrs/day	31.0 kWh/d	1,138 £/yr
Sewerage	Pumping station - centrifugal submersible pump 2	3.87	kW	11 kW	0 hrs/day	0 kWh/d	- £/yr
Sewerage	Pumping station building services	1.5	kW	2.5 kW	1 hrs/day	1.5 kWh/d	55 £/yr
Sewerage	**New MCC**	**5.37**	**kW**	**13.5 kW**			
	Power supply	**5.37**	**kW**	**13.5 kW**		**32.5 kWh/d**	**1,193 £/yr**
Sewerage	Sewerage Pumping Station instrumentation, 2 No @ 0.05 kW	0.1	kW	0.75 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Wastewater Treatment	Inlet Screens and Screens handling package 1	2	kW	10.5 kW	8 hrs/day	16 kWh/d	588 £/yr
Wastewater Treatment	Inlet Screens and Screens handling package 2	2	kW	10.5 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	Grit classification package plant	3	kW	3.5 kW	8 hrs/day	24 kWh/d	882 £/yr
Wastewater Treatment	Half bridge scraper 1, 58m2	0.5	kW	2.2 kW	24 hrs/day	12 kWh/d	441 £/yr
Wastewater Treatment	Half bridge scraper 2, 58m2	0.5	kW	2.2 kW	24 hrs/day	12 kWh/d	441 £/yr
Wastewater Treatment	Desludging pump 1 @ 0.11 l/s	0.06	kW	1.2 kW	8 hrs/day	0.48 kWh/d	18 £/yr
Wastewater Treatment	Desludging pump 2 @ 0.11 l/s	0.06	kW	1.2 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)	9.52	kW	22.5 kW	24 hrs/day	228.48 kWh/d	8,395 £/yr
Wastewater Treatment	Half bridge scraper 1	0.5	kW	2.2 kW	24 hrs/day	12 kWh/d	441 £/yr
Wastewater Treatment	Half bridge scraper 2	0.5	kW	2.2 kW	24 hrs/day	12 kWh/d	441 £/yr
Wastewater Treatment	RAS pump 1 @ 10 l/s	2.01	kW	7.5 kW	24 hrs/day	48.24 kWh/d	1,772 £/yr
Wastewater Treatment	RAS pump 2 @ 10 l/s	2.01	kW	7.5 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	SAS pump 1@ 1.2 l/s	3.5	kW	4 kW	3 hrs/day	10.5 kWh/d	386 £/yr
Wastewater Treatment	SAS pump 2 @ 1.2 l/s	3.5	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	Sludge tanks mixing 1	1	kW	5 kW	8 hrs/day	8 kWh/d	294 £/yr
Wastewater Treatment	Sludge tanks mixing 2	1	kW	5 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	Odour control, 198 m3/h	2	kW	5 kW	24 hrs/day	48 kWh/d	1,764 £/yr
Wastewater Treatment	Washwater booster pump 1	3	kW	4 kW	8 hrs/day	24 kWh/d	882 £/yr
Wastewater Treatment	Washwater booster pump 2	3	kW	4 kW	0 hrs/day	0 kWh/d	- £/yr
Wastewater Treatment	Autosampler	0.5	kW	1 kW	24 hrs/day	12 kWh/d	441 £/yr
Wastewater Treatment	Flowmeter, 4 no @ 0.05 kW each	0.2	kW	1 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Wastewater Treatment	Dry solids monitor, 2 NO @ 0.05 kW	0.1	kW	1 kW	24 hrs/day	2.4 kWh/d	88 £/yr
Wastewater Treatment	Sludge blanket monitor, 4 NO. @ 0.05 kW each	0.2	no	2 kW	24 hrs/day	4.8 kWh/d	176 £/yr
Wastewater Treatment	Level transmitters, 3 No. @ 0.05 kW	0.15	no	2 kW	24 hrs/day	3.6 kWh/d	132 £/yr
Wastewater Treatment	Actuated valves, 6 No @ 0.05kW	0.3	kW	1 kW	0.017 hrs/day	0.005 kWh/d	0.18 £/yr
Wastewater Treatment	Building services (heating, lighting etc)	4	kW	6 kW	4.0 hrs/day	16 kWh/d	588 £/yr
Wastewater Treatment	**New MCC**	**34**	**kW**	**87 kW**			
Wastewater Treatment	**Power supply**	**34**	**kVA**	**86.8 kW**		**502 kWh/d**	**18,434 £/yr**
	Total	**39.0**		**100.3**		**534 kWh/d**	**19,627 £/yr**
	Odour media - Activated carbon						**4 £/kg**
	Volume per year (assumes 75% media spent)	71	kg/yr				**284 £/kg**
	Sludge treatment and disposal						
	Sludge volume						3 m3/d
							5.50% DS
							60.2 tds/year
							1095 m3/yr
	Treatment and disposal cost						305 £/tonne
							18,369 £/yr
	Polymer use						1 **kg/d**
							1.9 **£/kg**
							693.5 **£/year**
	Manpower						
	Annual salary						35,000 £/yr
	Operational Hours/week						hrs/wk
							0 hrs/yr
	Additional callouts						4 hrs/month
							48 hrs/yr
	Maintenance hours						4 hrs/month
							48 hrs/yr
	hours/yr						96 hrs/yr
	% total working hours/year (assumes 40 hr week with 2.5 weeks annual leave)						5%
	Cost / yr						**1,697 £/yr manpower**
	Total Opex costs						**40,670 £/year**

Appendix C

List of Environmental Features

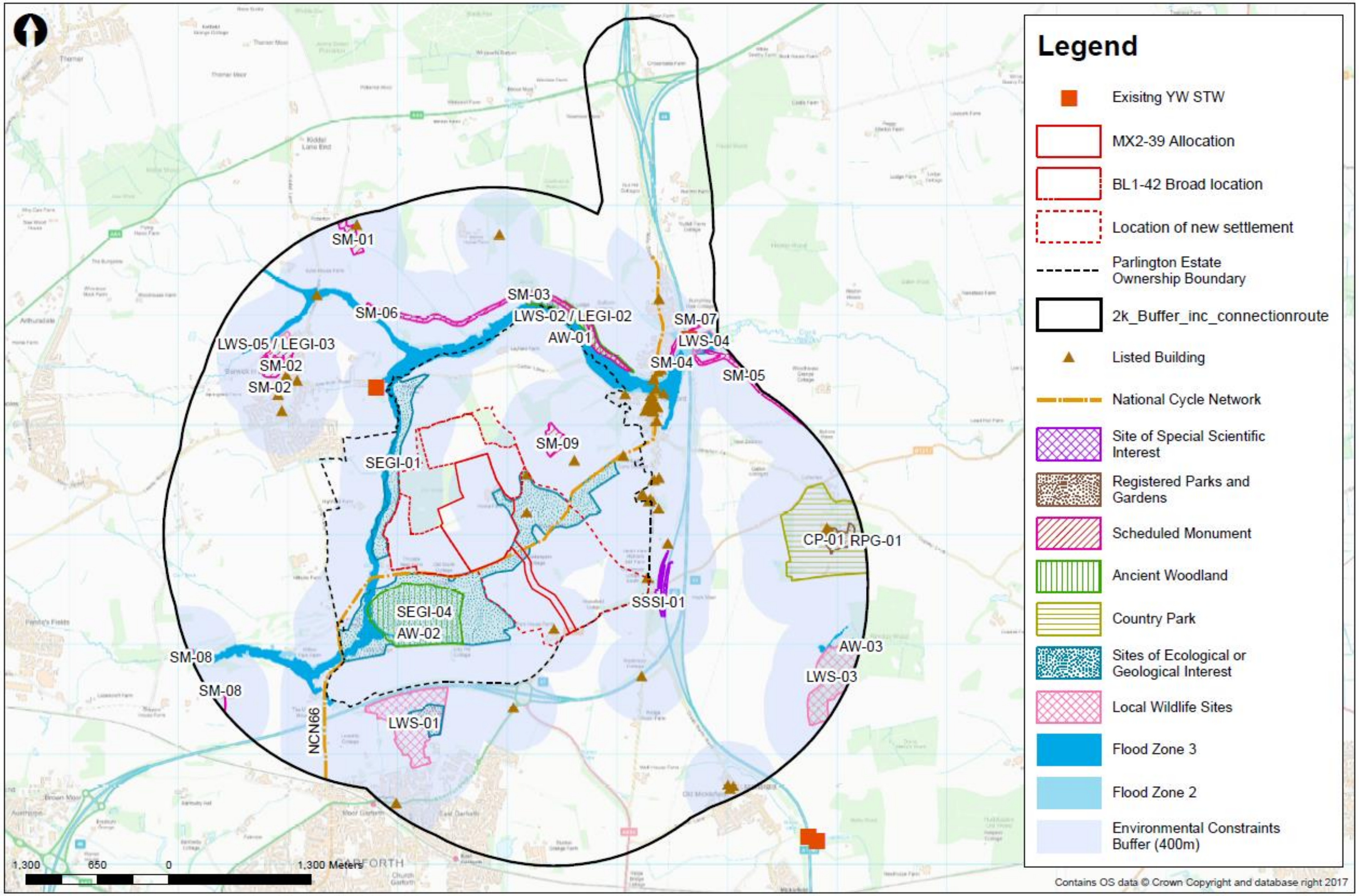
This Appendix provides a full list of environmental and social features identified by the desk-top research (Table 13) and a reference map showing the locations of these features (Figure 20).

Table 13: List of environmental and social features with map reference

Aspects	Map reference	Feature of interest	Location in relation to site
Ecology			
SSSI	SSSI-01	Hook Moor	120m to the east
Sites of Ecological or Geological Interest	SEGI-01	Barwick Bank Garforth	adjacent to the west
	SEGI-02	Becca Banks Garforth	1.1km to the north
	SEGI-03	Wendel Hill Bank Garforth	1.3km to the northwest
	SEGI-04	Parlington Hollins Garforth	adjacent to the south
Local Wildlife Sites	LWS-01	Hawks Nest Wood	1km to the south
	LWS-02	Becca Banks	1.1km to the north
	LWS-03	Corburnhill Wood	1.7km to the southeast
	LWS-04	Aberford Osiers	1.8km to the northeast
	LWS-05	Wendel Hill Bank	1.3km to the northwest
Ancient woodland	AW-01	Becca Low Wood	1.1km to the north
	AW-02	Parlington Hollins	100m to the south
	AW-03	Ringhay Wood	1.7km to the southeast
Heritage			
Scheduled Monument	SM-01	Deserted medieval village of Potterton	1.7km to the northwest
	SM-02	Barwick in Elmet large univallate hillfort and motte and bailey castle	1.3km to the northwest
	SM-03	Length of linear earthworks known as Becca Banks and The Ridge, part of the Aberford Dyke system, between Aberford and a quarry 590m north of Ass Bridge	1km to the north
	SM-04	Length of linear earthwork, part of the Aberford Dyke system, at Green Hill between Aberford and the Aberford By-pass	1.7km to the northeast
	SM-05	Linear earthworks known as Woodhouse Moor Rein and South Dyke, part of the Aberford Dyke system	2km to the east
	SM-06	Length of linear earthwork known as The Ridge, part of the Aberford Dyke system, 560m east of Potterton Bridge	1km to the north
	SM-07	Length of linear earthwork, part of the Aberford Dyke system, at Field Lane between the Aberford By-pass and Humphrey Dale Cottage	1.9km to the northeast

	SM-08	Former World War I National Filling Factory, Barnbow	1.9km to the southwest
	SM-09	Iron Age and Romano-British Settlement south of Hungerhills Plantation, Parlington	250m to the east
Registered Parks and Gardens	RPG-01	Lotherton Hall	1.6km to the east
Landscape and recreation			
Country Park	CP-01	Lotherton Hall Estate	1.3km to the east
National Cycle Network	NCN66	National Cycle Route 66	running through the site

Figure 20: Parlington environmental and social features of interest



Appendix D

Five Capital Appraisal framework

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
Natural	Crops and Livestock	What is the make up of agricultural land in the area e.g. quality/grade and type of food produced? Does the proposed option require land take of high quality agricultural land?	Permanent land take of Grade 1 agricultural land or other agricultural land of more than 5ha	Permanent land take of between 1ha and 5ha agricultural land of Grade 2 or below	Permanent land take of less than 1ha agricultural land of Grade 2 or below	Not relevant / negligible positive or negative impact	Minor positive impact on the ability of the affected land to support crops and livestock	Some positive impact on the ability of the affected land to support crops and livestock	Substantial positive impact on the ability of the affected land to support crops and livestock
	Fisheries	Are there fisheries (commercial or otherwise) which provide a food resource? (Avoid double counting with more recreational-based angling i.e. coarse fishing or catch and release). Are shellfish harvested in the area?	Substantial negative impact on the ability of the affected land to support fisheries	Some negative impact on the ability of the affected land to support fisheries	Minor negative impact on the ability of the affected land to support fisheries		Minor positive impact on the ability of the affected land to support fisheries	Some positive impact on the ability of the affected land to support fisheries	Substantial positive impact on the ability of the affected land to support fisheries
	Energy	Does the option allow energy production from water resources? What's the energy consumption during operation? Does it come from a sustainable source?	Operational energy consumption of over 0.7kWh/m3	Operational energy consumption of between 0.5 and 0.7kWh/m3	Operational energy consumption of less than 0.5kWh/m3		Minor net decrease in energy consumption during construction and/or operation	Some net decrease in energy consumption during construction and/or operation	Substantial net increase in energy consumption during construction and operation
	Water supply	How would the option change the quality or quantity of freshwater left in the environment? Does it include demand reduction measures?	Substantial negative impact on the availability of freshwater left in the environment, water demand increase of more than 5Ml/d	Some negative impact on the availability of freshwater left in the environment, water demand increase of between 1 and 5Ml/d, or options without demand reduction measures	Minor negative impact on the availability of freshwater left in the environment, water demand increase of less than 1Ml/d, or options which include demand reduction measures		Minor positive impact on the availability of freshwater left in the environment	Some positive impact on the availability of freshwater left in the environment	Substantial positive impact on the availability of freshwater left in the environment
	Global climate	Will the option affect any major peat deposits or large lakes and are these capturing carbon or releasing it? What is the whole life carbon associated with the option?	Substantial negative impact on the ability of affected land to sequester carbon. Large net increase in carbon emissions	Some negative impact on the ability of affected land to sequester carbon. Some net increase in carbon emissions	Minor negative impact on the ability of affected land to sequester carbon. Small net increase in carbon emissions		Minor positive impact on the ability of affected land to sequester carbon. Small net decrease in carbon emissions	Some positive impact on the ability of affected land to sequester carbon. Some net decrease in carbon emissions	Substantial positive impact on the ability of affected land to sequester carbon. Large net decrease in carbon emissions
	Air quality	Are there any known issues associated with car use and industry? Are there any nearby AQMA that will be affected by the option? Are there any nearby receptors? Will there be odour issues?	Site located within AQMA, or sensitive receptors within 200m	Site located adjacent to AQMA, or sensitive receptors within 400m	Site located within 400m of AQMA, or no sensitive receptors within 400m		Minor positive impact on air quality and odour	Some positive impact on air quality and odour	Substantial positive impact on air quality and odour
	Flood Regulation	Will the option require land take in Flood Zones 2 and 3? Consider how the option will impact on run-off and flood risk.	Land take within Flood Zone 2 or 3 of more than 10ha	Land take within Flood Zone 2 or 3 of between 5ha and 10ha	Land take within Flood Zone 2 or 3 of less than 5ha		Minor positive impact on the attenuation of water	Some positive impact on the attenuation of water	Substantial positive impact on the attenuation of water
	Water quality	Will the option positively or negatively affect water quality? Will the option improve the resilience of the YW operation that ensures the provision of quality water to users?	Substantial pollution of water quality with drop in WFD class or creating new red DWSP risk	Some pollution of water quality	Minor pollution of water quality with no drop in WFD class or element, slight impact on DWSP risk		Minor water quality improvement within WFD class or element. No impact on DWSP risks.	Some water quality improvement	Substantial water quality improvement, resulting in WFD class removal or avoidance of a DWSP risk.
	Pollination	Will the option impact on land which provide habitat for insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds?	Substantial negative impact on pollination, land take of woodland or grassland of more than 5ha	Some negative impact on pollination, land take of woodland or grassland of between 1 and 5ha	Minor negative impact on pollination, land take of woodland or grassland of less than 1ha		Minor positive impact on pollination	Some positive impact on pollination	Substantial positive impact on pollination

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
	Recreation	Does the option temporarily or permanently affect the use of recreational site and facilities e.g. country park, footpath along rivers and lakes, PRoWs? Does the option enhance the water environment for recreational use?	New infrastructure that permanently impact on recreation land	New pipeline of more than 1km, intersecting PRoW or national trails	New pipeline of less than 1km, intersecting PRoW		Minor positive impact on the recreational offering provided by affected land	Some positive impact on the recreational offering provided by affected land	Substantial positive impact on the recreational offering provided by affected land
	Amenity	Consider the presence of designated landscapes (National Parks, Heritage Coasts, AONBs), city scapes and areas of high visual amenity, will these be affected by the option?	Substantial negative impact on amenity	Some negative impact on amenity	Minor negative impact on amenity		Minor positive impact on amenity	Some positive impact on amenity	Substantial positive impact on amenity
	Non-Use Value	This is the value people place on simply knowing that something exists, often associated with valued habitats, flora and fauna, landscape or heritage assets. Does the option affect any nationally or internationally important areas or designations?	Substantial negative impact on areas or designations that are likely to provide a non-use value	Some negative impact on areas or designations that are likely to provide a non-use value	Minor negative impact on areas or designations that are likely to provide a non-use value		Minor positive impact on areas or designations that are likely to provide a non-use value	Some positive impact on areas or designations that are likely to provide a non-use value	Substantial positive impact on areas or designations that are likely to provide a non-use value
Social	Physical activity	Does the option promote physical activities and wellbeing? Does the option provide new green/blue infrastructure that will encourage active lifestyle of citizens?	Substantial negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Minor negative impact or net decrease in green/blue infrastructure or assets that promote physical activities		Minor positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Substantial positive impact or net decrease in green/blue infrastructure or assets that promote physical activities
	Quality of place	Does the option improve the quality of place in the local community? Does it provide new or improved community space/facilities?	High volume of traffic during construction and operation, down-wind receptors within 100m of new WWTW	Medium volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW	Low volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW		Minor positive impact on quality of place	Some positive impact on quality of place	Substantial positive impact on quality of place
	Trust	Does the option have the potential to damage YW's reputation and stakeholder trust? Does it disbenefit the local community?	Substantial negative impact on stakeholder trust or national media coverage and very high social media activity. Cited as laggard organisation	Some negative impact on stakeholder trust or regional media coverage and medium social media activity	Minor negative impact on stakeholder trust or local media coverage and very low social media activity		Minor positive impact on stakeholder trust or local media coverage and very low social media activity	Some positive impact on stakeholder trust or regional media coverage and medium social media activity	Substantial positive impact on stakeholder trust or national media coverage and very high social media activity. Cited as leading organisation
Human	Employment	Does the option offer employment opportunities? Are there policies to encourage the employment of local work force?	Loss of 50 or more existing FTE.	Loss of between 6 and 49 existing FTE	Loss of up to 5 existing FTE.		Enabling up to 15 new FTE.	Enabling between 15 and 49 FTE.	Enabling 50 or more FTE.
	Skills	Does the option offer the opportunity to upskill YW employees? Does it offer the opportunity for training and/or apprentice of the local labour force?	No opportunity for upskilling or training				Minor positive impact on upskilling and training, potential to support up to 0.5 apprenticeship by the scheme	Some positive impact on upskilling and training, potential to support up to 1 apprenticeship by the scheme	Substantial positive impact on upskilling and training, potential to support more than 1 apprenticeship by the scheme
	Health & Safety	Does the option pose a health and safety risk?	Creation of new Red business risk or escalation of existing business risk to Red threshold (strategic risk scale)	Creation of new Amber business risk or escalation of existing business risk to Amber threshold (strategic risk scale)	Creation of new Green business risk (strategic risk scale)		Removal of existing Green business risk (strategic risk scale)	Removal of existing Amber business risk or reduction of existing business risk to remove it from Amber threshold (strategic risk scale)	Removal of existing Red business risk or reduction of existing business risk to remove it from Red threshold (strategic risk scale)

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
	Local economy	Does the option benefit local economy? Does it create employment opportunities for local work force? Does it affect existing dwellings?	Loss of existing homes of more than 50 units	Loss of existing homes of between 10 and 50 units	Loss of existing homes of less than 10 units		Creating new homes of less than 1000 units	Enabling new homes of between 1000 and 5000 units	Creating new homes of over 5000 units
F&M	Private costs	Does the option impact on the long term financial viability of YW? Does it reduce YW's financial income or operational cost?	Loss of existing financial income or increased operating costs of £1m per year or more	Loss of existing financial income or increased operating costs of between £400k and £1m per year	Loss of existing financial income or increased operating costs of up to £400k per year		Creation of new financial income or reduced operating costs of up to £400k per year	Creation of new financial income or reduced operating costs of between £400,000 and £1m per year	Creation of new financial income or reduced operating costs of £1m per year or more
	Private benefits	Does the option expend on existing assets? Does it create new assets? Does it make any YW's assets redundant?	No private benefits				Increased asset value by up to £2m or Capital receipt of up to £2m	Increased asset value by between £2m and £10m or Capital receipt of between £2m and £10m	Increased asset value by £10m or more Capital receipt of £8m or more

Part of Appendix 8I:
vi. AMP7 Growth Planning, York
Author: Arup

YorkshireWater

Yorkshire Water Services Ltd

AMP7 Growth Planning

York

001

Issue | 13 April 2018

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 256398-00

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ARUP

Contents

Appendices

1 Introduction

Local authorities are required to set out their Local Plans for housing development to meet demand needs for population growth in the future. The Yorkshire Water Land Use Planning Team has received the latest population data to 2035 from Edge Analytics that combines local Plan information and trend based projections.

Significant housing development is forecast in York over the next 10-15 years with up to 10,000 houses being built in various locations around the city. Yorkshire Water's Land Use Planning Team is in close dialogue with the Council's policy planners to ascertain the distribution of the new housing. However, the location and housing numbers are still uncertain. The Preferred Options Sites Consultation document issued in July 2016 has been used for the study.

A full review of the waste water network is required in York to ensure the City's waste water infrastructure (above and below ground) is capable and fit for purpose to carry and treat the sewage loads of the future. Rationalisation potential has also been reviewed where possible.

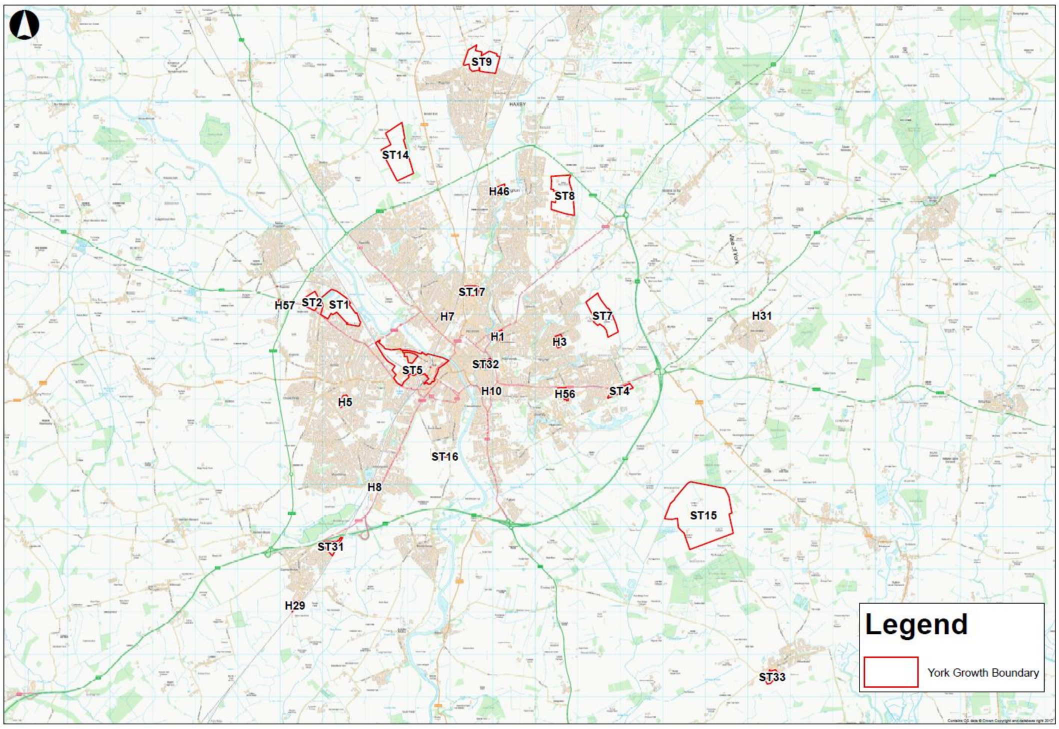
2 Future Growth

2.1 Location

Figure 1 shows the locations and boundaries of the new settlements in York as identified in the York Local Plan Preferred Sites Consultation (2016)[1]. The consultation document was produced to enable the public and other interested parties to comment on policies and sites in the context of the emerging Local Plan. As such, the site allocations are subjected to change. However, as the Preferred Sites Consultation provided the best available information on the sizes and locations of future growth in York at the time of assessment, it was used as the basis for this growth planning project.

The Preferred Sites Consultation document identified 37 sites for housing development, of which only sites larger than 50 units have been included in this study (25 sites in total). The land area covered by these sites is approximately 529 hectares.

Figure 1 York growth locations



2.2 Phasing

Information on the phasing of developments was taken from the Preferred Sites Consultation document[1]. Table 1 shows the projected development phasing for York from 2020 to 2040 and have been broken down by AMP.

[1] City of York Council (2016) City of York Local Plan Preferred Sites Consultation. Available from: https://www.york.gov.uk/downloads/file/11256/preferred_sites_consultation_document [last accessed 27/11/2017]

Table 1 York development phasing

Sites		AMP 7	AMP 8	AMP 9	AMP 10	Total (units)
Ref	**Name**	**2020-25**	**2025-30**	**2030-35**	**2035-40**	
ST1	British Sugar	537	268	168	168	1,140
ST2	Civil Service Sports Ground	195	97	-	-	292
ST4	Land adj Hull Road	141	70	-	-	211
ST5	York Central	833	417	125	125	1,500
ST7	Land East of Metcalfe Lane	537	268	20	20	845
ST8	Land North of Monks Cross	583	292	47	47	968
ST9	Land North of Haxby	490	245	-	-	735
ST14	Land to West of Wigginton Road	560	280	254	254	1,348
ST15	Land to west of Elvington Lane	1,073	537	865	865	3,339
ST16	Terrys (Extension Sites 1&2)	59	30	-	-	89
ST17	Nestle South	210	105	-	-	315
ST31	Land South of Tadcaster Rd	113	57	-	-	170
ST32	ST32 Hungate (Phases 5+)	203	102	-	-	305
ST33	Station Yard, Wheldrake	98	49	-	-	147
H1	Former Gas Works, Heworth Green	224	112	-	-	336
H3	Burnholme School	54	27	-	-	81
H5	Lowfield School	91	46	-	-	137
H7	Bootham Crescent	57	29	-	-	86
H8	Askham Bar Park and Ride	40	20	-	-	60
H10	Barbican	125	62	-	-	187
H29	Land at Moor Lane, Copmanthorpe	59	29	-	-	88
H31	Eastfield Lane, Dunnington	56	28	-	-	84
H46	Land to North of Willow Bank and East of Haxby Rd, New Earswick	69	35	-	-	104
H56	Land at Hull Road (Former site E15)	127	63	-	-	190
H57	Poppleton Garden Centre	62	31	-	-	93
Total		6,597	3,298	1,478	1,478	12,850

Employment growth has been assumed as 0% of the total population growth as only 10% of the total development is projected to include employment across the 5 AMP periods with a negligible amount of employment for AMP7.

An additional 5.2% of the total population has been assumed as school growth. This is in line with the assumptions used for other AMP7 growth planning reports.

3 Assessment of impacts to YW assets

3.1 Water demand

A high level water demand assessment was undertaken on the basis of the following parameters to estimate the projected water demand up to year 2045:

- Per capita water demand of 130l/d per person
- Household occupancy rate of 2.3 people.

The above parameters are consistent with those in existing YWS model for York.

The demand analysis was done for each of the housing development plots identified in Section 2.2 with at least 50 housing units. Table 2 identifies the development plots considered together with the projected total water demand for periods up to Year 2025 (End of AMP 7) and Year 2045:

Table 2 Summary of projected water demand for York development plots

Area Code	Plot ref	Up 2025 (End of AMP 7)		Up to 2045 - Total	
		No. of units	Water Demand (l/s)	No. of units	Water Demand (l/s)
Y022	ST1	537	1.855	1,140	3.945
Y012	ST2	195	0.671	292	1.011
Y009 Y007	ST4	141	0.484	211	0.730
Y051	ST5	833	2.886	1,500	5.191
Y067	ST7	537	1.855	845	3.945
Y082	ST8	583	2.021	968	3.350
Y016	ST9	490	1.696	735	2.544
Y016	ST14	560	1.938	1,348	4.665
Y008	ST15	1,073	3.717	3,339	11.555
York DA	ST17	210	0.727	315	1.090
Y006	ST31	113	0.395	170	0.588

Area Code	Plot ref	Up 2025 (End of AMP 7)		Up to 2045 - Total	
		No. of units	Water Demand (l/s)	No. of units	Water Demand (l/s)
Y050	ST32	203	0.706	305	1.055
Y028	H1	224	0.775	336	1.163
York DA	H10	125	0.429	187	0.647
Y009 Y007	H56	127	0.436	190	0.658

3.2 Flows and Loads

Following an initial review of the York catchment and the housing development locations, the flows and loads assessment was broken down into five areas, Figure 1 for reference:

- Haxby Walbutts WwTW catchment – ST9 and H46
- North York, Rawcliffe WwTW catchment – ST14
- Central York – all new developments within the ring road boundary including ST31, minus H46
- South York – ST15
- Wheldrake WwTW – ST33

As the new developments were spread across a large area, a decision was taken that there was no requirement to design a new sewage works for the entire development as this was not a practical solution. The only area which could potentially lead to a requirement for a new sewage works was the south York site, ST15. The closest existing works is Naburn WwTW at 4.7 km and there is sufficient available footprint adjacent to the new development.

A break-down of the entire combined housing development sewage requirements is therefore not provided. The flows and loads are assessed against the options in Section 10.2.

For each option the following assumptions were made unless stated otherwise:

- Per capita sewage discharge of 130 l/d per person
- Household occupancy rate of 2.3 people.
- Infiltration for new residents of 40 l/d per person
- No trade or imports associated with new housing developments

- For existing works, AMP 7 flows and loads are based on projected DWF population data provided by YWS[2], plus calculated theoretical FFT and loads.
- For existing works with sludge processing, existing capacity was taken from the Kelda Sludge headroom model[3]

The options reviewed are detailed in section 3.4.4.

3.3 Discharge consents

As part of the review, the following existing WwTW current consents were incorporated in the design:

Table 3 York catchment existing consents

Site	BOD consent (95%ile)	SS consent (95%ile)	Ammonia consent (95%ile)	Discharge watercourse
Haxby Walbutts WwTW	10	25	5	River Foss
Rawcliffe WwTW	30	50	21	River Ouse
Naburn	35	55	6	River Ouse
Wheldrake lane	20	30	70	River Derwent
New Works	20	40	5	River Ouse

During the review, it was noted that the predicted 2025 DWF for some of the design options exceeded the existing DWF consents. In order to account for this increase and ensure that the subsequent discharge load did not increase as a result, the design consents were reduced in proportion to the projected DWF increase for these options.

3.4 Identified risks and impacts

3.4.1 Water supply

The proposed housing development areas are all in the York Water Supply zone which is served by the Acomb Landing Water Treatment Works and the Elvington Water Treatment Works which are both pumped systems.

The YWS hydraulic model for York was run with the projected future demand added for the two scenarios of up to end of AMP 7 and up to year 2045. This was to assess the impact of the predicted increased demand on the existing network. The results of the hydraulic modelling can be summarised as follows:

- No major risks to the existing pipelines in terms of unit head loss and pipeline velocities for both scenarios;
- Small areas with supply pressure falling below 15m in YO34, YO47 and YO48 for the end of AMP 7 scenario indicating a risk of DG2 failure,

[2] DWF 80 and 90%ile.xls
[3] 249968-Calc-004-Kelda Sludge Asset Base_Headroom Model_P02 v6.xlsx

Figure 2. These are in areas of low supply pressure known to YWS system operating engineers. No intervention is required for the AMP 7 scenario as the observed pressure is above the minimum requirement of 10m for DG 2 reportable incidences.

- The number of customers receiving supply pressure less than 15m in YO34, YO47 and YO48 increase in the 2045 scenario, Figure 3 and Figure 4.
- Pipeline unit head losses in excess of 4m/km were recorded in the 6-inch / 4-inch main supplying YO47 and YO48 from grid reference 457854, 451486 to 456830, 451021. Please refer to Figure 5.

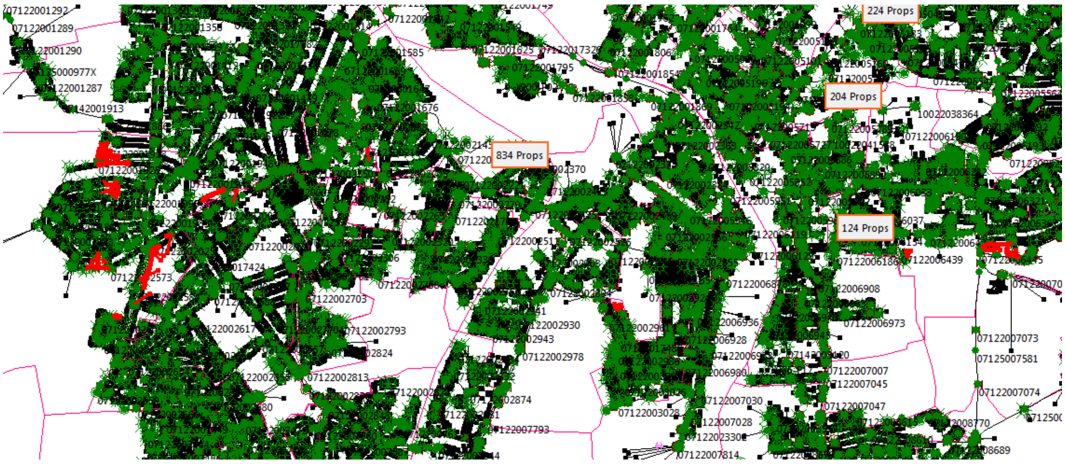


Figure 2 Customer points supply pressure in Y047 and YO 4, AMP 7 scenario (<15m in red)

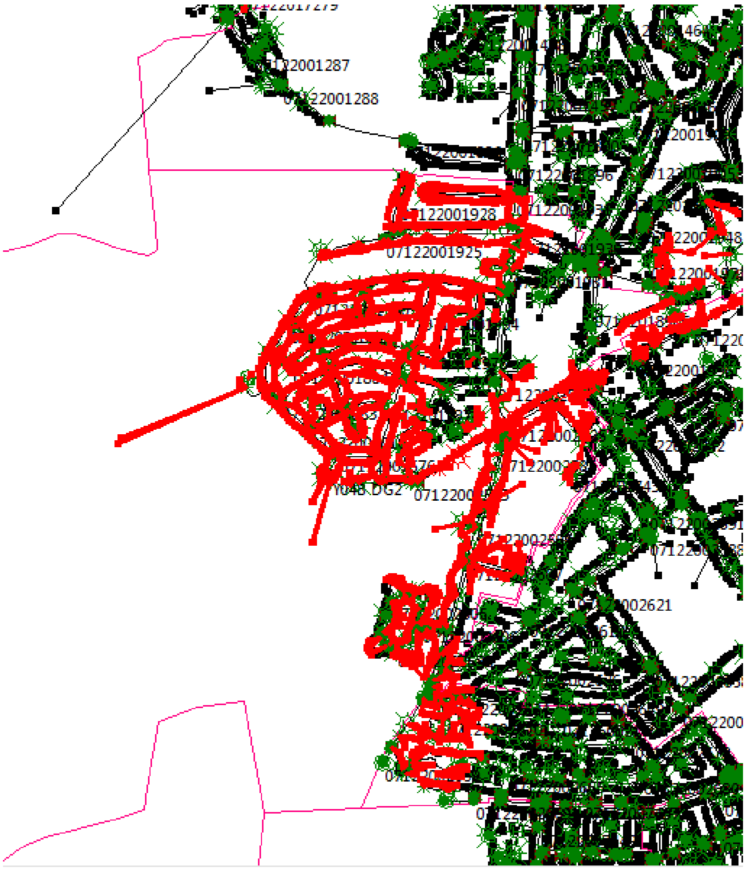


Figure 3 Customer points supply pressure in Y047 and YO48, 2045 scenario (<15m in red)

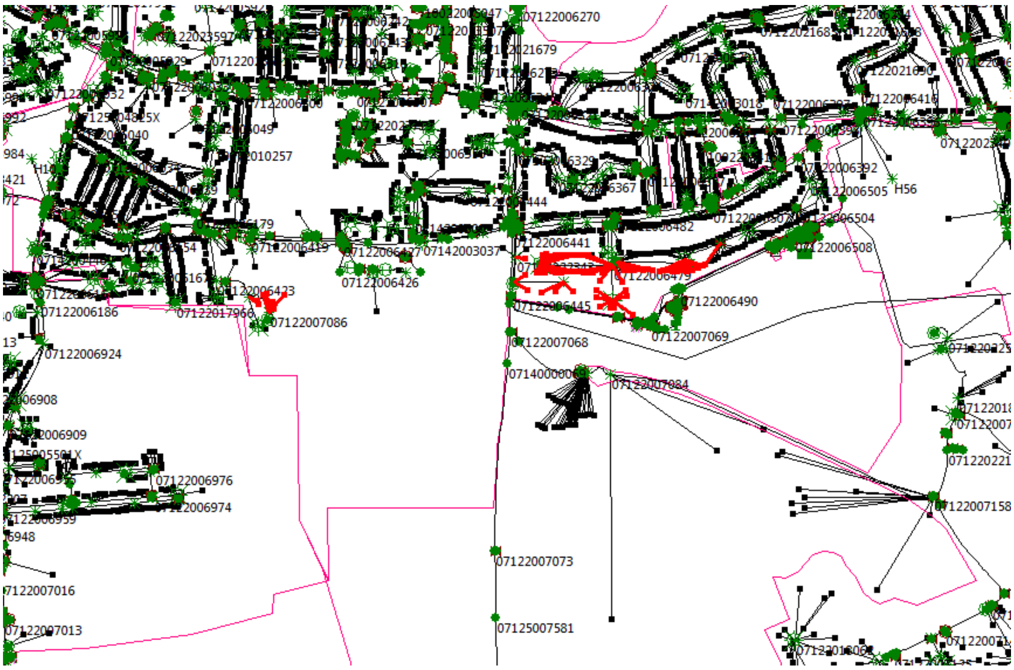


Figure 4 Customer points supply pressure in YO34, 2045 scenario (<15m in red)

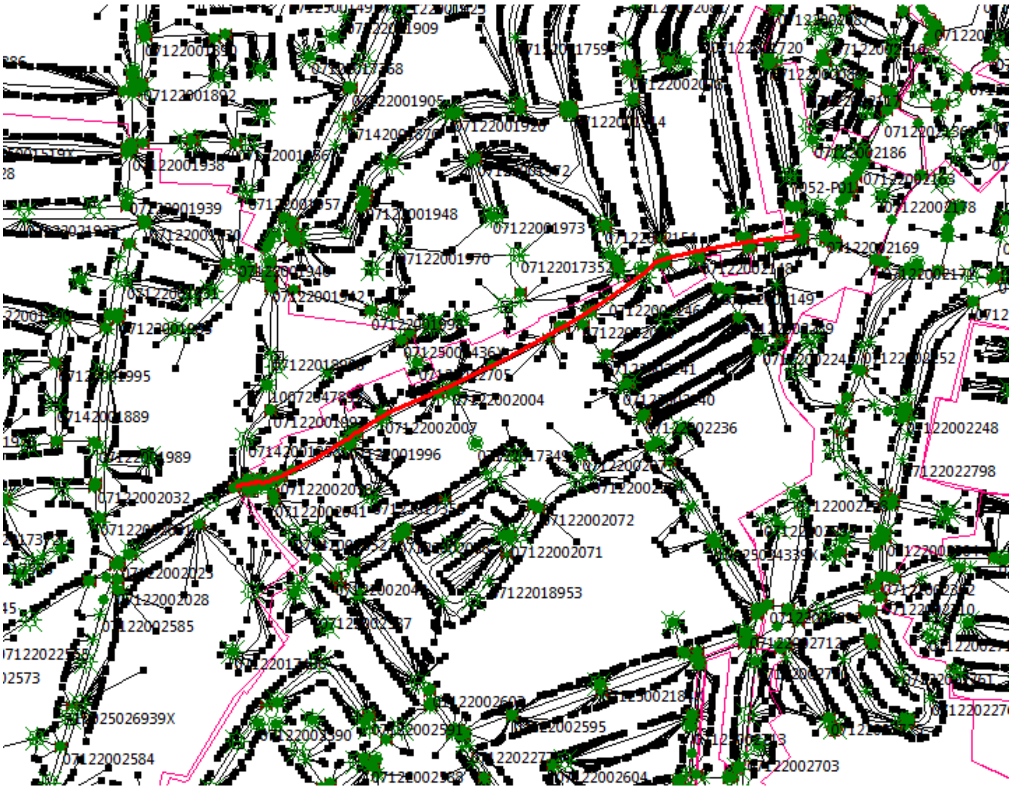


Figure 5 Pipeline unit head loss > 4m/km in main supplying YO47 and YO48, 2045 scenario

3.4.2 Wastewater treatment

The works in the York catchment have been assessed for capacity by comparing the FFT consent and the measured flows, and by comparing the final effluent quality to the current consent. The results for each site are as follows:

Table 4 York local works hydraulic capacity review (2012 – 2017)

Site	**Naburn**	**Rawcliffe**	**Haxby Walbutts**	**Wheldrake**
Measured 95%ile flow, m^3/d	81,605	10,432	7,259	760
Measured maximum flow, m^3/d	110,930	21,930	12,211	1,882
Consented FFT, m^3/d	106,925	13,219	10,000	1,539

Table 5 York local works treatment capacity review (2012 – 2017)

Site final effluent	**Naburn**	**Rawcliffe**	**Wheldrake**
No. samples	36	81	60
Measured average BOD, mg/l	3.7	4.2	4.8
Measured 95%ile BOD, mg/l	7.0	8.0	9
Consented 95%ile BOD, mg/l	35	30	20
Measured average Ammonia, mg/l	1.2	1.5	1.45

Site final effluent	Naburn	Rawcliffe	Wheldrake
Measured 95%ile Ammonia, mg/l	1.9	6.3	4.3
Consented 95%ile Ammonia, mg/l	6	21	70
Measured average SS, mg/l	7.3	9.1	9.2

The Rawcliffe sample data contained a single solids breach. There were no other consent breaches. There is no Haxby Walbutts final effluent data to review. No other consent breaches were noted.

The works were all assessed for process unit capacity, refer to Section 7.

3.4.3 Wastewater Networks

Of the twenty-five development sites (>50 units) located in York, seventeen sites are within the main ring road and the remainder outside. Figure 6 below presents the few developments for York area; the full map of the growth developments can be found in Appendix in section D1. Arup used multiple sources of information to assess YW's existing assets, as described below.

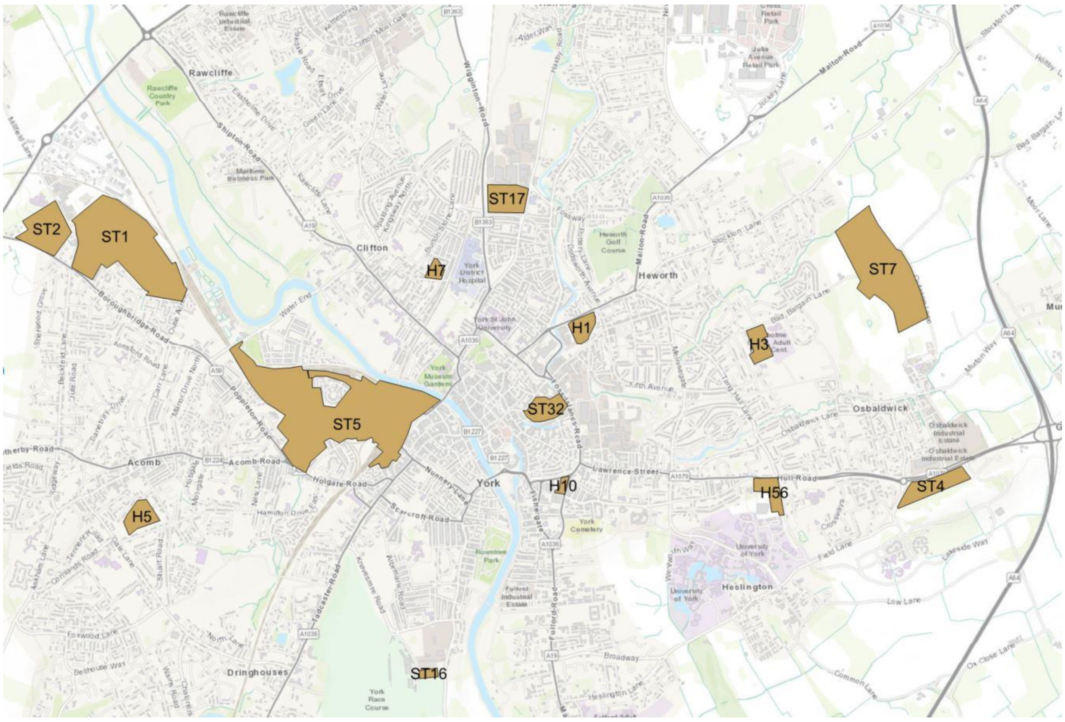


Figure 6 Growth developments in York central area

York is served by sewerage networks draining to several treatment works, details of the location of the treatment works and their consents can be found elsewhere in this report.

The assessment of YW's sewerage network was based on two sources of information: the YW hydraulic model and the GIS network obtained from YW database. However, some of the developments sites were not covered by either of these two sources. In this case the assessment was done based on topography of the terrain and experience. Figure 7 below shows the coverage of the new development sites by the YW's GIS database and existing hydraulic model. Due to the density and complexity of the sewer network in York, Figure 7 does not display the GIS network.

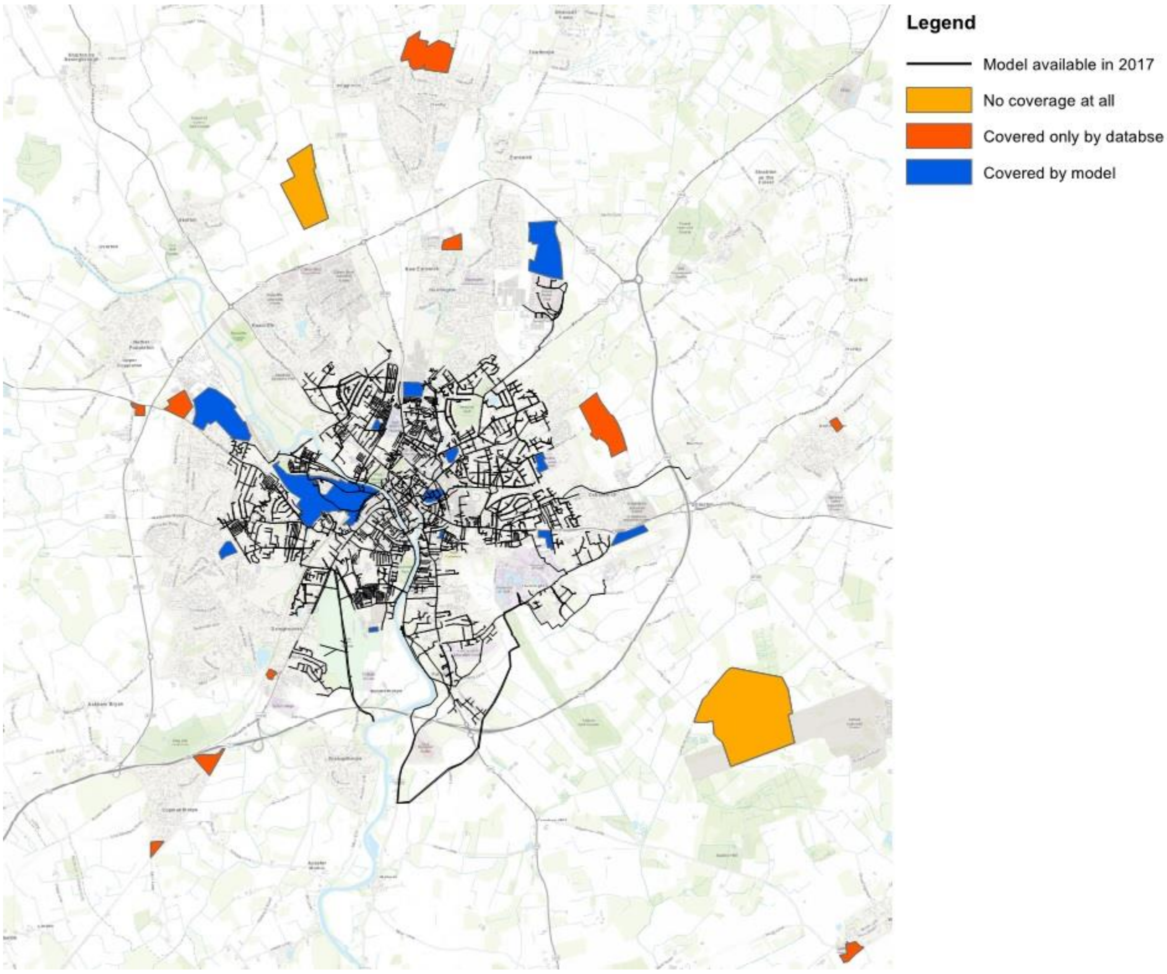


Figure 7 Coverage of new development sites by the YW's GIS database and existing hydraulic model

3.4.3.1 Existing Network in YW's GIS database

The existing network was obtained from YW's GIS database. The network covers the entire city and some suburb areas. The map showing the extents of the wastewater network in the York area and surroundings can be found in Appendix D2. The centre of the York is mainly covered with combined sewers while towards the outskirts the major type of network is a separate system (foul sewers and surface sewers)

3.4.3.2 Existing Model

Yorkshire Water have provided the hydraulic model of York called DAZ380_FossValleyDAP_Dec2014. Assessment of the model has shown that it only covers an area around the centre (the Foss Valley) in detail with further "skeleton model" extending to a slightly wider area beyond this, all within the York ring road. As such the model only extends to cover 13 out of the 25 future development sites, the extent is illustrated in Figure 7 and in more detail in Appendix D3.

3.4.3.3 Meeting with Gary Collins

The assessment process also drew on information provided at a meeting with Yorkshire Water Flood Risk & Engagement Manager, Gary Collins. The discussion was focused on the wider impact of new developments on YW assets and proposed solutions by Arup. At the meeting Gary gave description of the basic principles of the York Flood Defence Pump Station system, which Arup was able to consider as part of the modelling assessment.

York Flood Defence Pump Stations

Gary Collins explained that the centre of York features a system of automated penstocks and storm pumping stations that come into operation when the River Ouse is at 3.6m high. Arup understands that the system is designed to protect the YW wastewater network from high river levels by providing alternate combined sewer release points to cope with high river levels. No documents explaining the system in more detail were provided, despite requests, thus the only operation explanation is the description given by Gary.

Following the meeting Arup analysed the model and found that it featured some automated penstocks that appeared to be located within the area indicated by Gary. The model also provided two downstream boundary conditions for outfalls onto the river, the first being the mean river level of the Foss and Ouse (50%ile), the second being the 95%ile river level. No further information was available in either model report, or despite a request for other info, about how the model represented this system. For the testing of the system Arup tested with both river levels in the model and used the 95%ile river level to represent a worst case scenario.

York Environment Agency Proposed Flood Defence Schemes

Arup is aware that the EA are proposing some further flood defences within York following the flooding in December 2015. The EA has produced the high level explanation of some ideas in the document provided in Appendix D4. However, Arup has not been able to assess if these potential schemes could have an impact on YW assets without further details. This information has been requested from Gary Collins but to date no information has been received, therefore the assessment has not been able to include consideration of these schemes.

3.4.4 Wastewater treatment

The local works have been assessed for capacity by comparing the FFT consent and the measured flows, and by comparing the final effluent quality to the current consent. The results for each site are as follows:

Table 6 York local works hydraulic capacity

Site	Haxby Walbuts	Rawcliffe	Naburn	Wheldrake lane
Measured 95%ile flow, m^3/d	7,259	10,432	81,604	760
Measured maximum flow, m^3/d	12,211	14,217	110,930	1882
Consented FFT, m^3/d	10,000	13,219	106,925	1,539

Table 7 York local works final effluent quality review (2012 - 2017)

Site	Rawcliffe	Naburn	Wheldrake lane
No. samples	81	36	60
Measured average BOD, mg/l	4	3.7	4.81
Measured 95%ile BOD, mg/l	8	7	9
Consented 95%ile BOD, mg/l	30	35	20
Measured average Ammonia, mg/l	2	1.2	1.45
Measured 95%ile Ammonia, mg/l	6.3	1.9	4.4
Consented 95%ile Ammonia, mg/l	21	6	70
Measured average SS, mg/l	9	7.3	9.15
Measured 95%ile SS, mg/l	18	13.5	17
Consented 95%ile SS, mg/l	30	55	30

One consent breach was noted for Rawcliffe SS at 40 mg/l.

There is no outlet quality data available for Haxby Walbutts.

The capacity of the main process units is assessed for each site as part of the options breakdown in Section 0.

4 Environmental and social constraints

A desktop based study was undertaken to understand the existing environmental and social constraints at the growth location to inform the development of clean water and wastewater infrastructure solutions. The study area was defined by a two kilometre radius measured from the development boundaries. The search has returned a number of features of interest. A summary of these features are provided below and a full list of these features of interests are included in Appendix C.

4.1 Ecology

The search identified 7 statutory designations within the study area as shown in Figure 8. These designations include:

- *Sites of Special Scientific Interest (SSSI):* Identified as having flora, fauna, or geological features of special interest. There are 6 SSSI's located within the study area, including; Clifton Ings and Rawcliffe Meadows, Askham Bog, Heslington Tillmire, Fulford Ings and Naburn Marsh.

- *Local Nature Reserves (LNR):* These are nature reserves which have been identified by local authorities as being locally important for wildlife, geology, education or enjoyment. One LNR, St Nicholas Fields, has been identified partially within the study area.

There are a number of non-statutory designations within the study area, including:

- *Ancient Woodland:* This is an inventory administered by Natural England of ancient woodland sites in England, within the study boundary there are three areas of ancient woodland.
- *Sites of Importance for Nature Conservation (SINC)*: A site of importance for nature conservation is a local designation which seeks to protect areas rich in wildlife, including ancient woodland and flower-rich grassland. There are 18 SINC within the study area[4].

4.2 Heritage

There are 14 Scheduled Monuments within the study area, 11 of which are concentrated in York's Central Historic Core. 1,272 Listed Buildings were identified within the study area, including 63 Grade I listings, 156 Grade II* listings and 1,053 Grade II listings.

Within the study area two Parks & Gardens have been identified, including: Grade II listed Museum Gardens and Grade II* listed York Cemetery. The locations of heritage features are shown in Figure 8.

[4] City of York Council (2013) Local Plan Preferred Options proposals map. Available from: https://www.york.gov.uk/downloads/file/9677/local_plan_preferred_options_proposals_-_maps [accessed 19/02/2018]

4.3 Landscaping and recreation

There are no nationally or regionally designated landscape areas within the study area. However, the study has highlighted some features of interest for landscape and recreation, including:

- *Country Park:* An inventory administrated by Natural England of public green spaces often at the edge of urban areas which provide places to enjoy the outdoors and experience nature in an informal semi-rural park setting. There is 1 small registered country park, Rawcliffe Bar, located approximately 0.2km from the proposed pipeline.
- *Public Rights of Way (PRoW)*: There are a number of Public Rights of Ways within the study area. PRoW is available from Ordnance Survey 1:25,000 Colour Raster map and have been given due consideration during option development.

4.4 Flood risk

Both Flood Zone 2 and 3 are present in the study area as shown in Figure 8 These Flood Zones refer to the probability of river and sea flooding without the presence of defences and are defined as below:

- *Flood Zone 2:* Medium probability. 1 in 100~1,000 annual probability of river flooding or 1 in 200~1,000 annual probability of sea flooding.
- *Flood Zone 3:* High probability. 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding.

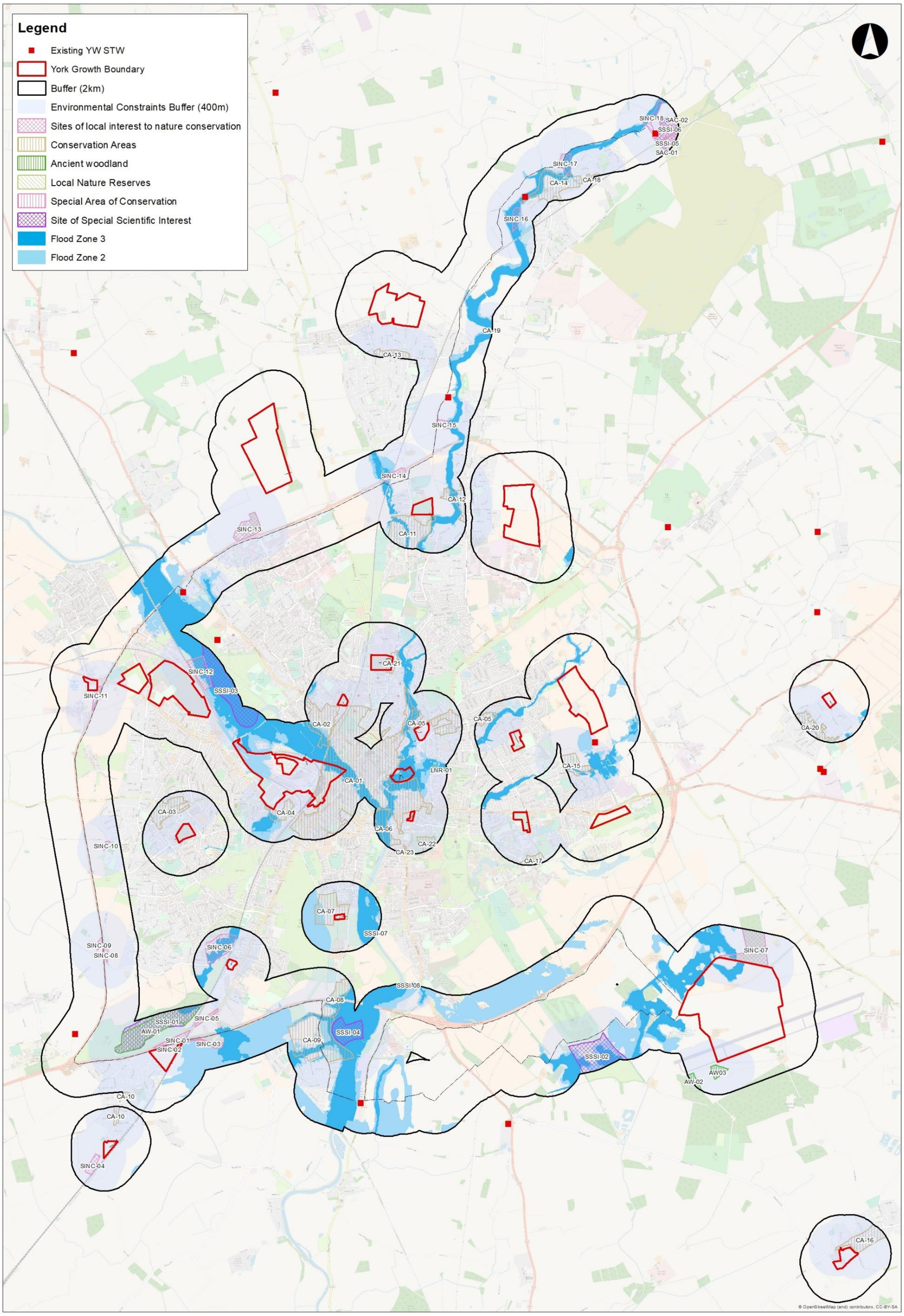
4.5 Sensitive receptors

The route of the proposed pipeline predominantly follows existing roads, including the A64 and A1237. Additionally, extensions to existing STW's are proposed rather than the construction of new works. Therefore, it is anticipated that there will be minimum impact on surrounding settlements and sensitive receptors.

4.6 Approach to constraints mapping

For the purpose of option development, a buffer of 400m has been applied to all the environmental and social constraints identified, with the exception of Flood Zones, to create a screening map highlighting the areas that are most suitable for new water and wastewater infrastructure from an environmental perspective. The mapping is used during option development to inform the siting and routing of new infrastructure. The screening map is shown in Figure 8.

Figure 8 York environmental and social constraints



5 Initial option identification and appraisal

5.1 Clean water infrastructure options

Individual site assessments are included in Section 6 of this report.

5.2 Sewerage and surface water options

Individual site assessments are included in Section 8 of this report.

5.3 Wastewater treatment options

The options considered were:

Option 1a – The flow and associated load of the new developments are directed to the local works. This generally means those in closest proximity to the existing local works.

- Haxby Walbutts – receives the flow and load associated with developments at ST9 and H46
- Rawcliffe - receives the flow and load associated with developments ST14
- Naburn – receives the flow and load associated with developments in central York expect H46 but including ST31

Option 2a, b and c – The flow and associated load of the new developments are again directed to local works, however, for this option the flow and load associated with the large development on land west of Elvington Lane (ST15) is treated in a new dedicated works.

- **2a** - Haxby Walbutts (as Option 1a), Rawcliffe (as Option 1a) and Naburn (as Option 1a but minus ST15) and a new south York works based upon activated sludge treatment to manage flow and load from ST15.
- **2b** - Haxby Walbutts (as Option 1a), Rawcliffe (as Option 1a) and Naburn (as Option 1a but minus ST15) and a new south York works based upon trickling filters to manage flow and load from ST15.
- **2c** - Haxby Walbutts (as Option 1a), Rawcliffe (as Option 1a) and Naburn (as Option 1a but minus ST15) and a new south York works based upon a lagoon to manage flow and load from ST15.

Option 3 – The flow and associated load of all new developments are directed to Naburn and the Rawcliffe and Haxby Walbutts works are closed.

Option 4 – The flow and associated load of all new developments are directed to Naburn except the flow and associated load from ST9 and H46. These are directed to the local works, Haxby Walbutts. Rawcliffe is closed and these flows are then directed to Naburn.

The additional assets identified for each option considered are associated with the growth due the housing developments and not associated with bringing an existing works up to meeting the requirements of the relevant YW Asset Standards. The increase in flows associated with growth are checked against the consented FFT particularly those associated with hydraulic capacity issues such as primary and final settlement. In options when the consented FFT is exceeded additional assets are identified if the existing process unit at a works is not sufficient.

For all Naburn related options, there are no additions to the anaerobic digesters, related equipment (mixing, heating and biogas handling) or dewatering equipment as additional sludge load is assumed to displace imported sludge.

6 Clean water infrastructure options

Solutions to provide water supply to each of the development areas have been identified. These include the point of connection to the existing water supply network and the pipework required to deliver water to the site boundary. The solutions are summarised in Table 8 and shown in more detail in Appendix A.

Table 8 Summary of water supply solutions to future housing developments in York

Area Code	**Plot ref**	**POC**		**Proposed works**
		X	**Y**	
Y022	ST1	457555.5	452824.9	8-inch / 125mm connection c/w meter Install 300m long 125mm ID pipe 9-inch /125mm connection c/w meter
Y012	ST2	456580	453195.2	6-inch / 100mm connection Install 50m long 100mm ID main
Y009 Y007	ST4	463775.9	451230.7	12-inch / 100mm connection Install 50m long 100mm ID main
Y051	ST5	458684	451585.5	15-inch / 150mm connection c/w meter Install 300m long 150mm ID main Install 200m long 150mm ID main by trenchless methods
Y067	ST7	463008.8	452070.2	12-inch / 125mm ID connection c/w meter 160mm / 125mm ID connection c/w meter Install 2.6km long 125mm ID main
Y082	ST8	462205.6	455543	6-inch / 125mm ID connection c/w meter 160mm / 125mm ID connection c/w meter Install 900m long 125mm ID main
Y016	ST9	460441.5	458754.6	6-inch / 100mm ID connection c/w meter Install 250m long 100mm ID main
Y016	ST14	459414.5	457303.6	200 / 125mm ID connection c/w meter 6-inch / 125mm ID connection c/w meter Install 1.9km long 125mm ID main
Y008	ST15	466862.9	449553.5	600 / 200mm ID connection c/w meter Install 6.2km long 200mm ID main

Area Code	Plot ref	POC		Proposed works
		X	Y	
York DA	ST17	460637.1	453446.8	Install meter
Y006	ST31	456946.5	447626.8	8-inch / 100mm ID connection c/w meter Install 350m long 100mm ID main
Y050	ST32	460753.3	451977.5	6-inch/100mm Connection c/w meter
Y028	H1	460992	452544.2	6-inch/100mm Connection c/w meter
York DA	H10	460969.6	451133.3	6-inch/80mm Connection c/w meter
Y009 Y007	H56	462484.9	451283.1	225/80mm Connection c/w meter

No network reinforcement works are required during AMP7. However, the 6-inch / 4-inch main supplying YO47 and YO48 from grid reference 457854, 451486 to 456830, 451021 will require reinforcing in future to enable adequate water supply to the low pressure customers identified in this area.

7 Wastewater treatment options

7.1 Option 1a – Local Works

7.1.1 Haxby Walbutts WwTW

The additional flow and load from the housing developments at ST9 and H46 and also allowing for population growth to 2025 does not result in an exceedance of the current consented DWF (3,900 m^3/d) or FFT (10,000 m^3/d) daily flows.

The current Haxby Walbutts treatment process is based upon:

- Primary settlement tanks (PST) - 2 No. at 16.5m diameter
- Mineral media filters - 4 No. at 35.6m diameter
- Humus tanks (HT) - 2 No. at 16.5 m diameter
- Biological Aerated Flooded Filter (BAFF) plant with 4 No. cells for tertiary treatment

Based upon Primary Settlement Asset Standard, the existing primary settlement tanks and humus tanks are not sufficient for the consented FFT. The respective up-flow velocities for the PSTs and HTs when one tank is not in service is not in compliance.

The BOD and ammoniacal-nitrogen loading to the mineral media filters based upon the population growth and with housing developments exceeds the loading requirements for secondary treatment as required in the Mineral Media Filters Asset Standard. The works does include a BAFF plant as a tertiary treatment process to manage residual BOD and ammoniacal-nitrogen (Amm-N) following treatment in the mineral media filters. The BAFF has hydraulic capacity to manage flows more than the consented FFT. No additional secondary or tertiary treatment is required to manage the flows associated with the growth and local developments.

Haxby Walbutts in many cases is not compliant with the relevant asset standards. The works was not compliant without the addition of the flow and load from the growth and housing developments.

Currently there are no sludge processing activities on site apart from storage and transfer. The facility has a gravity belt thickener that is currently not in operation. The quantities of sludge produced on site exceed the threshold of 340 tonnes DS per year given in the sludge related asset standard. This requires a standby unit at quantities above this value. This requires an additional thickening device and associated equipment. The works has raw sludge storage (co-settled primary / humus / BAFF sludge) for around 5 days of sludge pre-thickening but not based upon two tanks. An additional thickener with associated building and odour control has been included in the costing for this option.

7.1.2 Rawcliffe WwTW

The additional flow and load from the housing developments at ST14 and allowing for population growth to the year 2025 means the current consented DWF (4,973 m^3/d) and FFT (13,219 m^3/d) are exceeded.

The current Rawcliffe treatment process is based upon:

- PSTs - 3 No. at 16.4m diameter
- Activated Sludge Plant (ASP) - 2 No lanes with surface aerators
- Final settlement tanks (FSTs) - 2 No. at 16.4 m diameter
- Tertiary Nitrifying trickling filter (TNTF) – 2 No. at 16.4 m diameter and 3.6 m depth of media

The existing PSTs are sufficiently sized based upon the key criteria of up flow velocity when one tank is out of service and hydraulic retention time. There is sufficient aeration capacity based upon a sludge age of 4 days and a mixed liquor concentration of 3,000 mg/l. The ASP is not required to nitrify as the Amm-N discharge consent is 21 mg/l (95 percentile basis). The existing final settlement tanks when assessed against the requirements of the Asset Standard are sufficient apart from the scenario when one of two lanes are taken out of service. This limitation is not created by the growth associated with housing development therefore additional FST capacity is not included.

The ASP is expected to remove a proportion of the nitrogen as part of the biomass growth in the biological process. This removal associated with biomass growth is not sufficient to consistently reach the ammoniacal-nitrogen consent. Therefore, a TNTF is used to reduce the ammoniacal-nitrogen concentration to ensure compliance with the consent. The current performance on a 95-percentile basis is 6.3 mg/l.

A check of the potential ammoniacal-nitrogen loading when allowing for housing development growth for the year 2025 indicates the loading rate for the TNTF is satisfactory.

There is insufficient surplus activated sludge (SAS) storage pre-thickening. The existing storage tank holds 80 m^3 and an additional capacity of 179 m^3 is required to provide 2 days storage in line with the sludge related asset standard. There is one operational gravity belt thickener (GBT) and associated equipment to manage the SAS from the ASP. The one GBT is sufficient to manage the SAS including that associated with housing development growth. Even without the housing development growth, the annual sludge production exceeds the requirements for the sludge asset standard for including a standby thickener.

7.1.3 Naburn WwTW

The additional flow and load from the central York housing developments and allowing for the population growth to 2025 results in an exceedance of the current consented FFT (106,925 m^3/d). The consented DWF (45,148 m^3/d) is not exceeded.

The current Naburn treatment process after preliminary screening and de-gritting is based upon:

- ASP (4No. lanes with fine bubble diffused aeration)
- FSTs (6 No.) at 40m diameter

However, there is a potential limitation associated with the fine screens (6mm 2D) as part of the inlet works. Currently there are only two fine screens that operate on a duty / assist basis. Each screen is rated at 550 l/s, so the fine screening is not sufficient to manage the current consented FFT. This option includes for an additional fine screen (6mm 2D) and associated screenings handling, rated at 550 l/s. No change is included with the existing coarse screening (2 No.) and the detritors (2 No.) as no increase in storm flows are considered just an increase in foul flows.

The ASP has sufficient volume. It provides an aerated sludge of 12.7 days with an operating mixed liquor of 3,200 mg/l. There is also sufficient settlement capacity in the FSTs.

The SAS handling arrangements are insufficient for the sludge being handled at Naburn. Currently there are duty / assist / standby gravity belt thickeners on site for SAS. An additional sludge thickener is required along with additional raw SAS storage and associated odour control for the new equipment.

There are no additions to the anaerobic digesters or dewatering equipment as additional sludge load is assumed to displace imported sludge.

7.2 Option 2a – Local Works and flows from ST15 to New South WwTW (ASP)

Haxby Walbutts receives additional flow and load from the housing developments at ST9 and H46 along with population growth to the year 2025. This is the same as Option 1a. Rawcliffe receives additional flow and load from the housing developments at ST14 and population growth to the year 2025.

The changes to Haxby Walbutts and Rawcliffe for this option are identical to Option 2a.

Naburn receives additional flow and load as Option 1a, except from the large housing development at ST15. This is sent to a new works to be located to the south of York. The changes to Naburn are like Option 1a in terms of the need for additional fine screening capacity. The Naburn ASP and the FSTs are sufficiently sized for this option. The necessary SAS handling improvements are the same as Option 1a.

Like Option 1a, no additions to the anaerobic digesters or dewatering equipment are included as additional sludge load is assumed to displace imported sludge.

The new works located to the south of York manages the flow and load from the large development at ST15. The treatment process is based upon:

- An inlet works including fine screens (6mm 2D) with associated screenings handling operating on duty / standby basis and grit removal with classifier
- PSTs (2No)
- ASP (4No. lanes with fine bubble diffused aeration)
- FSTs (2 No.)
- Primary sludge storage tank with mixing and odour control
- Unthickened SAS storage with mixing, SAS thickener, Polymer make-up plant and thickened SAS tanks with mixing.
- Odour control for the tanks and thickener

Storm tanks are not included in the assessment as only foul flows are to be received by the new works.

7.3 Option 2a – Local Works and ST15 to New South WwTW (Trickling Filters)

Haxby Walbutts receives additional flow and load from the housing developments at ST9 and H46 along with population growth to the year 2025. This is the same as Option 1a. Rawcliffe receives additional flow and load from the housing developments at ST14 and population growth to the year 2025.

The changes to Haxby Walbutts and also Rawcliffe for this option are the same as Option 2a.

Naburn receives additional flow and load like Option 1a except from the large development at ST15. This is sent to a new works to be located to the south of York. The changes to Naburn are like Option 1a in terms of additional fine screening capacity. The ASP and FSTs are sufficient. The SAS handling improvements are the same as Option 1a. Like Option 1a, no additions to the anaerobic digesters or dewatering equipment are included as additional sludge load is assumed to displace imported sludge.

The new works located to the south of York manages the flow and load from the large development at ST15. The treatment process is based upon:

- Fine screens (6mm 2D) with associated screenings handling operating on duty / standby basis
- Grit removal and classifier
- PSTs (2No)
- Trickling Filters (2 No circular mineral media)
- Humus Tanks (2 No.)
- Primary and humus sludge storage tank with mixing and odour control.

Storm tanks are not included in the assessment as only foul flows are to be received by the new works.

7.4 Option 2a – Local Works and flows from ST15 to New South WwTW (Lagoon)

Haxby Walbutts receives additional flow and load from the housing developments located at ST9 and H46 along with the anticipated population growth up to the year 2025. Rawcliffe receives additional flow and load from the housing developments at ST14 and population growth to the year 2025.

The changes to Haxby Walbutts and Rawcliffe for this option are the same as Option 1a.

Naburn receives additional flow and load like Option 1a except it does not receive from the large development located at ST15. This is sent to a new works to be located to the south of York.

The changes to Naburn are like Option 1a in terms of additional fine screening capacity due to the lack of current capacity. The ASP and FSTs are sufficient. The SAS handling improvements are the same as Option 1a. Like Option 1a, no additions to the anaerobic digesters or dewatering equipment are included as any additional sludge load is assumed to displace imported sludge.

The alternative to traditional options for wastewater treatment plant design is facultative lagoons. The facultative lagoon option has been considered due to its sustainability, low power requirement and simplicity of operation. The foul flows are directed to the lagoons and are simply held in a series of two lagoons for between 41 and 108 days. The sludge produced stays in the lagoon with little risk of carry-over therefore no requirement for removal. Final effluent may require coarse filtration prior to discharge to a local water course.

Guidance from the supplier suggests that there is no requirement for inlet screening, however there has been some odour issues at a comparable lagoon installation in Scotland which is not fully understood yet and may be because of debris in the sewage. As a precaution, the cost of an asset standard inlet works has been included for this option. This may be removed if it is considered to be surplus to requirements following investigations.

The designed is based on a series of two lagoons. The area is based on population equivalent and is therefore not impacted by IWM measures. The design depth is 4.6m.

The design of the lagoons is based on YWS Facultative Lagoons Guidance Note V1 which has been developed in conjunction with the supplier Gurney Environmental Ltd.

A lagoon has been approved by YWS for construction at Withernsea. Currently, if the lagoon holds more than 25,000m^3 above lowest natural ground level, then it must be registered as a large raised reservoir and be subject to additional requirements. If Phase 2 of the Flood and Water Management Act is enacted, it would reduce this capacity to 10,000m^3.

The new lagoon based works located to the south of York for managing the flow and load associated with the large development at ST15 is based upon:

- Fine screens (6mm 2D) with associated screenings handling operating on duty / standby basis
- Grit removal and classifier
- Facultative aerated lagoon – aerated first cell and second cell containing a media for ammN removal

Storm tanks are not included in the assessment as only foul flows are to be received by the new works.

7.5 Option 3 – All Flows to Naburn WwTW and Rawcliffe WwTW and Haxby Walbutts WwTW decommissioned

This option is based all the flow and associated load from all the new developments being directed to Naburn. It is also based upon the works at Rawcliffe and Haxby Walbutts being closed. It is based upon a population growth up to the year 2025.

These additional flow and loads results in an exceedance of the current consented FFT (106,925 m^3/d). The consented DWF (45,148 m^3/d) is also exceeded.

The current Naburn treatment process is not sufficient to manage these additional flows. The additional process units included are:

- Coarse screen with associated screenings handling
- Grit removal and classifier
- Fine screen (6mm 2D) with associated screenings handling
- PSTs (4 No)
- Primary sludge storage with mixing
- Primary sludge thickening and thickened sludge storage
- Odour control for the primary sludge handling

Like previous options, there is a potential hydraulic limitation associated with the sewage screening. The limitation is likely to extend to the initial coarse screening stage therefore an additional 25mm 1D screen is included with associated screenings handling. An additional detritor and grit classifier is also included due to increased flows.

To manage the additional flow and load, 6 No. 38m diameter radial flow PSTs are included to reduce BOD and solids load burden onto the existing ASP. This results in sufficient ASP plant and aeration capacity being available. There is also sufficient capacity available using the existing FSTs.

The production of primary sludge from the PSTs results in the need for additional sludge management. Therefore, PST desludging, primary sludge storage, primary sludge thickening, thickened sludge storage and associated odour control is required.

The load reduction onto the ASP because of the introduction of PSTs leads to a reduction in SAS production therefore the existing SAS handling equipment is sufficient.

There are no additions to the anaerobic digesters or dewatering equipment as additional sludge load is assumed to displace imported sludge.

7.6 Option 4 – All Flows to Naburn WwTW and Haxby Walbutts WwTW and Rawcliffe WwTW decommisioned

The flow and associated load of all new developments are directed to Naburn except the flow and associated load from the developments at ST9 and H46. These are directed to Haxby Walbutts. Rawcliffe is closed and these flows are then directed to Naburn.

The requirements for Haxby Walbutts in this option is the same as Option 1a.

For Naburn, the additional flow and loads results in an exceedance of the current consented FFT (106,925 m^3/d). The consented DWF (45,148 m^3/d) is also exceeded.

The current Naburn treatment process is not sufficient to manage these additional flows. The additional process units included area:

- Coarse screen with associated screenings handling
- Grit removal and classifier
- Fine screen (6mm 2D) with associated screenings handling
- PSTs (4 No)
- Primary sludge storage with mixing
- Primary sludge thickening and thickened sludge storage
- Odour control for the primary sludge handling

Like previous options, there is a potential hydraulic limitation associated with the sewage screening. The limitation is likely to extend to the initial coarse screening stage therefore an additional 25mm 1D screen is included with associated screenings handling. An additional detritor and grit classifier is also included due to the increased flows.

To manage the additional flow and load, 6 No. 36m diameter PSTs are included to reduce BOD and solids load burden onto the existing ASP. This means there is sufficient ASP plant and aeration capacity. There is also sufficient capacity available using the existing FSTs.

The production of primary sludge from the PSTs results in a need for sludge management. Therefore, PST desludging, primary sludge storage, primary sludge thickening, thickened sludge storage and associated odour control is required.

The load reduction onto the ASP as a result of the introduction of PSTs leads to a reduction in SAS production therefore SAS handling equipment is sufficient.

There are no additions to the anaerobic digesters or dewatering equipment as additional sludge load is assumed to displace imported sludge.

8 Wastewater Network Assessment and Solutions

8.1 Methodology

8.1.1 General

Location and data about new development sites were taken from the City of York Council Local Plan. All together in the York area there are 49 new development sites planned. Sites with less units than 50 have not assessed as they are likely to have limited impact on YW assets. Therefore, the number of sites assessed was reduced to 25.

Arup undertook an assessment of both Foul and Surface Water flows from each site. Surface water was an addition to the scope, agreed with YW at the meeting on 6th September 2017. The assumptions and methodology used are described in the sections below.

8.1.2 Key assumptions

For the purpose of the assessment several key assumptions were made:

- The assessment has considered the impact of a new development's flows on the wider YW network and where necessary has proposed and costed a solution. The assessment did not just focus on each individual site's drainage.
- For individual sites, the costs to YW were considered to be any network improvements needed to connect to a suitable drainage point outside the site's boundaries.
- In cases where site topography shows low point within the site, this assessment has provided a cost for YW for a connection from the low point of the site to the nearest appropriate YW asset or river/watercourse.
- Where site topography is unknown/hard to determine, this assessment has provided a cost for YW for a connection from the centre of the site to the nearest appropriate YW asset or river/watercourse.
- For sites where sewers/rivers cross sites it is assumed the developer will connect directly and therefore there will be no costs for YW connected with these sites.
- Gravity solutions were always favoured over pumped solutions, for long term sustainability, however a number of sites did require some pumped drainage.

8.1.3 Brown and Greenfield Sites

To determine the size of the new flows that will be generated by sites in the York area, developments were divided into 2 categories: brownfield and greenfield sites. It was assumed that brownfield is the site which is or was previously developed, as assessed from aerial photographs, and greenfield sites were defined as previously not developed at all. The majority of the brownfield sites were located around central York. Figure 9 presents the location of greenfield and brownfield sites.

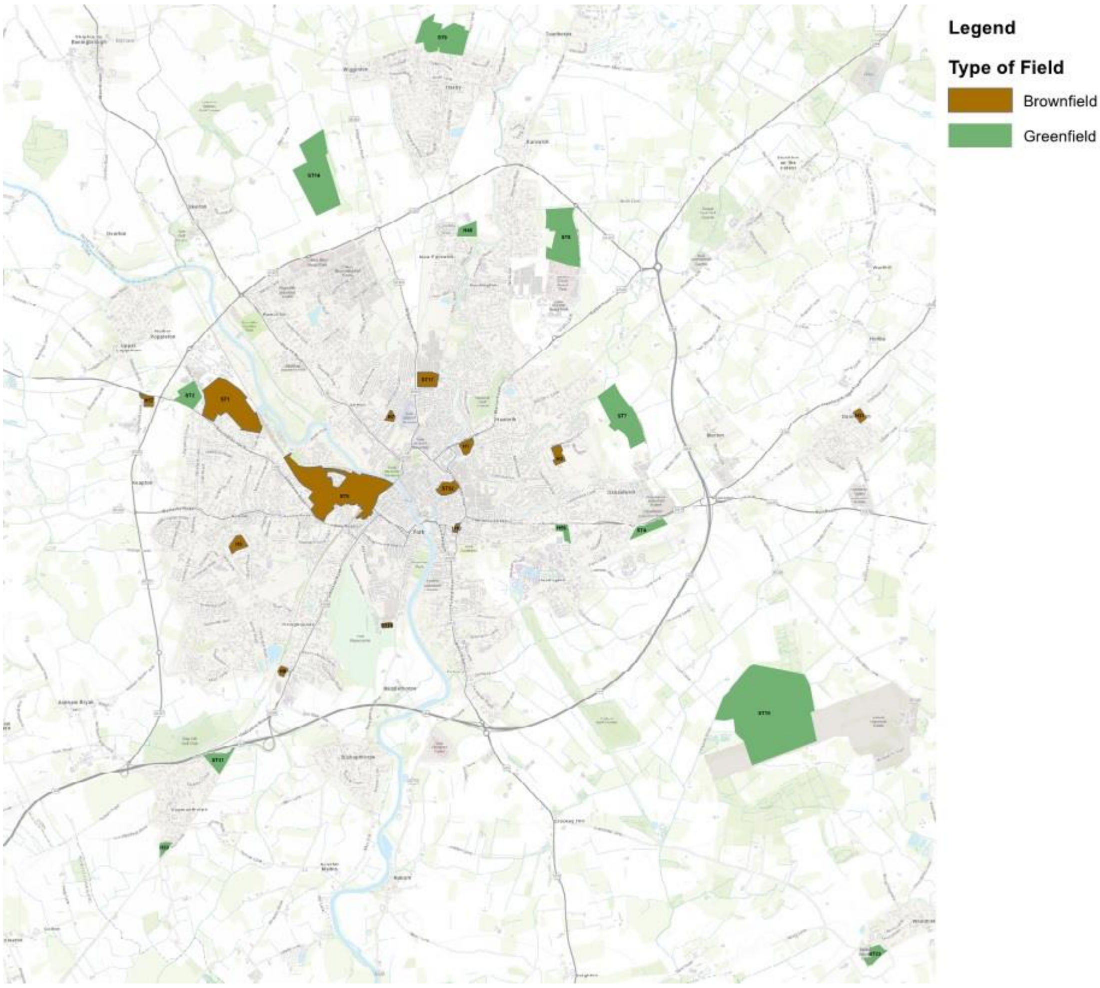


Figure 9 Brownfield and greenfield sites in York area

8.1.4 Foul flows

In the assessment of influence of foul flows from new developments on YW's assets two approaches were taken:

- Assessment for areas inside the modelled area
- Assessment for areas outside the modelled area

8.1.4.1 Sites covered by the YW model

In using the model, Arup took the supplied model from YW and began using it, no analysis of the model's accuracy or verification status was undertaken, in line with the scope of this project.

As described previously, there are 13 sites covered by model. One of these sites (H5), is on the very edge of the model's extents. It was assumed that the developer will connect into sewers crossing the site that are outside the model, therefore this site was not taken into account in the modelling task, therefore only 12 sites will be modelled for these 12 sites the model had to be adjusted.

A suite of durations was run through the model for a 1 in 5yr return period design rainfall event, using the 95 percentile river level to establish criticality. The critical duration was found to be 240mins in terms of the worst case flooding. Comparison of the flood volumes between the baseline and the development models were made to assess the impact of the new developments on the existing network. Where the model was found to be predicting more flooding in the new development model, solutions were looked at to resolve the flooding.

For details of the outcome of the modelling refer to the Surface Water section 8.1.5 below and for the required solutions are detailed in Table in section D5.

8.1.4.2 Sites outside the YW model

For Areas outside the model, DWF and Formula A were used in order to assess diameter of the connection pipe/rising main. Typically, the YW GIS Network did not provide gradients or invert levels, where this was the case Arup assumed that self cleansing gradients for pipe full flow had been used, using the principal that a gradient equivalent to diameter provides this (e.g. 225Ø at 1 in 225). Additionally, based on these factors and conversation with Gary Collins (Flood Risk & Engagement Manager in Yorkshire Water) the impact of the new developments on the wider YW network was assessed.

The approach followed to assess if new developments pose a risk on the YW assets is described below.

Dry Weather Flow

Dry Weather Flow (DWF) for the total development proposal up to AMP10 were calculated for each site in order to see how much additional foul flow will be entering the YW network.

The following formula was used to assess DWF from all sites:

$$DWF = PG + I + E$$

Where:

DWF – Dry weather flow in m^3/day and then converted into l/s

P – Population (number of people)

G – Average domestic wastewater contribution (130 l/hd/day)

I – Infiltration (assumed from YW figures 40 l/hd/day)

E – Employment/School wastewater contribution (50 l/hd/day – employment, 90 l/hd/day school contribution).

Employment and schools were only accounted for on a few sites.

- It was assumed that schools will be built for sites where more than 1000 units are planned (site ST1, ST14 and ST15). It was assumed that size of each school will be 500 people.
- Employment was added to sites where site type in City of York Local Plan was stated as Business or had description of Proposed Strategic Employment. Four sites were matching this criteria: ST33, ST5, ST17 and ST2. For these four sites it was assumed that on top of the number of units stated in the Local Plan there will be additional 25% contribution of employment.

Formula A Flows

Additionally, whilst DWF provides an averaged flow across a day, it is necessary to consider Formula A to account for greater peak flows as each site's flows enter a sewer. Formula A was calculated for each site with the following formula:

$$Formula\,A\; = \;DWF\; + \;1.36P\; + 2E$$

Where

DWF – Dry Weather Flow in m^3/day

P – Population of the given site, (number of people)

E – Industrial effluent (m^3/day – for this study neglected)

Site Topography and Gravity versus Pumped

The site topography was assessed by using LiDAR data obtained from the Environmental Agency. Each site was analysed and determined if it can be drained by gravity from the lowest point on the site. However, where there was no possibility to connect the site by gravity system, pumping was introduced.

In total 7 out of 25 development sites required pumping because of the topography. Additionally, pumping also occurred in the scenarios where flows were transferred from smaller treatment works to Naburn wastewater treatment works.

The pump ratings were calculated by the following standard pump power formula using the flow and head and an assumed efficiency of the pumps.

$$P_{hydraulic} = Q \times \rho \times g \times h$$

Where:

$P_{hydraulic}$– hydraulic power (W)

Q – flow rate (m3/s)

ρ – density of the liquid (kg/m3)

g – acceleration of gravity (m/s2)

h – head (m)

$$P_{pump} = \frac{P_{hydraulic}}{Pump\,Efficiency}$$

The efficiency assumption varies – modern pumps can run at high efficiencies of over 70%, but this is only at their optimum point and efficiencies can be much lower depending on the pump size and the relationship between flow and head. Efficiencies are particularly low for low flow but relatively high head duty.

Pump efficiency has been estimated on a case by case basis for the various duty applications. Due to the small flows and large static head most of pumps had a lower efficiency than 70 %. For all cases, it is assumed that submersible/immersible close-coupled wastewater pumps will be used. The calculated power ratings have been checked against manufacturer product ranges to ensure the proposed ratings are feasible, with corrections made as appropriate.

Rising mains were sized based on minimising friction losses whilst maintaining self-cleansing velocity through the pipes. For particularly low flows, the mains were sized based on the minimum permissible size according to Sewers for Adoption 7th edition - 80mm diameter. In this case pumped flows were increased from required flow in order to maintain sufficient velocity.

The emergency storage was calculated based on the population value feeding to each pump. The value of 160 litres per head was used to size the emergency storage as required by Sewers for Adoption 7th edition. The wet well volume was estimated based on assuming the minimum run time of the pumps is 10 minutes.

Site by Site Assessment

Using the brown/greenfield data, information provided by Gary Collins, site topography (where available) and the calculated flows, a site by site assessment was undertaken to evaluate the impact on the network and confirm the new sewers/assets requirements.

Where the GIS information contained depth or gradient information for pipes this was considered.

The outcome of the assessment is also shown in the table in Appendix D5.

8.1.5 Surface water flows

In order to assess how given site will be dealing with surface water, several assumptions had to be made and then several steps were taken, as described below.

8.1.5.1 Surface water assumptions

For the purpose of the surface water assessment several general assumptions were made:

- Surface water drainage should be drained from sites by considering the options using the drainage hierarchy. Firstly, consider infiltration, then discharge to river/watercourse, then discharge to surface water sewer and finally, only if no other option is available, discharge to combined sewer.

- Infiltration drainage is assumed to not be viable in York due to the ground conditions. Detailed site by site studies at a later stage may find this possible on some sites.
- During the September 2017 meeting with Yorkshire Water, it was agreed that the impact of new development's SW flows on the wider network, where they can not drain to a watercourse, should be assessed to a 1 in 5 year return period for no increased flooding. 1 in 5 year's was suggested to be in line with the DG5 2 in 10 year criteria, the lowest DG5 storm magnitude.
- Arup used the supplied model from YW but did not carry out any analysis of the model's accuracy or verification status, in line with the scope of this project.
    - This included no detailed assessment of "sealed manholes" used by the modellers. Following flooding analysis by Arup some were found around the sites being studied and were changed if necessary/worked around appropriately. Those that Arup have found seem to have logical modelling explanations attached to them. However, Arup did not do an extensive study to establish the extent of their use has been undertaken, therefore this may hide some flooding.
    - In addition, the supplied downstream boundary conditions (river levels) were not analysed and were used as supplied, without modification. Arup did request further information on this from YW but no further data was received.

8.1.5.2 Watercourse and existing drainage proximity

All 25 sites were divided into three categories based on proximity to drain to a watercourse:

- Watercourse through/on the boundary of the site
- Watercourse less than 50 meters from the site
- Watercourse more than 50 meters from the site

The 50 meters threshold was used because it is relatively easy to access a watercourse which is located 50 meters from the site and be able to discharge to it. Any greater distances may cause legal issues crossing private land that a developer may have no rights to do.

A similar assessment was taken regarding the coverage of existing surface water drainage. Sites were again divided to three categories:

- Covered by surface water network
- Covered by combined network only
- Not covered at all by either combined nor surface water network

These two assessments helped identify the sites that can be drained directly to watercourses and sites that could impact on YW assets. It was assumed that if the watercourse runs through or on the boundary of the site, the developer will have a duty to discharge surface water directly to watercourse.

8.1.5.3 Brownfield or greenfield sites

As described in section 8.1.3 in order to calculate new flows generated by new developments, sites were divided into 2 categories: Brownfield and Greenfield sites. The calculation of flow depends on this classification. Below there can be found explanation about the methods taken to assess flow generated by greenfield and brownfield sites.

Brownfield SW Flow Calculation

The following reasoning was undertaken to calculate the flows discharging from brownfields. The September 2017 meeting with Yorkshire Water agreed that if surface water cannot be drained to a watercourse then the assessment was to assume LLFA & YW will restrict the development’s surface water to at least 30% reduction from existing surface water flows. The following formula was used to calculate the flow generated by brownfield sites:

$$Q_{brown} = 0.7 \times 3.61 \times CIA_{imp}$$

Where:

0.7 – reduction coefficient of the brownfield flow by 30%

C – Dimensionless coefficient of permeability – 0.95

I – Rainfall intensity (mm/hr) – 50 mm/hr

A_{imp} – Current/previous impermeable area of the site (ha)

The value for rainfall intensity was chosen to be 50 mm/hr because this figure is often used LLFAs and it was, therefore, appropriate for use in this assessment. For information 50mm/hr is the average intensity for a roughly equivalent 1 in 5 year return period summer storm in York.

Greenfield Runoff Calculation

At the September 2017 meeting with Yorkshire Water, it was agreed that if SW cannot drain to a watercourse, then Arup should assume the LLFA & YW will restrict a development’s SW discharge rate of 3l/s/ha (i.e. greenfield runoff rates) into a surface water or combined sewer.

Following the meeting, it was considered that it is unlikely the planning process would impose a simple rigid 3l/s/ha. This is because, from Arup’s development experience, 3l/s/ha could be found to be too low and not covering a range of rates as storm sizes increase. Therefore, this could be easily challenged by a developer and the assessment would therefore not reflect reality. Applying an appropriate greenfield run-off calculation to each site would be more applicable. As such, the greenfield runoff was calculated using the ICP SUDS method for the 1 in 5 years return period.

This calculation method was designed to calculate flows from undeveloped and partly urbanised catchments and it is also used for determination of allowable discharge for new developments. This technique is based on Flood Studies Report approach. It yields the Mean Annual Maximum Flood (knows as QBAR). The growth factors are generated based on recommendations from CIRIA Book 14 and used to convert QBAR to different return periods for different regions of UK. The ICP SUDS method is designed to calculate flow for catchments smaller than 50 ha.

Site by Site Assessment

In the assessment of influence of surface water flows from new developments on YW's assets two approaches were taken:

1. Assessment for areas inside the modelled area
2. Assessment for areas inside the modelled area

Sites covered by the YW Model

Sites within the model were assessed against the 1 in 5 year critical duration storm. A range of storm durations were assessed across whole city and the critical duration was found to be 240min. The run-time for the simulations used to assess the sites was 2 days.

In order to assess the effect of developments on the YW's assets several scenarios have been created:

- Scenario 1: Baseline scenario (current stage in York) using mean river levels
- Scenario 2: Developments added on top of the Baseline Scenario 1
- Scenario 3: Baseline scenario with 95%ile river levels
- Scenario 4: Developments added on top of Baseline Scenario 3

For the purpose of this project river levels were assessed using both the mean and the 95percentile of the river level. In particular, the 95 percentile appears to be a very simplified event of a single level consistently applied to the downstream boundary. Therefore, it will exaggerate flooding because it will keep very high level of the river for the duration of the run – 2 days, which is a very unlikely scenario in reality.

For all the scenarios run in this study the main focus was given to increases in flooding above 30m^3, in line with the accepted modelling threshold.

Modelled Results and Solutions

Table 9**Error! Reference source not found.** presents manholes which experienced flooding for the worst case scenario (95-percentile river levels). Figure 10 displays the location of these flooded manholes. As it can be seen, 5 out of 7 manholes were flooded already in baseline scenario with 95%ile river levels.

Table 9 Flooded manholes for baseline 95%ile river levels and added developments to baseline 95%ile river levels

Node ID	Baseline M5-240 95%ile (m^3)	Added Development M5-240 95%ile (m^3)	Increase in flooding (m^3)	Nearest Development site
SE59523104	8,381.6	9,276.1	894.5	ST5
SE60512506	2,679.8	2,851.9	172.1	
SE60512704	10,942.4	11,051.9	109.5	
SE62512501	1,547.4	1,650.7	103.3	H56
SE62523403	6.1	90.9	84.8	H3
SE62524405	0	53.9	53.9	H3
SE62558301	0	562.5	562.5	ST8

The flooding is discussed below:

- The first three manholes (SE59523104, SE60512506 and SE60512704) flooded only in scenarios where river percentile was raised to 95%tile. It is suspected, as explained earlier, that model simplicity is the main cause of this flooding. Because foul flows contribute for entire period of the simulation run (2 days), it is suspected that the difference seen in Table 9 comes from the continued high river flows and constant discharge of DWF. It is suspected that were the model run against actual observed river levels this increase in flooding would be prevented/much reduced, however these actual levels were not available for this study so no further solution work has been undertaken.
  It is worth noting that whilst the flooding at SE59523104 occurred, the upstream York Flood Defence Pump had not been triggered and thus a simple increase in the pump rate would not improve the situation. More information regarding the York Flood Defence Pump would be needed before being able to analyse this flooding any further.
  Manholes SE60512506 and SE60512704 are both very remote from any of the new development sites.
- Manhole SE62512501 was investigated and it was found out that the flooding occurs because it is the hydraulic low point in the vicinity and adjacent to the Osbaldwick Beck. There is one new development upstream – H56, albeit not in the immediate vicinity, which is understood to be the reason for the flooding increase on top of the existing predicted flooding. The solution was proposed to restrict the current surface water discharge rate of the hydrobrake of an upstream recent development from 10 l/s to 8 l/s. This would reduce the flow rate in the combined sewer by the DWF from new development H56. The solution was modelled and proved to reduce increased flooding volume at the manhole adjacent to the Osbaldwick Beck to within $7m^3$, which is acceptable for this level of study. It is worth noting that there is a DG5 property on the register near manhole SE62518106, upstream of the Hydrobrake chamber. This was checked and found that the proposed solution did show an increase in flooding at this manhole. However, during a 1 in 30yr storm 240min duration, the model predicts a $11.1m^3$ flooding in the baseline (existing) and the proposed solution increases this to $12m^3$. As such the $0.9m^3$

flooding increase was assessed as being very minor, within the modelling tolerances, hence why this solution has been proposed. Detailed design would need to be sensitive to the DG5 property in the area.

- Flooding in manholes SE62523403 and SE62524405 was caused by insufficient capacity of network downstream. Upon further analysis it was found that the baseline model was significantly under sizing the actual impermeable areas that appears to be feeding into the network at this point, therefore is likely to be under predicting baseline flooding in this location. The proposed solution is to upsize of downstream network by two pipe sizes. The simulation was rerun with upsized system and flooding was resolved. There may be opportunity to explore some upstream SW removal/SuDS, but the upstream catchment is not very large so the pipe upsizing was proposed instead for this study.
- The cause of flooding for the last manhole in Figure 10 Location of modelled flooded manholes marked in red**Error! Reference source not found.** – SE62558301 was an insufficient pump rate in the existing foul pump station that the site would drain to. The proposed solution is to increase the pump rate from existing rate of 10.2 l/s to 18 l/s, as well as increasing the emergency storage volume. The model was rerun with this solution and the flooding was resolved.

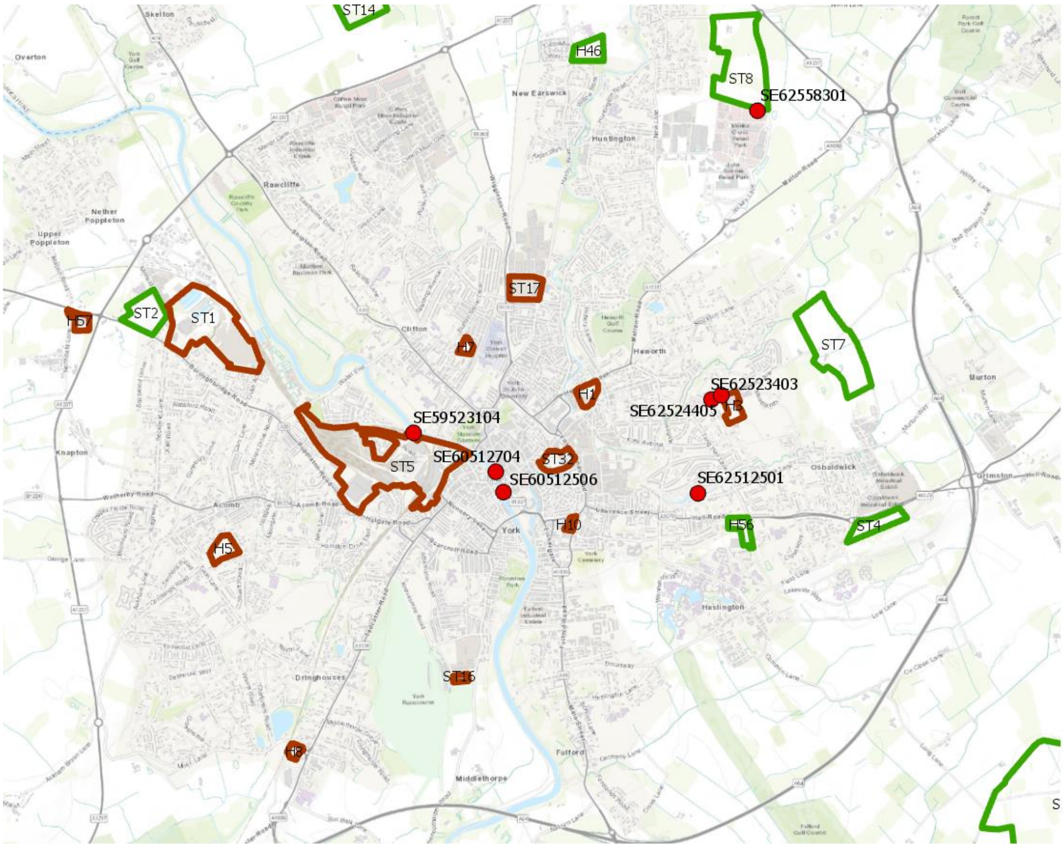


Figure 10 Location of modelled flooded manholes marked in red

Assessment for areas outside the model

A site by site assessment was carried out using the available GIS network data. The impact of the new flows on the wider network were evaluated and any new sewers/assets confirmed. The assessment was undertaken using the Watercourse and Existing Drainage Proximity data, brown/greenfield data, information provided by Gary Collins, site topography (where available) and calculated flows from each new development.

Where the GIS information contained depth or gradient information for pipes, this information was taken into account. Where pipes needed upsizing Arup sized these to self cleansing gradients for pipe full flow with the anticipated increased flows, typically using the principle that a gradient equivalent to diameter provides self cleansing velocities (e.g. 225Ø at 1 in 225).

The outcome of the assessment is also shown in the table in Appendix D5.

8.2 Proposed solutions

The proposed solutions for each location are summarised in Appendix D5.

9 IWM opportunities

Integrated Water Management (IWM) is the management of the water cycle (water efficiency, potable water demands, non-potable water demands, surface water, wastewater and water supply) in harmony with the built environment through planning and urban design. Within this approach the water cycle is considered from the outset and throughout the planning and design process for developments.

Water management approaches are also consistent with the designs for successful places and consider:

- Understanding of the local constraints, such as local environment, infrastructure capacity, available space, etc.
- Making the best use of existing infrastructure and delaying or minimising the need for reinforcements and upgrades.
- Provision of resource security and greater resilience in the future.

The IWM approaches can deliver multiple benefits, include reduced cost of water abstraction and treatment, reduced pumping of potable water and wastewater, increased headroom in water supply and drainage networks, and reduced footprint of wastewater treatment plants.

Meeting the demands for water that can be satisfied by non-potable quality water is one of the central parts of the IWM approach and included measures such as rainwater harvesting.

The non-potable water supply system (rainwater, stormwater, or greywater) can take three primary forms, which are outlined in the image below:

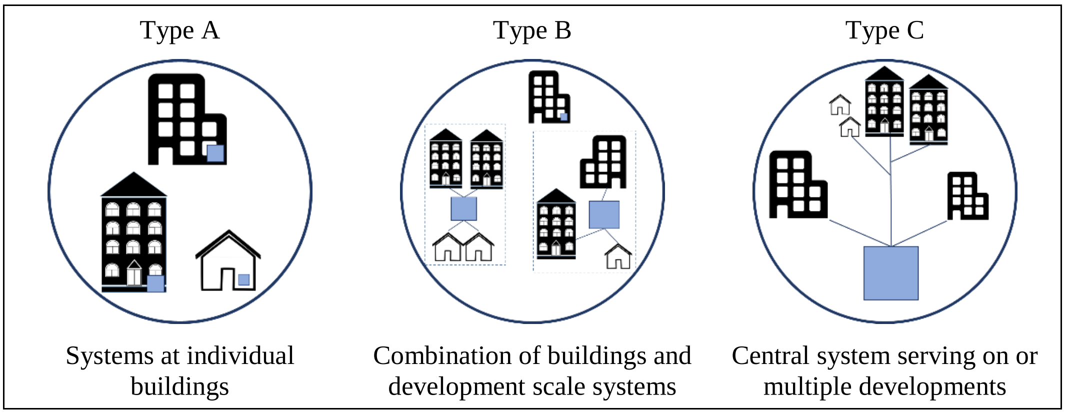


Figure 11 Typologies of non-potable reuse systems

The selection of most suitable system configuration will be dependent on the development type, layout, phasing, as well as local constraints.

9.1 Review of IWM options

There are a number of processes at work within IWM. The approaches considered in the options appraisal for Catterick include:

- Higher water efficiency measures
- Rainwater Harvesting
- Stormwater Harvesting
- Greywater Reuse

The higher water efficiency estimates are based on Building Regulations Part G and assume water demand of 105 l/d per person. The potential supply of rainwater (from rooftops) and stormwater (from catchment surfaces) has been estimated assuming plot area of 250 m^2 and a building footprint of 70 m^2. The potential supply of greywater is estimated using British Standard as well as micro-component breakdown of water uses within homes.

Table 10 Demand reduction potential of IWM options

	Reduction in potable demand ^	**Non-potable demand satisfied**
Rainwater	14%	48%
Rainwater + Stormwater	29%	100%
Greywater	29%	100%

^ compared to Part G 'high efficiency'

** over 25 years and assuming simple payback*

The site ST15 was selected as the most suitable location for implementing Integrated Water Management Measures. The driver at this location is local wastewater treatment capacity and the assessment focusses on reducing the volume of foul flow entering the system.

9.2 Impact on clean water infrastructure solutions

The proposed IWM options may result in a reduction in water mains diameters. These are not considered to have a significant impact on the clean water infrastructure costs in York.

9.3 Impact on wastewater treatment solutions

The IWM option involves reduced potable water consumption and grey water recycling, which results in a revised sewage flow of 75 l/d per person. This is a conservative figure, as the flows can be reduced down to 60 l/d per person based on the industry standard 'water calculator'.

The reduced flow has an impact on all hydraulic processes, namely settlement stages and pumping costs. It does not impact on the secondary treatment process capacity as this is based on load per person and this does not change from implementing IWM. As an example, IWM's impact on the ASP solution design for site ST15 is presented in Table 11 with reductions shown in red. The full IWM solutions for site ST15 are presented in Appendix A.

Table 11 ASP solution summary for site ST15 - IWM design @ 75 l/hd.d

AMP	**7**
P.E.	2,468
FFT, m^3/d	851 (-407)
No. PSTs @ 5.1 (-1.1) m	2
No. ASP lanes @2m width, 20m long	2
No. FSTs @ 6.2m (-1.3m) m	2
Sludge storage (thickened), m^3	20

9.4 Impact on sewerage solutions

The proposed IWM options may result in reduced foul flows reaching the sewers. As such there may be opportunity to reduce the size of some of the proposed wastewater assets by either reducing pipe, storage or pump sizes. In particular, the sizing of the emergency storage may be able to be reduced significantly if a lower volume per dwelling is agreed from the figure of 160l per dwelling given by Sewers for Adoption.

9.5 IWM Cost basis and assumptions

The cost estimates (refer to Table 12) are based on the approach devised and agreed for Old Oak Common Integrated Water Management Study and the Thames Water study on Non Potable Water Reuse as a Demand Management Option for WRMP19. They are totex estimates over 40 years assuming a 6.25% discounting factor.

The cost estimates utilise the New Rules of Measurement (NRM) and Building Cost Information Service (BCIS) from Royal Chartered Institute of Surveyors (RCIS), and are suitable for initial cost estimates at masterplanning stage.

The energy cost of pumping for local non-potable supply have been based on research by University of Exeter on energy consumption in RWH systems.

More detail costing would be possible once there is greater level of understanding of site and building layouts and designs. This would also enable optimisation of costs and finding cost efficiencies.

It is assumed that the necessary storage in pre-treatment stage for rainwater and stormwater will be met by the storm attenuation that will be required to comply with surface water runoff constraints.

Although passive treatment systems are available, to ensure a guaranteed non-potable water quality it is assumed the surface water harvesting will require similar type of membrane treatment systems as used in greywater reuse.

There are two primary avenues available to reduce the volume of wastewater being discharged from the new development at Site S15: implementing (1) higher water efficiency (105 lppd); or (2) greywater reuse (effective wastewater discharge of 60 lppd).

Table 12 Cost estimate for IWM strategy to 2025 (end of AMP7)Table 12 presents the costs of implementing greywater reuse compared to standard and high water efficiency. It takes into consideration 1,064 developments proposed to be delivered for the site by the end of AMP7. A further 2,267 developments are proposed on this site from 2025 onwards.

Table 12 Cost estimate for IWM strategy to 2025 (end of AMP7)

	#	Cost Item	Cost borne by	Standard Water Efficiency (new build)	High Water Efficiency	Greywater
		Properties		1064	1064	**1,064**
		Water Demand		0.32 MLd	0.27 MLd	**0.20 MLd**
		WW discharge		0.28 Mld	0.23 MLd	**0.16 MLd**
CAPEX	1	Dual plumbing (supply)	Developer	NA	NA	**£0.60 mil**
	2	Dual plumbing (greywater drainage)	Developer	NA	NA	**£0.60 mil**
	3	Treatment system	Developer or independent Water Service Company (iWaSCo)	NA	NA	**£0.20 mil**
	4	Membrane replacement (every 10 years)	Facility Management (FM) or iWaSCo	NA	NA	**£20,000**
	5	Pump renewal / replacement (15 years)	Householder, FM or iWaSCo	NA	NA	**£24,000**
OPEX	6	Treatment system operation (annual energy cost)	FM or iWaSCo	NA	NA	**£23,100**
	7	Non-potable supply – annual energy cost for pumping water	Householder, FM or iWaSCO	NA	NA	**£1,400**

- The capital costs for dual plumbing will be borne by the developer in the first instance as the infrastructure will need to be implemented at the time of construction.
- The capital cost of the treatment plant may be borne by developer or an independent operator (WaSCo) if developer enters into such an agreement.
- The operating costs for non-potable system (treatment plant and pumping system) and will be borne by the site Facilities Management or WaSCo.
- For rainwater harvesting, the pump renewal / replacement costs will be borne directly by the householder, as the systems will be at individual households.
- Some or all of these additional costs for others may be recouped through a charging mechanism (service charge or a volumetric charge for non-potable supply).

In Olympic Park in London, the non-potable water supply is charged at a rate below potable water supply charges. In some office buildings where greywater systems are employed, the cost of their operation are included within the service charges for tenants. It is noted that the reduced YW revenue has not been included in the calculations.

10 Costing of options

10.1 Data and assumptions

The capex for the options has been estimated by YWS using the Yorkshire Water Unit Cost Database (UCD). Any items that are not covered in the UCD have been costed by Arup and/or suppliers. The source of the costing information for each work element is presented in Appendix A.

The opex of all options has been estimated by Arup. The totex has been calculated over a 40-year period.

The assumptions used for the design and costing exercise are summarised below:

Area	Capex assumptions	Opex assumptions
Land requirements	AMP10 footprint	n/a
Sewerage	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	
Wastewater treatment	AMP7 requirements	Estimate is based on the AMP7 solution only
Clean water infrastructure	Civil elements have been sized to accommodate the flows from the full development	Estimate is based on the AMP7 solution only
	M&E elements have been sized to accommodate the flows from the AMP7 development	

10.2 Costed options

The following option has been costed for AMP7 implementation.

ID	Option	ID	Sub-options
1	Flows to local works	a	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs

ID	Option	ID	Sub-options
2	Flows to local works + new South WwTW	a	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (ASP) for ST15 and ST33
		b	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (TF) for ST15 and ST33
		c	Expand Haxby Walbuts, Naburn and Rawcliffe WwTWs New South WwTW (lagoon) for ST15 and ST33
		d	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (ASP) for ST15 and ST33 + IWM measures at site ST15
		e	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (TF) for ST15 and ST33 + IWM measures at site ST15
		f	Expand Haxby Walbuts, Naburn and Rawcliffe WwTWs New South WwTW (lagoon) for ST15 and ST33 + IWM measures at site ST15
3	Centralised option	A	Transfer Haxby Walbutts and Rawcliffe WwTWs to Naburn WwTW. Abandon Haxby Walbutts and Rawcliffe WwTWs
4	Centralised option + retain Haxby Walbutts WwTW	a	Transfer Rawcliffe WwTWs to Naburn WwTW. Discharge developments H46 and ST9 to Haxby Walbutts WwTW. Abandon Rawcliffe WwTW.

10.3 Costs

The option costs (capex, opex and totex) over a 40-year period (NPV) are summarised overleaf.

Option ID	Sewerage / wastewater treatment		Clean water infrastructure		Totex (£m)
	Capex (£m)	Opex (£m)	Capex (£m)	Opex (£m)	
1a	19.0	0.9	3.6	-	23.5
2a	21.7	1.9	3.6	-	26.9
2b	22.1	1.6	3.6	-	27.3
2c	20.9	1.8	3.6	-	26.3
2d	21.5	1.9	3.6	-	26.0
2e	22.0	1.6	3.6	-	27.2
2f	20.7	1.8	3.6	-	26.1
3a	53.3	2.2	3.6	-	59.1
4a	41.5	1.8	3.6	-	46.9

11 Environmental and social appraisal

A five-capital approach has been developed to qualitatively appraise the environmental and social impact of the shortlisted options. The assessment framework provides scoring criteria against 21 aspects as listed in the table below, from high negative impact (-3) to high positive impact (+3). The detailed scoring criteria can be found in.

The score under each of the aspects were summed to provide a total for each of the options. Equal weighting has been assumed for all aspects considered.

Table 13 Five capital appraisal summary for all York options

Option ID	Natural													Social			Human				F&M		Total score
	Crops and Livestock	Fisheries	Energy	Water supply	Global climate	Air quality	Flood Regulation	Water quality	Pollination	Recreation	Amenity	Non-Use Value	Physical activity	Quality of place	Trust	Employment	Skills	Health & Safety	Local economy	Private costs	Private benefits	
1a	-1	0	-2	-2	0	-3	-1	0	0	-2	0	0	0	-2	0	1	2	0	3	2	3	**-2**
2a	-1	0	-2	-2	-1	-2	-1	0	-1	-2	0	0	0	-2	0	1	2	0	3	2	3	-3
2b	-2	0	-2	-2	-1	-2	-1	0	-2	-2	0	0	0	-2	0	1	2	0	3	2	3	-5
2c	-2	0	-2	-2	0	-2	-1	0	-2	-2	0	0	0	-1	0	1	2	0	3	2	3	-3
2d	-1	0	-2	-1	-1	-2	-1	0	-1	-2	0	0	0	-2	0	1	2	0	3	2	3	**-2**
2e	-2	0	-2	-1	-1	-2	-1	0	-2	-2	0	0	0	-2	0	1	2	0	3	2	3	-4
2f	-2	0	-2	-1	0	-2	-1	0	-2	-2	0	0	0	-1	0	1	2	0	3	2	3	**-2**
3a	-1	0	-2	-2	-3	-3	0	0	0	-2	0	0	0	-3	0	2	2	0	3	2	3	-4
4a	-1	0	-2	-2	-3	-3	0	0	0	-2	0	0	0	-3	0	2	2	0	3	2	3	-4

As shown in Table 13, the top three options ranked by their overall impact on the five capitals, in descending order are:

- **1a.** Flows to local works – Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs
- **2d.** Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs, New South WwTW (ASP) for ST15 and ST33 + IWM measures at site ST15
- **2f.** Expand Haxby Walbuts, Naburn and Rawcliffe WwTWs, New South WwTW (lagoon) for ST15 and ST33 + IWM measures at site ST15

12 Conclusions and recommendations

Based on the latest phasing information, the lowest totex solution includes the diversion of wastewater flows to local works (Naburn, Rawcliffe and Haxby Walbutts WwTW) and the upgrade of these WwTWs. The short term water supply requirements can be met through local network upgrades. The totex for this option has been estimated at £23.5m.

The option of constructing a new WwTW south of York has also been considered, however, the totex of such solution has been estimated at £26.3-27.3m. Part or full rationalisation of the York wastewater treatment facilities has been estimated at £47m and £59m respectively.

Implementation of IWM solutions in York is likely to be effective in Site ST15. These solutions will reduce YWS totex, but will result in additional costs for others (developers, non-potable reuse system installers) through provision of additional on-site infrastructure required to enable non-potable use.

The costs of the non-potable reuse system and supply of non-potable water are likely to be recouped through a charging scheme. This could be as a flat service charge or metered charges for non-potable supply. The end users (e.g. homeowners) are likely to save on their water bills, provided the non-potable water is supplied at rate below the potable water supply.

Appendix A

List of items for Options Costing

A1 Options

ID	Option	ID	Sub-options
1	Flows to local works	a	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs
2	Flows to local works + new South WwTW	a	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (ASP) for ST15 and ST33
		b	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (TF) for ST15 and ST33
		c	Expand Haxby Walbuts, Naburn and Rawcliffe WwTWs New South WwTW (lagoon) for ST15 and ST33
		d	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (ASP) for ST15 and ST33 + IWM measures at site ST15
		e	Expand Haxby Walbutts, Naburn and Rawcliffe WwTWs New South WwTW (TF) for ST15 and ST33 + IWM measures at site ST15
		f	Expand Haxby Walbuts, Naburn and Rawcliffe WwTWs New South WwTW (lagoon) for ST15 and ST33 + IWM measures at site ST15
3	Centralised option	A	Transfer Haxby Walbutts and Rawcliffe WwTWs to Naburn WwTW. Abandon Haxby Walbutts and Rawcliffe WwTWs
4	Centralised option + retain Haxby Walbutts WwTW	a	Transfer Rawcliffe WwTWs to Naburn WwTW. Discharge developments H46 and ST9 to Haxby Walbutts WwTW. Abandon Rawcliffe WwTW.

A2 Option 1a

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural &	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	220 m length, 225 mm dia, urban	ZY7270	Length	220	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22	kW
ST15	Sewerage	Rising Main to Naburn WwtW Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	6336 m length, 250 mm dia, rural	ZY7311	Length	6336	m
ST15	Sewerage	Pumping station to works	ST15 , 28 m3 normal storage, 534.24 m3 emergency storage	ZY1601	Total internal volume	562	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	22	kW
ST15	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	22	kW
ST15	Sewerage	Brick building		ZY1040	Area	9	m2
ST15	Sewerage	New MCC		ZY1255	Power	44	kW
ST15	Sewerage	Power supply		ZY1355	Power	44	kW
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural &	245 m length, 375 mm dia, urban	ZY7280	Length	245	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
	Sewerage	Chamber (2 chambers) - for rising main ST15	2 Chambers, 1.32 m3 volume each	ZY1065	Volume	2.64	m3
Haxb Wal	Wastewater Treatment	Additional Sludge thickener (standby thickener)	Duty	ZY1820	Through put	1.6	tds/d
Haxb Wal	Wastewater Treatment	Additional thickening plinth / building enclosure, Allow 5 x 5m		ZY1335	Area	25	m2
Haxb Wal	Wastewater Treatment	Odour control for additional thickener	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional ASP feed ps capacity		ZY1601	Volume	3.9	m3
Nab	Wastewater Treatment	Additional centrifugal submersible intermediate pump, 40 l/s	Duty	ZY5050	kW	4	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	4	kW
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional building required. Allow 10 x 8 m2		ZY1335	Area	80	m2
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughp ut	7.5	tds/d

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	Odour control (raw, thickened and digested sludge storage combined)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
Nab	Other	Level transmitters	Sludge storage tanks	ZY0146	Number	6	no
Nab	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	135 m length, 300 mm dia, rural	ZY7276	Length	135	m
Rawc	Wastewater Treatment	Additional SAS storage	Duty	ZY1260	Volume	179	m3
Rawc	Wastewater Treatment	Mixing for sludge storage tank	Duty	ZY1260	Power	3	kW
ST15	Sewerage	Nutriox system (dosing skid for septicity)					
ST15	Sewerage	Dosing skid concrete slab		ZY1335	Area	30	m2
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A3 Option 2a

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open	280m length, 150 mm dia, urban	ZY7271	Length	280	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural &	209m length, 150 mm dia, urban	ZY7270	Length	209	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grasslan	305 m length, 375 mm dia, rural	ZY7276	Length	305	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		d & verge, <2m depth to crown					
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2	ZY1601	Total internal volume	32	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
			m3 emergency storage				
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25.00	m2
Hax Wal	Wastewater Treatment	Odour control for additional thickener	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughput	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building required. Allow 10 x 8 m2		ZY1335	Area	80.00	m2
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughput	7.5	tDS/d
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south work	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south work	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	2,518	m3/d
New south work	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	1,259	m3/d
New south work	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	1,259	m3/d
New south work	Wastewater Treatment	Grit detritor (M&E)	Duty/standby	ZY6790	Flow	2,518	m3/d

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south work	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south work	Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	30	m2
New south work	Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	30	m2
New south work	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	30	m2
New south work	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	30	m2
New south work	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	5	kW
New south work	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	5	kW
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
New south work	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south work	Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	480	m3
New south work	Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air flow	271	m3/h
New south work	Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	44	m2
New south work	Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	44	m2
New south work	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	44	m2
New south work	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	44	m2
New south work	Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	1.6	m3
New south work	Wastewater Treatment	RAS pump 1		ZY1638	Power	4	kW
New south work	Wastewater Treatment	RAS pump 2		ZY1638	Power	4	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south work	Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
New south work	Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	1	kW
New south work	Wastewater Treatment	SAS pump 2	Standby (5l/s)	ZY1638	Power	1	kW
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
New south work	Wastewater Treatment	Primary Sludge tank	1 No.	ZY1650	Volume	35	m3
New south work	Wastewater Treatment	SAS Sludge Tank No.1 (unthickened)	1 No.	ZY1650	Volume	19	m3
New south work	Wastewater Treatment	SAS Sludge Tank No.2 (unthickened)	1 No.	ZY1650	Volume	19	m3
New south work	Wastewater Treatment	SAS Sludge Tank (thickened)	1 No.	ZY1650	Volume	20	m3
New south work	Wastewater Treatment	Primary Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
New south work	Wastewater Treatment	Primary Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
New south work	Wastewater Treatment	SAS Sludge Tank No.1 (unthickened)	Duty	ZY1260	Power	1	kW
New south work	Wastewater Treatment	SAS Sludge Tank No.2 (unthickened)	Duty	ZY1260	Power	1	kW
New south work	Wastewater Treatment	SAS Sludge Tank (thickened) mixing 1	Duty	ZY1260	Power	1	kW
New south work	Wastewater Treatment	SAS Sludge Tank (thickened) mixing 2	Standby	ZY1260	Power	1	kW
New south work	Wastewater Treatment	SAS thickener	Duty	ZY1820	Sludge throughput	156	kgDS/d
New south work	Wastewater Treatment	Additional plinth / enclosure building required for thickener and poly plant. Allow 5 x 10 m2		ZY1335	Area	50.00	m2
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	6	kW
New south work	Wastewater Treatment	Odour control	Sludge storage tanks and thickener	ZY6025	m3/h	670	m3/h

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south work	Wastewater Treatment	Washwater booster package@ 21.7 l/s ins flow, all mech plus elec		ZY1567	m3/d	318	m3/d
New south work	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
New south work	Other	Security site fencing		ZY1175	Length	340	m
New south work	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south work	Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
New south work	Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
New south work	Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no
New south work	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
New south work	Other	Earthworks/Landscaping		ZY1090	Volume	2,000	m3
New south work	Other	Admin building with SCADA		ZY1040	Area	25	m2
New south work	Other	Site access roads	Off site roads	ZY1410	Area	120	m2
New south work	Other	Land purchase	80m x 90m	Steph Walden	Area	1.7792	acres
New south work	Other	STW Power supply		ZY1355	Power	85	kW
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A1 Option 2b

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4	105 m length, 300 mm dia, urban	ZY7279	Length	105	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural &	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	305 m length, 375 mm dia, rural	ZY7276	Length	305	m
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2	ZY1601	Total internal volume	142	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
			m3 emergency storage				
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open	575 m length, 100 mm dia, urban	ZY7312	Length	575	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)					
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25.00	m2
Hax Wal	Wastewater Treatment	Odour control for additional co-settled sludge storage	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building required. Allow 10 x 8 m2		ZY1335	Area	80.00	m2
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	1266	m3/h

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	891	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south work	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south work	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	2,518	m3/d
New south work	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	1,259	m3/d
New south work	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	1,259	m3/d
New south work	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	2,518	m3/d
New south work	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south work	Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	30	m2
New south work	Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	30	m2
New south work	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	30	m2
New south work	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	30	m2
New south work	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	5	kW
New south work	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	5	kW
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
New south work	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south work	Wastewater Treatment	Trickling filter 1		ZY6541	Area	412	m2
New south work	Wastewater Treatment	Trickling filter 2		ZY6541	Area	412	m2
New south work	Wastewater Treatment	Mineral Filter media		ZY1903	Volume	1483.2	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south work	Wastewater Treatment	Distributor 1 including motor drive		ZY6420	Area	412	m2
New south work	Wastewater Treatment	Distributor 2 invluding motor drive		ZY6420	Area	412	m2
New south work	Wastewater Treatment	Humus Tanks 1		ZY6920	Area	35	m2
New south work	Wastewater Treatment	Humus Tanks 2		ZY6920	Area	35	m2
New south work	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	35	m2
New south work	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	35	m2
New south work	Wastewater Treatment	Final effluent recirculation chamber		ZY1065	Volume	3.8	m3
New south work	Wastewater Treatment	TF recirculation pump 1		ZY6100	Power	2	kW
New south work	Wastewater Treatment	TF recirculation pump 2		ZY6100	Power	2	kW
New south work	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW
New south work	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	6	kW
New south work	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south work	Wastewater Treatment	Sludge tank	1no	ZY1650	Volume	59	m3
New south work	Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	2	kW
New south work	Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	2	kW
New south work	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	4	kW
New south work	Wastewater Treatment	Odour control	Sludge storage tank	ZY6025	Flow	59	m3/h

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south work	Wastewater Treatment	Washwater booster package@ 16.7 l/s ins flow, all mech plus elec		ZY1567	Flow	192	m3/d
New south work	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
New south work	Other	Security site fencing		ZY1175	Length	500	m
New south work	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south work	Other	Flowmeter	PST sludge(common), HT desludge (common)	ZY0059	Number	2	no
New south work	Other	Dry solids monitor	PST desludge (common), HT desludge (common)	ZY1690	Number	2	no
New south work	Other	Level transmitters	FFT flowmeter, Sludge storage tank	ZY0146	Number	2	no
New south work	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
New south work	Other	Earthworks/Landscaping		ZY1090	Volume	3,000	m3
New south work	Other	Admin building with SCADA		ZY1040	Area	25	m2
New south work	Other	Site access roads	Off site roads	ZY1410	Area	100	m2
New south work	Other	Land purchase	110 x 110	Steph Walden	Area	2.9900	acres
New south work	Other	Power supply (WwTW)		ZY1355	Power	72	kW
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A2 Option 2c

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural &	105 m length, 300 mm dia, urban	ZY7279	Length	105	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	305 m length, 375 mm dia, rural	ZY7276	Length	305	m
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional co-settled sludge storage volume	1 no	ZY1650	Volume	24	m3
Hax Wal	Wastewater Treatment	Additional co-settled sludge tanks mixing	Duty	ZY1260	Power	1	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25	m2
Hax Wal	Wastewater Treatment	Odour control for additional thickener	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building required. Allow 10 x 8 m2		ZY1335	Area	80	m2
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south works	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south works	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	2,518	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	1,259	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	1,259	m3/d
New south works	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	2,518	m3/d
New south works	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south works	Wastewater Treatment	Lagoon M&E plus civils supply to site (includes ammonia removal media)		From supplier	Flow / load	2,500	p.e.
New south works	Wastewater Treatment	Lagoon construction services, M&E		From supplier	Flow / load	2,500	p.e.
New south works	Wastewater Treatment	Lagoon site civil services		From supplier	Flow / load	2,500	p.e.
New south works	Wastewater Treatment	Lagoon earthworks and lining		From supplier	Flow / load	2,500	p.e.
New south works	Other	Security site fencing		ZY1175	Length	500	m
New south works	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south works	Other	Earthworks/Landscaping		ZY1090	Volume	1,500	m3
New south works	Other	Admin builidng with SCADA		ZY1040	Area	25	m2
New south works	Other	Site access roads	Off site roads	ZY1410	Area	100	m2
New south works	Other	Land purchase	48,500m2 (AMP10 footprint)	Steph Walden	Area	11.985	acres

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Other	Power supply		ZY1355	Power	79	kW
New south works	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A3 Option 2d

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	159 m length, 150 mm dia, urban	ZY7270	Length	159	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-	190m length, 150 mm dia, urban	ZY7270	Length	190	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		urban roads (T3/4 reinstatement), <2m depth to crown					
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	82 m length, 225 mm dia, urban	ZY7270	Length	82	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	305 m length, 375 mm dia, rural	ZY7276	Length	305	m
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe	80 m length, 900 mm dia, urban	ZY7306	Length	80	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		jacking and auger boring)					
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25.00	m2
Hax Wal	Wastewater Treatment	Odour control for additional thickener	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building		ZY1335	Area	80.00	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		required. Allow 10 x 8 m2					
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughput	7.5	tDS/d
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south works	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south works	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	1,703	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	1,703	m3/d
New south works	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south works	Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	21	m2
New south works	Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	21	m2
New south works	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	21	m2
New south works	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	21	m2
New south works	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	5	kW
New south works	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	5	kW
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south works	Wastewater Treatment	ASP tank (inc selector anoxic zone)	2 lanes	ZY6050	Volume	480	m3
New south works	Wastewater Treatment	ASP plant mixing, diffusers, blowers (M&E)		ZY6065	Air flow	271	m3/h
New south works	Wastewater Treatment	Final Settlement tanks 1		ZY6920	Area	31	m2
New south works	Wastewater Treatment	Final Settlement tanks 2		ZY6920	Area	31	m2
New south works	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	31	m2
New south works	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	31	m2
New south works	Wastewater Treatment	RAS/SAS sump		ZY1626	Total internal volume	1.6	m3
New south works	Wastewater Treatment	RAS pump 1		ZY1638	Power	4	kW
New south works	Wastewater Treatment	RAS pump 2		ZY1638	Power	4	kW
New south works	Wastewater Treatment	RAS & SAS pumps dry well		ZY1626	Total internal volume	8	m3
New south works	Wastewater Treatment	SAS pump 1	Duty (5l/s)	ZY1638	Power	1	kW
New south works	Wastewater Treatment	SAS pump 2	Standby (5l/s)	ZY1638	Power	1	kW
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
New south works	Wastewater Treatment	Primary Sludge tank	1 No.	ZY1650	Volume	35	m3
New south works	Wastewater Treatment	SAS Sludge Tank No.1 (unthickened)	1 No.	ZY1650	Volume	19	m3
New south works	Wastewater Treatment	SAS Sludge Tank No.2 (unthickened)	1 No.	ZY1650	Volume	19	m3
New south works	Wastewater Treatment	SAS Sludge Tank (thickened)	1 No.	ZY1650	Volume	20	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Wastewater Treatment	Primary Sludge tanks mixing 1	Duty	ZY1260	Power	1	kW
New south works	Wastewater Treatment	Primary Sludge tanks mixing 2	Standby	ZY1260	Power	1	kW
New south works	Wastewater Treatment	SAS Sludge Tank No.1 (unthickened)	Duty	ZY1260	Power	1	kW
New south works	Wastewater Treatment	SAS Sludge Tank No.2 (unthickened)	Duty	ZY1260	Power	1	kW
New south works	Wastewater Treatment	SAS Sludge Tank (thickened) mixing 1	Duty	ZY1260	Power	1	kW
New south works	Wastewater Treatment	SAS Sludge Tank (thickened) mixing 2	Standby	ZY1260	Power	1	kW
New south works	Wastewater Treatment	SAS thickener	Duty	ZY1820	Sludge throughput	156	kgDS/d
New south works	Wastewater Treatment	Additional plinth / enclosure building required for thickener and poly plant. Allow 5 x 10 m2		ZY1335	Area	50.00	m2
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	6	kW
New south works	Wastewater Treatment	Odour control	Sludge storage tanks and thickener	ZY6025	m3/h	670	m3/h
New south works	Wastewater Treatment	Washwater booster package@ 21.7 l/s ins flow, all mech plus elec		ZY1567	m3/d	318	m3/d
New south works	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
New south works	Other	Security site fencing		ZY1175	Length	340	m
New south works	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south works	Other	Flowmeter	PST sludge(common), RAS (per FST), SAS	ZY0059	Number	4	no
New south works	Other	Dry solids monitor	MLSS, RAS, PST desludge (common)	ZY1690	Number	3	no
New south works	Other	Level transmitters	RAS chamber, FFT flowmeter, Sludge storage tank	ZY0146	Number	3	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
New south works	Other	Earthworks/Landscaping		ZY1090	Volume	2,000	m3
New south works	Other	Admin building with SCADA		ZY1040	Area	25	m2
New south works	Other	Site access roads	Off site roads	ZY1410	Area	120	m2
New south works	Other	Land purchase	80m x 90m	Steph Walden	Area	1.7792	acres
New south works	Other	STW Power supply		ZY1355	Power	85	kW
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

A4 Option 2e

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural &	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	220 m length, 225 mm dia, urban	ZY7270	Length	220	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	305 m length, 375 mm dia, rural	ZY7276	Length	305	m
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland &	135 m length, 150 mm dia, rural	ZY7267	Length	135	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		verge, <2m depth to crown					
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25.00	m2
Hax Wal	Wastewater Treatment	Odour control for additional co-settled sludge storage	Duty	ZY6025	m3/h	625	m3/h

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building required. Allow 10 x 8 m2		ZY1335	Area	80.00	m2
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughp ut	7.5	tDS/d
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south works	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south works	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	1,703	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	1,703	m3/d
New south works	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south works	Wastewater Treatment	Primary Settlement Tank 1		ZY6920	Area	21	m2
New south works	Wastewater Treatment	Primary Settlement Tank 2		ZY6920	Area	21	m2
New south works	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	21	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	21	m2
New south works	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	5	kW
New south works	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	5	kW
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	10	kW
New south works	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south works	Wastewater Treatment	Trickling filter 1		ZY6541	Area	412	m2
New south works	Wastewater Treatment	Trickling filter 2		ZY6541	Area	412	m2
New south works	Wastewater Treatment	Mineral Filter media		ZY1903	Volume	1483.2	m3
New south works	Wastewater Treatment	Distributor 1 including motor drive		ZY6420	Area	412	m2
New south works	Wastewater Treatment	Distributor 2 invluding motor drive		ZY6420	Area	412	m2
New south works	Wastewater Treatment	Humus Tanks 1		ZY6920	Area	24	m2
New south works	Wastewater Treatment	Humus Tanks 2		ZY6920	Area	24	m2
New south works	Wastewater Treatment	Half bridge scraper 1		ZY6900	Area	24	m2
New south works	Wastewater Treatment	Half bridge scraper 2		ZY6900	Area	24	m2
New south works	Wastewater Treatment	Final effluent recirculation chamber		ZY1065	Volume	3.8	m3
New south works	Wastewater Treatment	TF recirculation pump 1		ZY6100	Power	2	kW
New south works	Wastewater Treatment	TF recirculation pump 2		ZY6100	Power	2	kW
New south works	Wastewater Treatment	Desludging pump 1	Duty	ZY1638	Power	1	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Wastewater Treatment	Desludging pump 2	Standby	ZY1638	Power	1	kW
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	6	kW
New south works	Wastewater Treatment	Desludging dry well		ZY1626	Total internal volume	8	m3
New south works	Wastewater Treatment	Sludge tank	1no	ZY1650	Volume	59	m3
New south works	Wastewater Treatment	Sludge tanks mixing 1	Duty	ZY1260	Power	2	kW
New south works	Wastewater Treatment	Sludge tanks mixing 2	Standby	ZY1260	Power	2	kW
New south works	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	4	kW
New south works	Wastewater Treatment	Odour control	Sludge storage tank	ZY6025	Flow	59	m3/h
New south works	Wastewater Treatment	Washwater booster package@ 16.7 l/s ins flow, all mech plus elec		ZY1567	Flow	192	m3/d
New south works	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	200	m
New south works	Other	Security site fencing		ZY1175	Length	500	m
New south works	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south works	Other	Flowmeter	PST sludge(common), HT desludge (common)	ZY0059	Number	2	no
New south works	Other	Dry solids monitor	PST desludge (common), HT desludge (common)	ZY1690	Number	2	no
New south works	Other	Level transmitters	FFT flowmeter, Sludge storage tank	ZY0146	Number	2	no
New south works	Other	Rotation sensors	4 No trickling filters		Number	4	no
New south works	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Other	Earthworks/Landscaping		ZY1090	Volume	3,000	m3
New south works	Other	Admin building with SCADA		ZY1040	Area	25	m2
New south works	Other	Site access roads	Off site roads	ZY1410	Area	100	m2
New south works	Other	Land purchase	110 x 110	Steph Walden	Area	2.9900	acres
New south works	Other	Power supply (WwTW)		ZY1355	Power	72	kW
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

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Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open	199 m length, 150 mm dia, urban	ZY7270	Length	199	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	M
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm)	485m length, 375 mm dia, urban	ZY7280	Length	485	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural &	82 m length, 375 mm dia, urban	ZY7279	Length	82	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), <2m depth to crown					
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW
ST15	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	305 m length, 375 mm dia, rural	ZY7276	Length	305	m
ST15	Sewerage	River Outfall	375mm dia, rural	Z1215	Diameter of outfall pipe	375	mm
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional	ZY1601	Total internal volume	166	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
			emergency storage				
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal	Wastewater Treatment	Additional co-settled sludge storage volume	1 no	ZY1650	Volume	24	m3
Hax Wal	Wastewater Treatment	Additional co-settled sludge tanks mixing	Duty	ZY1260	Power	1	kW
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25	m2
Hax Wal	Wastewater Treatment	Odour control for additional thickener	Duty	ZY6025	m3/h	625	m3/h

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional SAS Thickening capacity	Duty	ZY1820	Sludge throughput	7.5	tDS/d
Nab	Wastewater Treatment	Additional plinth / enclosure building required. Allow 10 x 8 m2		ZY1335	Area	80	m2
Nab	Wastewater Treatment	Additional thickening polymer dosing capacity (liquid for SAS only)	Duty	ZY6245	Sludge throughput	7.5	tDS/d
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 20 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	891	m3/d
Nab	Wastewater Treatment	Odour control (additional thickener)	Duty	ZY6025	m3/h	1266	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	100	m
New south works	Wastewater Treatment	Isolation penstocks (actuated)		ZY0084	Number	2	nr
New south works	Wastewater Treatment	Inlet Works Civil including bypass		ZY6000	Flow	1,703	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 1	Duty	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Inlet Screens and Screens handling package 2	Standby	ZY6790	Flow	851	m3/d
New south works	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	1,703	m3/d
New south works	Wastewater Treatment	Isolation penstocks (manual)		ZY0150	Number	2	nr
New south works	Wastewater Treatment	Lagoon M&E plus civils supply to site (includes ammonia removal media)		From supplier	Flow / load	2,500	p.e.
New south works	Wastewater Treatment	Lagoon construction services, M&E		From supplier	Flow / load	1,500	p.e.
New south works	Wastewater Treatment	Lagoon site civil services		From supplier	Flow / load	1,500	p.e.

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
New south works	Wastewater Treatment	Lagoon earthworks and lining		From supplier	Flow / load	1,500	p.e.
New south works	Other	Security site fencing		ZY1175	Length	500	m
New south works	Other	Autosampler	Final effluent	ZY0122	Number	1	no
New south works	Other	Earthworks/Landscaping		ZY1090	Volume	1,500	m3
New south works	Other	Admin builidng with SCADA		ZY1040	Area	25	m2
New south works	Other	Site access roads	Off site roads	ZY1410	Area	100	m2
New south works	Other	Land purchase	48,500m2 (AMP10 footprint)	Steph Walden	Area	11.985	acres
New south works	Other	Power supply		ZY1355	Power	79	kW
New south works	Other	Measuring/monitoring chamber		ZY1065	Volume	1	m3
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

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Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	220 m length, 225 mm dia, urban	ZY7270	Length	220	m
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22.0	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Sewerage	Rising Main to Naburn WwtW Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	6336 m length, 250 mm dia, rural	ZY7311	Length	6336	m
ST15	Sewerage	Pumping station to works	ST15 , 28 m3 normal storage, 534.24 m3 emergency storage	ZY1601	Total internal volume	562	m3
ST15	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	22	kW
ST15	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	22	kW
ST15	Sewerage	Brick building		ZY1040	Area	9	m2
ST15	Sewerage	New MCC		ZY1255	Power	44	kW
ST15	Sewerage	Power supply		ZY1355	Power	44	kW
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4	200 m length, 450 mm dia, urban	ZY7280	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), 2-4m depth to crown					
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	245 m length, 375 mm dia, urban	ZY7280	Length	245	m
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
ST7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
ST7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST7	Sewerage	Brick building		ZY1040	Area	9	m2
ST7	Sewerage	New MCC		ZY1255	Power	22	kW
ST7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Hax Wal Trans	Sewerage	Transfer from Haxby Wallbuts to Naburn Sewerage: Rising Main/Open Cut/Plastic/Urban highway, cities & towns (T2 reinstatement)	4.4 km length, 400 mm dia, highway	ZY7313	Length	4424	m
Hax Wal Trans	Sewerage	Transfer from Haxby Wallbuts to Naburn Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	1 km length, 400 mm dia, urban	ZY7312	Length	1083	m
Hax Wal Trans	Sewerage	Transfer from Haxby Wallbuts to Naburn Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	5.7 km length, 400 mm dia, field	ZY7311	Length	5677	m
Hax Wal Trans	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	166 m length, 400 mm dia, urban	ZY7306	Length	166	m
Hax Wal Transr	Sewerage	Pumping station transfering sewerage from works to works	Haxby Wallbuts to Rawcliffe transfer , 76 m3 normal storage, 915 m3 emergency storage	ZY1601	Total internal volume	991	m3
Hax Wal Trans	Sewerage	Pumping station transfering sewerage from works to works	Haxby Wallbuts to Rawcliffe transfer ,	ZY1601	Total internal volume	1494	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Alternate method of emergency storage calculation	76 m3 normal storage, 1417 m3 emergency storage				
Hax Wal Trans	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	85	kW
Hax Wa Trans	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	85	kW
Hax Wal Trans	Sewerage	Brick building		ZY1040	Area	9	m2
Hax Wal Trans		New MCC		ZY1255	Power	170	kW
Hax Wal Trans	Sewerage	Power supply		ZY1355	Power	170	kW
Rawc Trans	Sewerage	Transfer from Rawcliffe to Naburn Sewerage: Rising Main/Open Cut/Plastic/Urban highway, cities & towns (T2 reinstatement)	11.7 km length, 600 mm dia, highway	ZY7313	Length	11729	m
Raw Trans	Sewerage	Transfer from Rawcliffe to Naburn Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	1.85 km length, 600 mm dia, urban	ZY7312	Length	1850	m
Rawc Trans	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	410 m length, 600 mm dia, urban	ZY7306	Length	410	m
Rawc Trans	Sewerage	Pumping station transfering seweage from works to works	Rawcliffe to Naburn transfer 180 m3 normal storage, 2159 m3 emergency storage	ZY1601	Total internal volume	2339	m3
Rawc Trans	Sewerage	Pumping station transfering sewerage from works to works Alternate method of emergency storage calculation	Rawcliffe to Naburn transfer 180 m3 normal storage, 3409 m3 emergency storage	ZY1601	Total internal volume	3589	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Rawc Trans	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	185	kW
Rawc Trans	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	185	kW
Rawc Trans	Sewerage	Brick building		ZY1040	Area	9	m2
Rawc Trans	Sewerage	New MCC		ZY1255	Power	370	kW
Rawc Trans	Sewerage	Power supply		ZY1355	Power	370	kW
	Sewerage	Chamber (10 chambers) - for 3 major rising mains (ST15, Rawclifee Transfer and Haxby Wallbuts transfer)	10 Chambers, 1.32 m3 volume each	ZY1065	Volume	13.2	m3
Nab	Wastewater Treatment	Additional coarse screen and screenings handling	Duty	ZY6665	Flow	28,642	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	STW/SCR/Coarse and or Fine screens structure (civils) - Refurb/Modify		ZY6671	Flow	28,642	m3/d
Nab	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	28,642	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (manual)		ZY0084		2	nr
Nab	Wastewater Treatment	Additional Inlet Fine Screens and Screens handling package 1	Duty	ZY6790	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0150	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47,520	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0150	Number	2	nr
Nab	Wastewater Treatment	Additional interstage transfer PS volume	Duty	ZY1601	Total internal volume	84	m3
Nab	Wastewater Treatment	Additional interstage transfer centrifugal pump 1	Duty	ZY5050	Power	97	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	97	kW
Nab	Wastewater Treatment	New Primary Settlement Tank 1	Duty	ZY6920	Area	1,134	m2
Nab	Wastewater Treatment	New Primary Settlement Tank 2	Duty	ZY6920	Area	1,134	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	New Primary Settlement Tank 3	Duty	ZY6920	Area	1,134	m2
Nab	Wastewater Treatment	New Primary Settlement Tank 4	Duty	ZY6920	Area	1,134	m2
Nab	Wastewater Treatment	New Half bridge scraper 1	Duty	ZY6900	Area	1,134	m2
Nab	Wastewater Treatment	New Half bridge scraper 2	Duty	ZY6900	Area	1,134	m2
Nab	Wastewater Treatment	New Half bridge scraper 3	Duty	ZY6900	Area	1,134	m2
Nab	Wastewater Treatment	New Half bridge scraper 4	Duty	ZY6900	Area	1,134	m2
Nab	Wastewater Treatment	PST Desludging pump 1	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 2	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 3	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 4	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 5	Standby	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PST Desludging pump 6	Standby	ZY1638	Power	6	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	36	kW
Nab	Wastewater Treatment	Additional Desludging dry well capacity	Duty	ZY1626	Total internal volume	12	m3
Nab	Wastewater Treatment	New Primary sludge storage Tank No. 1	Duty	ZY1650	Volume	451	m3
Nab	Wastewater Treatment	New Primary sludge storage Tank No. 2	Duty	ZY1650	Volume	451	m3
Nab	Wastewater Treatment	New primary sludge mixing, No. 1	Duty	ZY1638	kW	7.5	kW
Nab	Wastewater Treatment	New primary sludge mixing, No. 2	Standby	ZY1638	kW	7.5	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	15	kW
Nab	Wastewater Treatment	New primary sludge thickening capacity (2 No units)	Duty	ZY1810	Sludge throughput	13.55	tds/d
Nab	Wastewater Treatment	Additional thickening plinth / enclosure		ZY1335	Area	50	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	New thickening polymer dosing capacity (powder for Primary)	Duty	ZY6240	Sludge throughput	13.55	tds/d
Nab	Wastewater Treatment	Additional thickening + screening washwater booster package@ 25 l/s flow, all mech plus elec	Duty	ZY1567	m3/d	1010	m3/d
Nab	Wastewater Treatment	Additional thickened sludge storage volume, tank No. 1 (digester feed tank)	Duty	ZY1650	Volume	292	m3
Nab	Wastewater Treatment	Additional thickened sludge tanks mixing, No. 1	Duty	ZY1260	Power	5	kW
Nab	Wastewater Treatment	Additional thickened sludge tanks mixing , No. 2	Standby	ZY1260	Power	5	kW
Nab	Wastewater Treatment	Additional liquor return ps capacity	Duty	ZY1601	Volume	8	m3
Nab	Wastewater Treatment	Additional STF liquor returns pump NO. 1	Duty	ZY6105	Power	3	kW
Nab	Wastewater Treatment	Additional STF liquor returns pump NO. 2	Standby	ZY6105	Power	3	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	16	kW
Nab	Wastewater Treatment	Odour control (primary sludge tanks, new thickener(s) and digester feed tanks)	Sludge storage tank	ZY6025	Flow	1775	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	1480	m
Nab	Other	Level transmitters	Sludge storage tanks x 6, intermediate ps x 1	ZY0146	Number	7	No
Nab	Other	Flow meters	PST sludge (common)	ZY0059	Number	1	No
Nab	Other	Earthworks/Landscaping		ZY1090	Volume	560	m3
Nab	Other	Power supply		ZY1355	Power	164	kW
Nab	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	135 m length, 600 mm dia, rural	ZY7276	Length	135	m
Nab	Sewerage	River Outfall	600 mm dia, rural	Z1215	Diameter of outfall pipe	600	mm

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 1				
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 2				
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 4				
	Septicity issue in rising main	Concrete slab	Rising main 1	ZY1335	Area	30	m2
	Septicity issue in rising main	Concrete slab	Rising main 2	ZY1335	Area	30	m2
	Septicity issue in rising main	Concrete slab	Rising main 4	ZY1335	Area	30	m2
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

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Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	199 m length, 150 mm dia, urban	ZY7270	Length	199	m
H1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	159 m length, 150 mm dia, urban	ZY7270	Length	159	m
H1	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	128 m length, 300 mm dia, urban	ZY7279	Length	128	m
H10	Sewerage	Combined Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	105 m length, 300 mm dia, urban	ZY7279	Length	105	m
H29	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	170m length, 150 mm dia, urban	ZY7270	Length	170	m
H29	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	169m length, 300 mm dia, urban	ZY7279	Length	169	m
H3	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	280m length, 150 mm dia, urban	ZY7271	Length	280	m
H3	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural &	193.5m length, 375 mm dia, urban	ZY7280	Length	193	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
H3	Sewerage	Upsizing sewer diameter to 375 mm (from 225 mm) Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	485m length, 375 mm dia, urban	ZY7280	Length	485	m
H31	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	190m length, 150 mm dia, urban	ZY7270	Length	190	m
H31	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	192 m length, 300 mm dia, urban	ZY7279	Length	192	m
H46	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	216.5m length, 150 mm dia, urban	ZY7270	Length	216.5	m
H46	Sewerage	Storm Pipeline to river Foss Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	143 m length, 225 mm dia, rural	ZY7267	Length	143	m
H5	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	58 m length, 525 mm dia, rural	ZY7276	Length	58	m
H56	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	209m length, 150 mm dia, urban	ZY7270	Length	209	m
H56	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4	220 m length, 225 mm dia, urban	ZY7270	Length	220	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		reinstatement), <2m depth to crown					
H7	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 375 mm dia, urban	ZY7279	Length	82	m
ST1	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	82 m length, 225 mm dia, urban	ZY7270	Length	82	m
ST14	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	2675 m length, 150 mm dia, urban	ZY7312	Length	2675	m
ST14	Sewerage	Pumping station to works	ST14 , 12 m3 normal storage, 215.68 m3 emergency storage	ZY1601	Total internal volume	228	m3
ST14	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
ST14	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
ST14	Sewerage	Brick building		ZY1040	Area	9	m2
ST14	Sewerage	New MCC		ZY1255	Power	22	kW
ST14	Sewerage	Power supply		ZY1355	Power	22	kW
ST15	Sewerage	Rising Main to Naburn WwtW Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	6336 m length, 250 mm dia, rural	ZY7311	Length	6336	m
ST15	Sewerage	Pumping station to works	ST15 , 28 m3 normal storage, 534.24 m3 emergency storage	ZY1601	Total internal volume	562	m3

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	22	kW
ST15	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	22	kW
ST15	Sewerage	Brick building		ZY1040	Area	9	m2
ST15	Sewerage	New MCC		ZY1255	Power	44	kW
ST15	Sewerage	Power supply		ZY1355	Power	44	kW
ST16	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	135 m length, 150 mm dia, rural	ZY7267	Length	135	m
ST16	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	127.5 m length, 450 mm dia, rural	ZY7276	Length	127.5	m
ST2	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	184 m length, 150 mm dia, urban	ZY7270	Length	184	m
ST2	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	123 m length, 300 mm dia, urban	ZY7279	Length	123	m
ST2	Sewerage	Upsizing sewer diameter to 450 mm Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	200 m length, 450 mm dia, urban	ZY7280	Length	200	m
ST2	Sewerage	Modification to ditch	400 m length 7 m width, 1m depth				
ST31	Sewerage	Rising Main to Rawcliffe WwTW Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	95 m length, 80 mm dia, urban	ZY7312	Length	95	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST31	Sewerage	Rising Main to existing network Sewerage: Rising Main/Open Cut/Plastic/Grassland & verge	286 m length, 80 mm dia, rural	ZY7311	Length	286	m
ST31	Sewerage	Pumping station to works	ST31 , 5 m3 normal storage, 27.2 m3 emergency storage	ZY1601	Total internal volume	32	m3
ST31	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST31	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST31	Sewerage	Brick building		ZY1040	Area	9	m2
ST31	Sewerage	New MCC		ZY1255	Power	5	kW
ST31	Sewerage	Power supply		ZY1355	Power	5	kW
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 150 mm dia, urban	ZY7270	Length	40	m
ST4	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Grassland & verge, <2m depth to crown	80 m length, 150 mm dia, rural	ZY7267	Length	80	m
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	40 m length, 300 mm dia, urban	ZY7279	Length	40	
ST4	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	80 m length, 300 mm dia, rural	ZY7276	Length	80	m
ST4	Sewerage	Storm water :Upsizing sewer diameter from 300mm to 375mm Sewerage: Open Cut/Concrete/Rural &	245 m length, 375 mm dia, urban	ZY7280	Length	245	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
		Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown					
ST4	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10 to 13 l/s)	ST4 , 8 m3 normal storage, 34 m3 of additional emergency storage	ZY1601	Total internal volume	42	m3
ST4	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	2.5	kW
ST4	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	2.5	kW
ST4	Sewerage	Brick building		ZY1040	Area	9	m2
ST4	Sewerage	New MCC		ZY1255	Power	5	kW
ST4	Sewerage	Power supply		ZY1355	Power	5	kW
ST5	Sewerage	Storm Pipeline to river Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), 2-4m depth to crown	134 m length, 900 mm dia, urban	ZY7280	Length	134	m
ST5	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	80 m length, 900 mm dia, urban	ZY7306	Length	80	m
St7	Sewerage	Rising Main to existing pump station Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	1622m length, 100 mm dia, urban	ZY7312	Length	1622	m
St7	Sewerage	Pumping station to works	ST7 , 7 m3 normal storage, 135.2 m3 emergency storage	ZY1601	Total internal volume	142	m3
St7	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	11	kW
St7	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	11	kW
St7	Sewerage	Brick building		ZY1040	Area	9	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
St7	Sewerage	New MCC		ZY1255	Power	22	kW
St7	Sewerage	Power supply		ZY1355	Power	22	kW
ST8	Sewerage	Foul Pipeline to existing network Sewerage: Open Cut/Clay/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	322.5 m length, 150 mm dia, urban	ZY7270	Length	322.5	m
ST8	Sewerage	Storm Pipeline to existing network Sewerage: Open Cut/Concrete/Rural & Sub-urban roads (T3/4 reinstatement), <2m depth to crown	245 m length, 450 mm dia, urban	ZY7279	Length	275	m
ST8	Sewerage	Upsize of Pumping station feeding to existing netwok (from 10.2 to 18 l/s)	ST8 , 11 m3 normal storage, 155 m3 of additional emergency storage	ZY1601	Total internal volume	166	m3
ST8	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	7.5	kW
ST8	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	7.5	kW
ST8	Sewerage	Brick building		ZY1040	Area	9	m2
ST8	Sewerage	New MCC		ZY1255	Power	15	kW
ST8	Sewerage	Power supply		ZY1355	Power	15	kW
ST9	Sewerage	Rising Main to existing gravity sewers Sewerage: Rising Main/Open Cut/Plastic/ Rural & Sub-urban roads (T3/4 reinstatement)	575 m length, 100 mm dia, urban	ZY7312	Length	575	m
ST9	Sewerage	Pumping station to works	ST9 , 6 m3 normal storage, 118 m3 emergency storage	ZY1601	Total internal volume	124	m3
ST9	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	4.7	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST9	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	4.7	kW
ST9	Sewerage	Brick building		ZY1040	Area	9	m2
ST9	Sewerage	New MCC		ZY1255	Power	9.4	kW
ST9	Sewerage	Power supply		ZY1355	Power	9.4	kW
Rawc Trans	Sewerage	Transfer from Rawcliffe to Naburn Sewerage: Rising Main/Open Cut/Plastic/Urban highway, cities & towns (T2 reinstatement)	11.7 km length, 500 mm dia, highway	ZY7313	Length	11729	m
Rawc Trans	Sewerage	Transfer from Rawcliffe to Naburn Sewerage: Rising Main/Open Cut/Plastic/Rural & Sub-urban roads (T3/4 reinstatement)	1.85 km length, 500 mm dia, urban	ZY7312	Length	1850	m
Rawc Trans	Sewerage	Sewerage: Trenchless New Lay (to include directional drilling, pipe jacking and auger boring)	410 m length, 500 mm dia, urban	ZY7306	Length	410	m
Rawc Trans	Sewerage	Pumping station transfering seweage from works to works	Rawcliffe to Naburn transfer 104 m3 normal storage, 1244 m3 emergency storage	ZY1601	Total internal volume	1348	m3
Rawc Trans	Sewerage	Pumping station transfering sewerage from works to works Alternate method of emergency storage calculation	Rawcliffe to Naburn transfer 104 m3 normal storage, 1992 m3 emergency storage	ZY1601	Total internal volume	2096	m3
Rawc Trans	Sewerage	Pumping station - centrifugal submersible pump 1	Duty	ZY5050	Power	115	kW
Rawc Trans	Sewerage	Pumping station - centrifugal submersible pump 2	Standby	ZY5050	Power	115	kW
Rawc Trans	Sewerage	Brick building		ZY1040	Area	9	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Rawc Trans	Sewerage	New MCC		ZY1255	Power	230	kW
Rawc Trans	Sewerage	Power supply		ZY1355	Power	230	kW
	Sewerage	Chamber (8 chambers) - for 2 major rising mains (ST15 and Rawcliffe Transfer)	8 Chambers, 1.32 m3 volume each	ZY1065	Volume	10.6	m3
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional sludge thickening	Duty	ZY1820	Through put	1.6	tds/d
Hax Wal	Wastewater Treatment	Additional plinth / enclosure building required. Allow 5 x 5 m2		ZY1335	Area	25	m2
Hax Wal	Wastewater Treatment	Odour control for additional co-settled sludge storage	Duty	ZY6025	m3/h	625	m3/h
Nab	Wastewater Treatment	Additional coarse screen and screenings handling	Duty	ZY6665	Flow	19708	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (actuated)		ZY0084	Number	2	nr
Nab	Wastewater Treatment	STW/SCR/Coarse and or Fine screens structure (civils) - Refurb/Modify		ZY6671	Flow	19708	m3/d
Nab	Wastewater Treatment	Grit classification package plant	Duty/standby	ZZ6760	Flow	19708	m3/d
Nab	Wastewater Treatment	Additional Isolation penstocks (manual)		ZY0150	Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Fine Screens and Screens handling package 1	Duty	ZY6790	Flow	47520	m3/d
Nab	Wastewater Treatment	Additional isolation penstocks (actuated)			Number	2	nr
Nab	Wastewater Treatment	Additional Inlet Works Civil inc bypass channel		ZY6000	Flow	47520	m3/d
Nab	Wastewater Treatment	Additional isolation penstocks (actuated)			Number	2	nr
Nab	Wastewater Treatment	Additional interstage transfer ps volume	Duty	ZY1601	Total internal volume	56	m3
Nab	Wastewater Treatment	Additional interstage transfer centrifugal pump 1	Duty	ZY5285	Power	49	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	49	kW

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	New Primary Settlement Tank 1	Duty	ZY6920	Area	1018	m2
Nab	Wastewater Treatment	New Primary Settlement Tank 2	Duty	ZY6920	Area	1018	m2
Nab	Wastewater Treatment	New Primary Settlement Tank 3	Duty	ZY6920	Area	1018	m2
Nab	Wastewater Treatment	New Primary Settlement Tank 4	Duty	ZY6920	Area	1018	m2
Nab	Wastewater Treatment	New Half bridge scraper 1	Duty	ZY6900	Area	1018	m2
Nab	Wastewater Treatment	New Half bridge scraper 2	Duty	ZY6900	Area	1018	m2
Nab	Wastewater Treatment	New Half bridge scraper 3	Duty	ZY6900	Area	1018	m2
Nab	Wastewater Treatment	New Half bridge scraper 4	Duty	ZY6900	Area	1018	m2
Nab	Wastewater Treatment	PST Desludging pump 1	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 2	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PSTDesludging pump 3	Duty	ZY1638	Power	6	kW
Nab	Wastewater Treatment	PST Desludging pump 4	Common standby	ZY1638	Power	6	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	24	kW
Nab	Wastewater Treatment	Additional Desludging dry well capacity	Duty	ZY1626	Total internal volume	12	m3
Nab	Wastewater Treatment	New Primary sludge storage Tank No. 1	Duty	ZY1650	Volume	415	m3
Nab	Wastewater Treatment	New Primary sludge storage Tank No. 2	Duty	ZY1650	Volume	415	m3
Nab	Wastewater Treatment	New primary sludge mixing, No. 1	Duty	ZY1638	kW	6.5	kW
Nab	Wastewater Treatment	New primary sludge mixing, No. 2	Standby	ZY1638	kW	6.5	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	14	kW
Nab	Wastewater Treatment	New primary sludge thickening capacity, drum thickener, asumne 2 NO.	Duty	ZY1810	Sludge throughput	12.45	tds/d
Nab	Wastewater Treatment	Additional thickening plinth		ZY1335	Area	70	m2

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
Nab	Wastewater Treatment	New thickening polymer dosing capacity (powder for Primary)	Duty	ZY6240	Sludge throughput	12.45	tds/d
Nab	Wastewater Treatment	Additional thickening washwater booster package@ 25l/s flow, all mech plus elec	Duty	ZY1567	m3/d	1010	m3/d
Nab	Wastewater Treatment	Additional thickened sludge storage volume, tank No. 1	Duty	ZY1650	Volume	292	m3
Nab	Wastewater Treatment	Additional thickened sludge tanks mixing, No. 1	Duty	ZY1260	Power	3.8	kW
Nab	Wastewater Treatment	Additional thickened sludge tanks mixing , No. 2	Standby	ZY1260	Power	3.8	kW
Nab	Wastewater Treatment	Additional liquor return ps capacity	Duty	ZY1601	Volume	8	m3
Nab	Wastewater Treatment	Additional STF liquor returns pump NO. 1	Duty	ZY6105	Power	3	kW
Nab	Wastewater Treatment	Additional STF liquor returns pump NO. 2	Standby	ZY6105	Power	3	kW
Nab	Wastewater Treatment	COM/GEN MCC Kiosk c/w plinth - (power kW)		ZY1235	Power	13.6	kW
Nab	Wastewater Treatment	Odour control (primary sludge tanks, new thickener(s) and digester feed tanks)	Sludge storage tank	ZY6025	Flow	1703	m3/h
Nab	Wastewater Treatment	Interprocess pipework <300mm		ZY1320	Length	1480	m
Nab	Other	Level transmitters	Sludge storage tanks x 6, intermediate ps x 1	ZY0146	Number	7	No
Nab	Other	Flow meters	PST sludge (common)	ZY0059	Number	1	No
Nab	Other	Earthworks/Landscaping		ZY1090	Volume	560	m3
Nab	Other	Power supply		ZY1355	Power	101	kW
Nab	Sewerage	Outlet from WwTW to watercourse Sewerage: Open Cut/Concrete/Grassland & verge, <2m depth to crown	135 m length, 525 mm dia, rural	ZY7276	Length	135	m
Nab	Sewerage	River Outfall	525 mm dia, rural	Z1215	Diameter of outfall pipe	525	mm

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 1				
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 2				
	Septicity issue in rising main	Nutriox system (dosing skid)	Rising main 3				
	Septicity issue in rising main	Concrete slab	Rising main 1	ZY1335	Area	30	m2
	Septicity issue in rising main	Concrete slab	Rising main 2	ZY1335	Area	30	m2
	Septicity issue in rising main	Concrete slab	Rising main 3	ZY1335	Area	30	m2
ST1	Clean Water	8-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST1	Clean Water	Install 125mm HDPE pipe in road verge		ZY7325	Length	300	m
ST1	Clean Water	9-inch /125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST2	Clean Water	6-inch / 100mm connection in road	1	Covered in pipe model	Number	1	no
ST2	Clean Water	Install 125mm HDPE main (Road crossing 20%, rest in field)		ZY7325	Length	50	m
ST4	Clean Water	12-inch / 100mm connection in road verge	1	Covered in pipe model	Number	1	no
ST4	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	50	m
ST5	Clean Water	15-inch / 150mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST5	Clean Water	Install 180mm HDPE main in road verge		ZY7325	Length	300	m
ST5	Clean Water	Install 180mm HDPE main by directional drilling		ZY7329	Length	200	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST7	Clean Water	12-inch / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	160mm / 125mm connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST7	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	2600	m
ST8	Clean Water	6-inch / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	160mm / 125mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST8	Clean Water	Install 160mm HDPE main in road verge		ZY7325	Length	900	m
ST9	Clean Water	6-inch / 100mm ID connection c/w meter in road		ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST9	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	250	m
ST14	Clean Water	200 / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	6-inch / 125mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST14	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	1570	m
ST14	Clean Water	Install 125mm HDPE main in road verge		ZY7325	Length	300	m
ST14	Clean Water	125mm HDPE major road crossing by directional drilling		ZY7329	Length	30	m

Site	Discipline	Item	No	Model Reference	Measure unit	Measurement no	Unit
ST15	Clean Water	600 / 200mm ID connection c/w meter	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST15	Clean Water	Install 225mm HDPE main in road verge		ZY7325	Length	150	m
ST15	Clean Water	Install 225mm HDPE main in grass		ZY7325	Length	6000	m
ST15	Clean Water	225mm HDPE main major road crossing by directional drilling		ZY7329	Length	50	m
ST17	Clean Water	Install meter c/w chamber	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	8-inch / 100mm ID connection c/w meter in road	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
ST31	Clean Water	Install 125mm HDPE main in grass		ZY7325	Length	350	m
ST31	Clean Water	125mm HDPE main major road crossing by directional drilling		ZY7329	Length	351	m
ST32	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H1	Clean Water	6-inch/100mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H10	Clean Water	6-inch/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3
H32	Clean Water	225/80mm Connection c/w meter in road verge	1	ZY0059	Number	1	no
	Clean Water	Meter Chamber		ZY1065	Volume	2	m3

Appendix B

Five Capital Appraisal framework

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
Natural	Crops and Livestock	What is the make up of agricultural land in the area e.g. quality/grade and type of food produced? Does the proposed option require land take of high quality agricultural land?	Permanent land take of Grade 1 agricultural land or other agricultural land of more than 5ha	Permanent land take of between 1ha and 5ha agricultural land of Grade 2 or below	Permanent land take of less than 1ha agricultural land of Grade 2 or below	Not relevant / negligible positive or negative impact	Minor positive impact on the ability of the affected land to support crops and livestock	Some positive impact on the ability of the affected land to support crops and livestock	Substantial positive impact on the ability of the affected land to support crops and livestock
	Fisheries	Are there fisheries (commercial or otherwise) which provide a food resource? (Avoid double counting with more recreational-based angling i.e. coarse fishing or catch and release). Are shellfish harvested in the area?	Substantial negative impact on the ability of the affected land to support fisheries	Some negative impact on the ability of the affected land to support fisheries	Minor negative impact on the ability of the affected land to support fisheries		Minor positive impact on the ability of the affected land to support fisheries	Some positive impact on the ability of the affected land to support fisheries	Substantial positive impact on the ability of the affected land to support fisheries
	Energy	Does the option allow energy production from water resources? What's the energy consumption during operation? Does it come from a sustainable source?	Operational energy consumption of over 0.7kWh/m3	Operational energy consumption of between 0.5 and 0.7kWh/m3	Operational energy consumption of less than 0.5kWh/m3		Minor net decrease in energy consumption during construction and/or operation	Some net decrease in energy consumption during construction and/or operation	Substantial net increase in energy consumption during construction and operation
	Water supply	How would the option change the quality or quantity of freshwater left in the environment? Does it include demand reduction measures?	Substantial negative impact on the availability of freshwater left in the environment, water demand increase of more than 5Ml/d	Some negative impact on the availability of freshwater left in the environment, water demand increase of between 1 and 5Ml/d, or options without demand reduction measures	Minor negative impact on the availability of freshwater left in the environment, water demand increase of less than 1Ml/d, or options which include demand reduction measures		Minor positive impact on the availability of freshwater left in the environment	Some positive impact on the availability of freshwater left in the environment	Substantial positive impact on the availability of freshwater left in the environment
	Global climate	Will the option affect any major peat deposits or large lakes and are these capturing carbon or releasing it? What is the whole life carbon associated with the option?	Substantial negative impact on the ability of affected land to sequester carbon. Large net increase in carbon emissions	Some negative impact on the ability of affected land to sequester carbon. Some net increase in carbon emissions	Minor negative impact on the ability of affected land to sequester carbon. Small net increase in carbon emissions		Minor positive impact on the ability of affected land to sequester carbon. Small net decrease in carbon emissions	Some positive impact on the ability of affected land to sequester carbon. Some net decrease in carbon emissions	Substantial positive impact on the ability of affected land to sequester carbon. Large net decrease in carbon emissions
	Air quality	Are there any known issues associated with car use and industry? Are there any nearby AQMA that will be affected by the option? Are there any nearby receptors? Will there be odour issues?	Site located within AQMA, or sensitive receptors within 200m	Site located adjacent to AQMA, or sensitive receptors within 400m	Site located within 400m of AQMA, or no sensitive receptors within 400m		Minor positive impact on air quality and odour	Some positive impact on air quality and odour	Substantial positive impact on air quality and odour
	Flood Regulation	Will the option require land take in Flood Zones 2 and 3? Consider how the option will impact on run-off and flood risk.	Land take within Flood Zone 2 or 3 of more than 10ha	Land take within Flood Zone 2 or 3 of between 5ha and 10ha	Land take within Flood Zone 2 or 3 of less than 5ha		Minor positive impact on the attenuation of water	Some positive impact on the attenuation of water	Substantial positive impact on the attenuation of water
	Water quality	Will the option positively or negatively affect water quality? Will the option improve the resilience of the YW operation that ensures the provision of quality water to users?	Substantial pollution of water quality with drop in WFD class or creating new red DWSP risk	Some pollution of water quality	Minor pollution of water quality with no drop in WFD class or element, slight impact on DWSP risk		Minor water quality improvement within WFD class or element. No impact on DWSP risks.	Some water quality improvement	Substantial water quality improvement, resulting in WFD class removal or avoidance of a DWSP risk.
	Pollination	Will the option impact on land which provide habitat for insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds?	Substantial negative impact on pollination, land take of woodland or grassland of more than 5ha	Some negative impact on pollination, land take of woodland or grassland of between 1 and 5ha	Minor negative impact on pollination, land take of woodland or grassland of less than 1ha		Minor positive impact on pollination	Some positive impact on pollination	Substantial positive impact on pollination
	Recreation	Does the option temporarily or permanently affect the use of recreational site and facilities e.g. country park, footpath along rivers and lakes, PRoWs? Does the option enhance the water environment for recreational use?	New infrastructure that permanently impact on recreation land	New pipeline of more than 1km, intersecting PRoW or national trails	New pipeline of less than 1km, intersecting PRoW		Minor positive impact on the recreational offering provided by affected land	Some positive impact on the recreational offering provided by affected land	Substantial positive impact on the recreational offering provided by affected land
	Amenity	Consider the presence of designated landscapes (National Parks, Heritage Coasts, AONBs), city scapes and areas of high visual amenity, will these be affected by the option?	Substantial negative impact on amenity	Some negative impact on amenity	Minor negative impact on amenity		Minor positive impact on amenity	Some positive impact on amenity	Substantial positive impact on amenity

Capital	Aspect	Questions to ask	Impact score						
			High negative impact (-3)	**Medium negative impact (-2)**	**Low negative impact (-1)**	**No impact (0)**	**Low positive impact (+1)**	**Medium positive impact (+2)**	**High positive impact (+3)**
	Non-Use Value	This is the value people place on simply knowing that something exists, often associated with valued habitats, flora and fauna, landscape or heritage assets. Does the option affect any nationally or internationally important areas or designations?	Substantial negative impact on areas or designations that are likely to provide a non-use value	Some negative impact on areas or designations that are likely to provide a non-use value	Minor negative impact on areas or designations that are likely to provide a non-use value		Minor positive impact on areas or designations that are likely to provide a non-use value	Some positive impact on areas or designations that are likely to provide a non-use value	Substantial positive impact on areas or designations that are likely to provide a non-use value
Social	Physical activity	Does the option promote physical activities and wellbeing? Does the option provide new green/blue infrastructure that will encourage active lifestyle of citizens?	Substantial negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some negative impact or net decrease in green/blue infrastructure or assets that promote physical activities	Minor negative impact or net decrease in green/blue infrastructure or assets that promote physical activities		Minor positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Some positive impact or net decrease in green/blue infrastructure or assets that promote physical activities	Substantial positive impact or net decrease in green/blue infrastructure or assets that promote physical activities
	Quality of place	Does the option improve the quality of place in the local community? Does it provide new or improved community space/facilities?	High volume of traffic during construction and operation, down-wind receptors within 100m of new WWTW	Medium volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW	Low volume of traffic during construction and operation, no down-wind receptor within 100m of new WWTW		Minor positive impact on quality of place	Some positive impact on quality of place	Substantial positive impact on quality of place
	Trust	Does the option have the potential to damage YW's reputation and stakeholder trust? Does it disbenefit the local community?	Substantial negative impact on stakeholder trust or national media coverage and very high social media activity. Cited as laggard organisation	Some negative impact on stakeholder trust or regional media coverage and medium social media activity	Minor negative impact on stakeholder trust or local media coverage and very low social media activity		Minor positive impact on stakeholder trust or local media coverage and very low social media activity	Some positive impact on stakeholder trust or regional media coverage and medium social media activity	Substantial positive impact on stakeholder trust or national media coverage and very high social media activity. Cited as leading organisation
Human	Employmen t	Does the option offer employment opportunities? Are there policies to encourage the employment of local work force?	Loss of 50 or more existing FTE.	Loss of between 6 and 49 existing FTE	Loss of up to 5 existing FTE.		Enabling up to 15 new FTE.	Enabling between 15 and 49 FTE.	Enabling 50 or more FTE.
	Skills	Does the option offer the opportunity to upskill YW employees? Does it offer the opportunity for training and/or apprentice of the local labour force?	No opportunity for upskilling or training				Minor positive impact on upskilling and training, potential to support up to 0.5 apprenticeship by the scheme	Some positive impact on upskilling and training, potential to support up to 1 apprenticeship by the scheme	Substantial positive impact on upskilling and training, potential to support more than 1 apprenticeship by the scheme
	Health & Safety	Does the option pose a health and safety risk?	Creation of new Red business risk or escalation of existing business risk to Red threshold (strategic risk scale)	Creation of new Amber business risk or escalation of existing business risk to Amber threshold (strategic risk scale)	Creation of new Green business risk (strategic risk scale)		Removal of existing Green business risk (strategic risk scale)	Removal of existing Amber business risk or reduction of existing business risk to remove it from Amber threshold (strategic risk scale)	Removal of existing Red business risk or reduction of existing business risk to remove it from Red threshold (strategic risk scale)
	Local economy	Does the option benefit local economy? Does it create employment opportunities for local work force? Does it affect existing dwellings?	Loss of existing homes of more than 50 units	Loss of existing homes of between 10 and 50 units	Loss of existing homes of less than 10 units		Creating new homes of less than 1000 units	Enabling new homes of between 1000 and 5000 units	Creating new homes of over 5000 units
F&M	Private costs	Does the option impact on the long term financial viability of YW? Does it reduce YW's financial income or operational cost?	Loss of existing financial income or increased operating costs of £1m per year or more	Loss of existing financial income or increased operating costs of between £400k and £1m per year	Loss of existing financial income or increased operating costs of up to £400k per year		Creation of new financial income or reduced operating costs of up to £400k per year	Creation of new financial income or reduced operating costs of between £400,000 and £1m per year	Creation of new financial income or reduced operating costs of £1m per year or more
	Private benefits	Does the option expend on existing assets? Does it create new assets? Does it make any YW's assets redundant?	No private benefits				Increased asset value by up to £2m or Capital receipt of up to £2m	Increased asset value by between £2m and £10m or Capital receipt of between £2m and £10m	Increased asset value by £10m or more Capital receipt of £8m or more

Appendix C

List of Environmental Features

This Appendix provides a full list of environmental and social features identified by the desk-top research (Table 14) and a reference map showing the locations of these features (Figure 12).

Table 14 List of environmental and social features with map reference

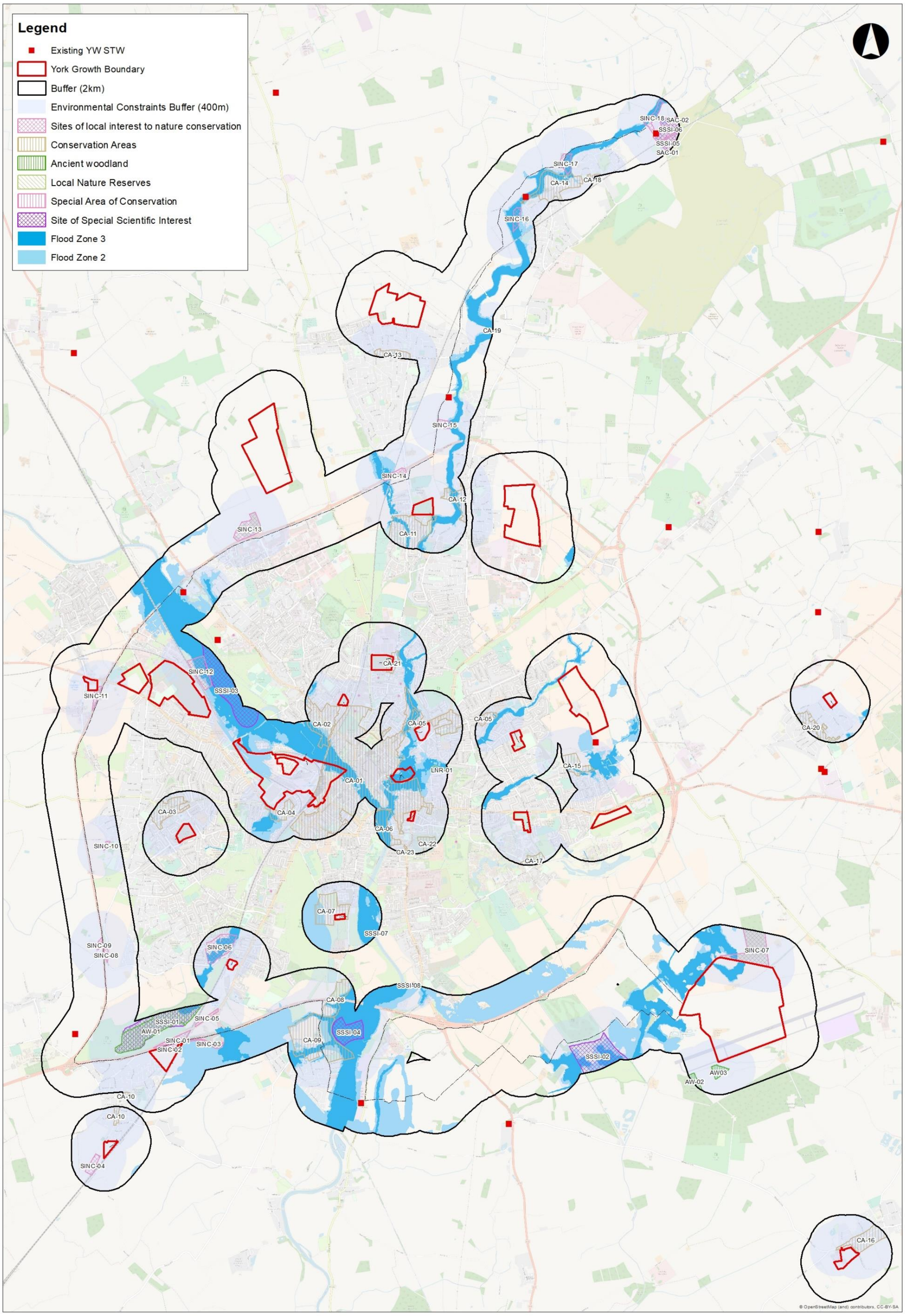
Aspects	**Map reference**	**Feature of interest**	**Location in relation to the nearest site**
Ecology			
Ancient woodland	AW-01	Askham Bogs - Ancient & Semi-Natural Woodland	140m to the north – ST31
	AW-02	Langwith Great Wood - Ancient Replanted Woodland	400m to the south west – ST15
	AW-03	Snactry Wood - Ancient Replanted Woodland	50m to the south – ST15
Local Nature Reserve	LNR-01	St Nicholas Fields	300m to the east – ST32
Sites of importance for nature conservation	SINC-01	Site of Local Interest for Nature Conservation (no specific site name available)	140m to the north – ST31
	SINC-02		Adjacent to the north – ST31
	SINC-03		200m to the west - ST31
	SINC-04		600m to the west – H29
	SINC-05		320m to the north east – ST31
	SINC-06		1km to the north west – H8
	SINC-07		Adjacent to the north – ST15
	SINC-08		1.5km to the north west – ST31
	SINC-09		1.7km to the north west – ST31
	SINC-10		1.05km to the west of H5
	SINC-11		Adjacent to the north – H57
	SINC-12		700m to the east – ST1
	SINC-13		340m to the south west – ST14
	SINC-14		500m to the north west – H46
	SINC-15		1.05km to the north – H46

Aspects	**Map reference**	**Feature of interest**	**Location in relation to the nearest site**
	SINC-16		1.75km to the north east – ST9
	SINC-17		2.9km to the north east – ST9
	SINC-18		4.3km to the north east – ST9
Special Area of Conservation	SAC-01	Strensall Common	4.3km to the north east – ST9
	SAC-02	Strensall Common	4.3km to the north east – ST9
Site of Special Scientific Interest	SSSI-01	Askham Bog	130m to the north – ST31
	SSSI-02	Heslington Tillmire	1.35km to the west – ST15
	SSSI-03	Clifton Ings And Rawcliffe Meadows	240m to the east – ST1
	SSSI-04	Naburn Marsh	2.3km to the east – ST31
	SSSI-05	Strensall Common	4.3km to the north east – ST9
	SSSI-06	Strensall Common	4.3km to the north east – ST9
	SSSI-07	Fulford Ings	500m to the south east – ST16
	SSSI-08	Fulford Ings	1.4km to the south east – ST16
Countryparks	CP-01	Rawcliffe - Known as a Country Park	800m to the north – ST1
Heritage			
Scheduled Monument	SM-01	South angle tower of Roman fortress	300m to the west – ST32
	SM-02	Lamel Hill (Anglo-Saxon tumulus)	500m to the south east – H10
	SM-03	Merchant's Hall, Fossgate	130m to the south west – ST32
	SM-04	City Walls, gates, posterns (not including the section from Bootham Bar to Monk Bar, N of the Minster, now part of National Monument No 13280), moats, mounds, Bayle (or Baile) Hill, St Leonard's Hospital and Merchant Taylor's Hall, Aldwark	Adjacent to the north west – ST5
	SM-05	St Mary's Abbey	50m to the north east – ST5
	SM-06	St Mary's Abbey precinct walls	50m to the north east – ST5

Aspects	**Map reference**	**Feature of interest**	**Location in relation to the nearest site**
	SM-07	St Peter's Hospital, part of undercroft beneath the Theatre Royal	280m to the north east – ST5
	SM-08	York Castle: motte and bailey castle, tower keep castle (including Clifford's Tower), and site of part of Romano-British fort-vicus and Anglian cemetery	280m to the south west – ST32
	SM-09	Siwards How, south east of the water tower, Heslington Hill	480m to the south west – H56
	SM-10	York Minster cathedral precinct: including Bootham Bar and the length of City Walls extending round the precinct up to Monk Bar	350m to the north west – ST32
	SM-11	World War II bombing decoy 500m east of Bland's Plantation	1.65km to the west – ST15
	SM-12	Medieval stone town house known as The Norman House to the rear of Nos 48 and 50 Stonegate	500m to the north west -ST32
	SM-13	St George's medieval chapel 120m south of York Castle	400m to the west – H10
	SM-14	Standing tower and below ground remains of St Lawrence's Church and associated burial ground	230m to the east – H10
Conservation Area	CA-01	Central Historic Core	Adjacent to multiple sites – ST5, H10, ST32
	CA-02	Clifton	Adjacent to the south west – H7
	CA-03	Acomb	230m to the north east – H5
	CA-04	St Pauls Square / Holgate Road	Adjacent to the north – ST5
	CA-05	Heworth	Adjacent to the north – H1
	CA-06	New Walk / Terry Avenue	320m to the west – H10
	CA-07	The Racecourse and Terry's Factory	Adjacent to the south – ST16
	CA-08	Middlethorpe	950m to the south – ST16
	CA-09	Bishopthorpe	1.5km to the south - ST16
	CA-10	Copmanthorpe	300m to the north – H29
	CA-11	New Earswick	Adjacent to the south – H46
	CA-12	Huntington	150m to the east – H46

Aspects	**Map reference**	**Feature of interest**	**Location in relation to the nearest site**
	CA-13	Haxby	380m to the south – ST9
	CA-14	Strensall	2.15km to the north east – ST9
	CA-15	Osbaldwick	400m to the south west – ST7
	CA-16	Wheldrake	Adjacent to the north east – ST33
	CA-17	Heslington	370m to the south – H56
	CA-18	Strensall Railway	3.1km to the north east – ST9
	CA-19	Towthorpe	1.1km to the east – ST9
	CA-20	Dunnington	370m to the south west – H31
	CA-21	Nestle Rowntree Factory	Adjacent to the east – ST17
	CA-22	The Retreat / Heslington Road	300m to the south east – H10
	CA-23	Fulford Road	400m to the south – H10
Parks and Gardens	P&G-01	Museum Gardens, York – Grade II	50m to the north east – ST5
	P&G-02	Rowntree Park, Grade II	500m to the south west – H10
	P&G-03	York Cemetery, Grade II*	220m to the south – H10

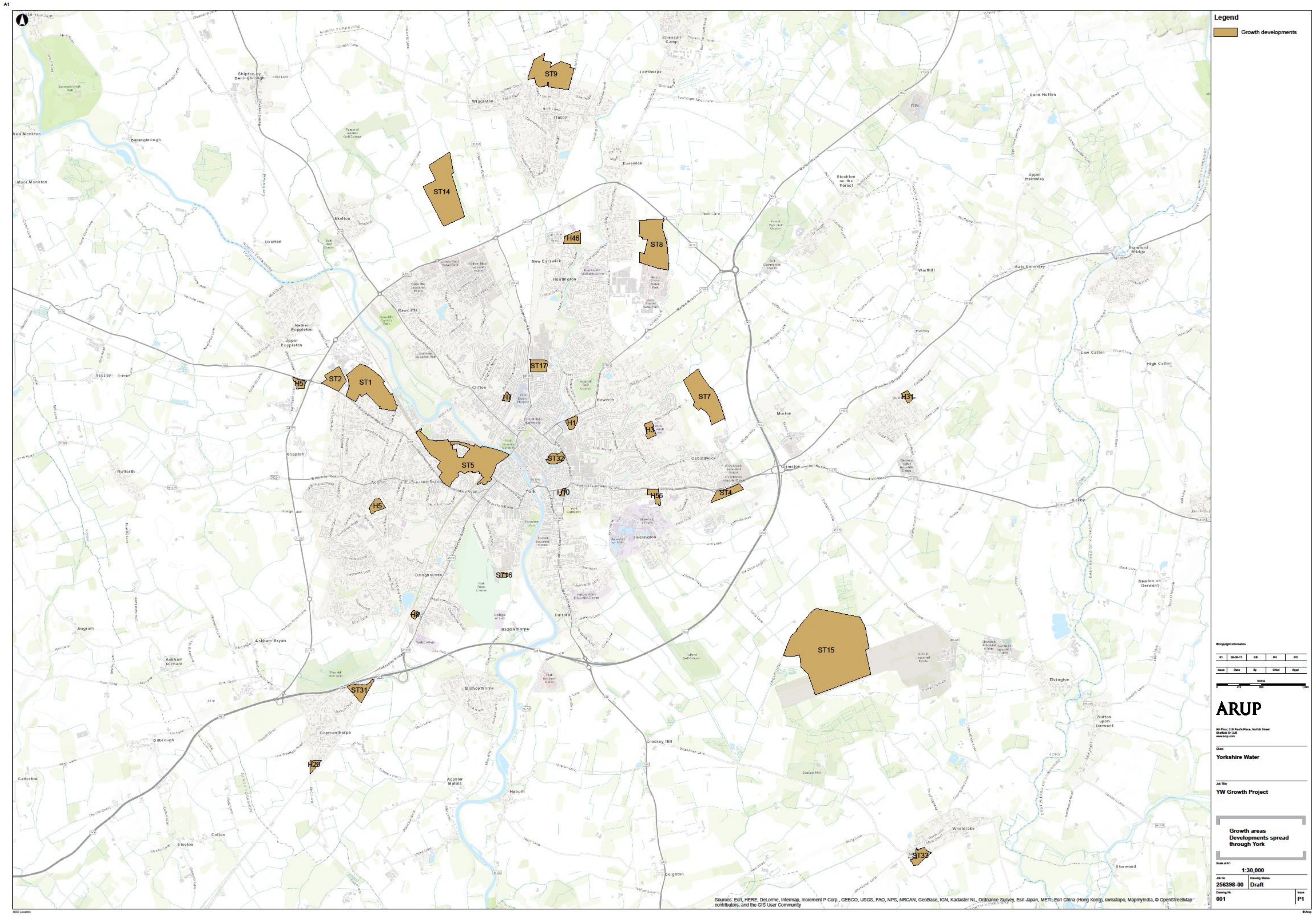
Figure 12 York environmental and social constraints



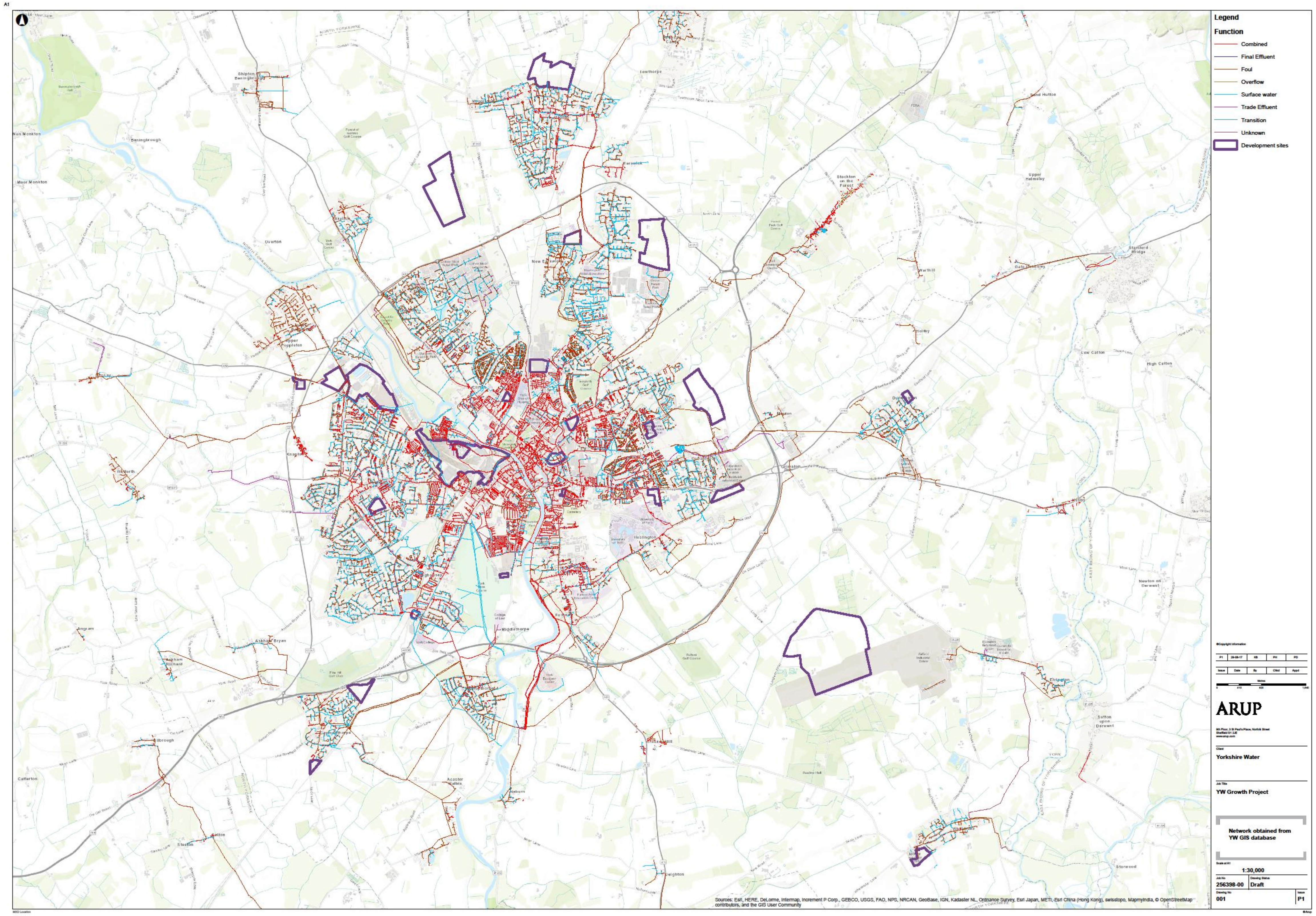
Appendix D

Wastewater networks

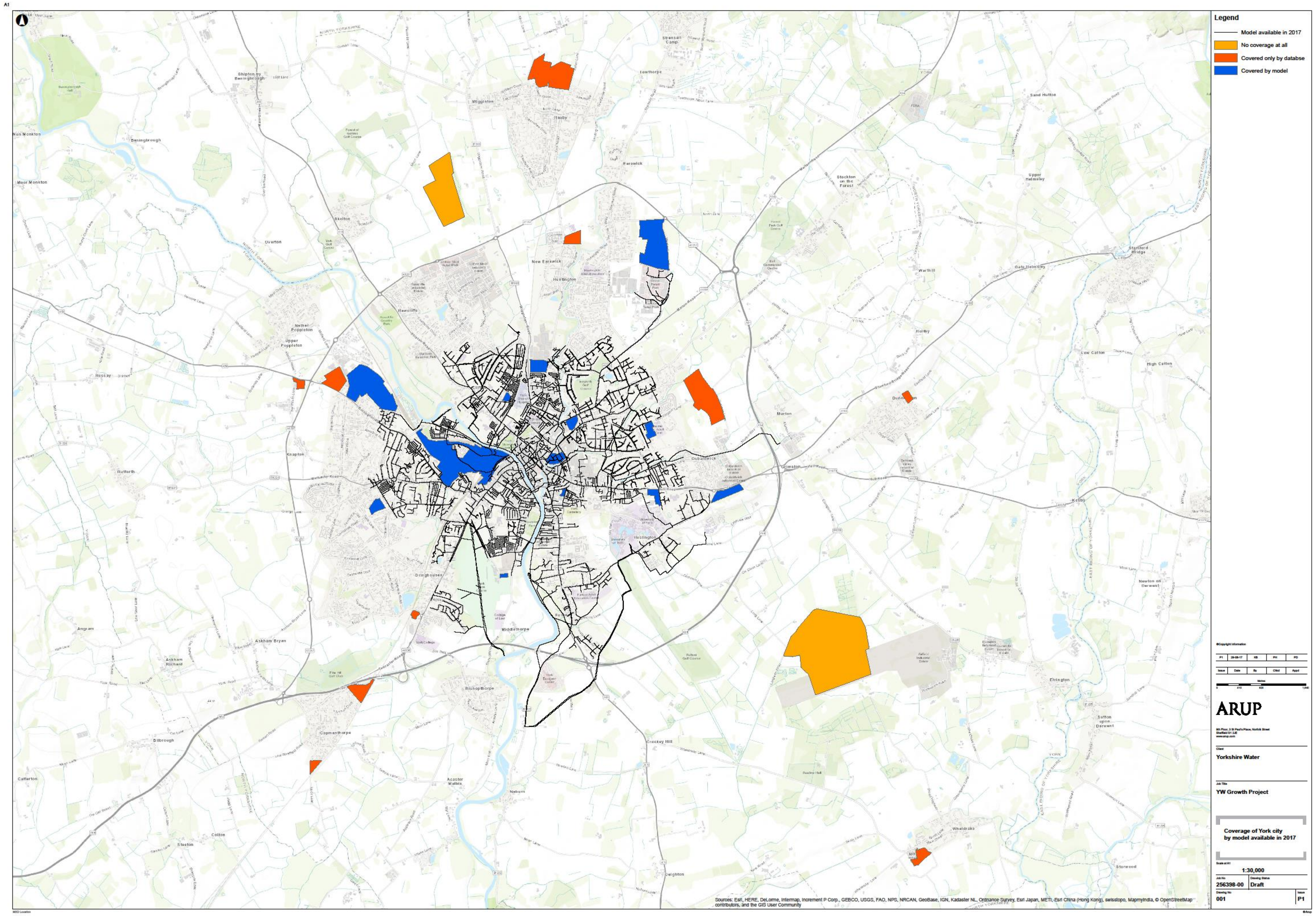
D1 Growth developments in York



D2 YW's GIS Database network



D3 Hydraulic model available in 2017 extent



D4 York flood defence plan

Environment Agency

how we're reducing the risk of flooding for York

Our 5-year plan

November 2016

What's the purpose of this 5 year plan?

Following the floods of December 2015, the government allocated an additional £45 million to the Environment Agency to better protect 2,000 properties in York.

In the past, both the Environment Agency and our partners have invested substantially in York, which has significantly reduced the risk of flooding for thousands of residents and businesses. However the recent floods and the increase in frequency of high river levels on the River Ouse have demonstrated that the flood defences in York are no longer providing the standard of protection that they were designed for. Our work over the next five years will improve the standard of protection to York and take into account climate change.

Since receiving the additional funding we have assessed what changes could be made to the existing flood defences within the city and what new defences could be built. The results of this have been summarised within this plan. We will use this plan to guide our work in the city over the next 5 years.

The options we are presenting in this plan are based on our ambition to achieve a consistent standard of flood protection across the city.

In some places across York, raising or installing new defences to this level is unlikely to be acceptable or feasible and we may need to look at other options. We will agree the most suitable option by liaising with City of York Council and the relevant communities.

Foreword

York is a beautiful city with a unique history going back over 2,000 years. This is why we choose to live and work here, and why visitors from across the globe flock to experience the rich mosaic of the historic and the modern.

The rivers Ouse and Foss flowing through York have been instrumental in the city's success, providing first a defensive role for the Roman settlers, then an artery for trade and industrial growth as the city expanded. Our relationship with the rivers has not been without problems. Throughout history the city has regularly flooded, though none as fresh in the mind, nor as painful as the events of December 2015. The city's flood defences have protected residents on many occasions, and the people who live here have shown remarkable resilience.

We must remember that we cannot prevent all flooding. What we can do, and what we must do, is manage water better. Building new and improved defences throughout the city, and look upstream at the catchment as a whole for new ways to slow the flow, store water, and reduce the impact of flooding on York. The £45 million investment provided to York by the government is the first step towards that.

Over the next 5 years, working with City of York Council, we will carry out a major programme of upgrading flood defences within the city. This plan outlines our options and where we think the greatest improvements can be made.

Beyond this, the direction we take together will be guided by you. Early next year, we will begin consulting on a long term plan to reduce the risk of flooding in York over the next 100 years. This is an opportunity for you to shape the way that floods are managed into the future. I hope you will join me on this journey.

Mark Scott,
Yorkshire Area Manager, Environment Agency

As Chief Executive of City of York Council, I welcome the publication of this plan and look forward to working with the Environment Agency to deliver options for reducing the impact of flooding to the city over the coming years.

As organisations, we will work together to consider where changes are needed to our emergency plans; where we can involve others in helping keep communities safe and how we can best utilise our resources to tackle and manage the flood risk to the residents and businesses of York.

Mary Weastell,
Chief Executive, City of York Council

What we're investing in York

We are currently working with City of York Council and other partners to ensure we invest the additional funding that has been allocated to York, to improve the level of protection against flooding across the city.

In recent years, notable investments include:

- Almost **£200,000** a year spent on maintaining the River Foss and the Foss Barrier over the past 5 years.
- **£4.2 million** from the government in the Water End flood alleviation scheme. City of York Council has contributed an additional **£1 million**.
- Developed models for the rivers Ouse and Foss to inform the design of the proposed work and inform future catchment-wide actions.

From the additional funding from the government in 2016, we will:

- Invest up to **£17 million** to upgrade and improve the Foss Barrier.
- Invest the **£45 million** over the next 5 years to better protect at least 2,000 properties from flooding within York's administrative boundary.

Our partners, City of York Council have already allocated (as of November 2016) over **£500,000** in Property Level Resilience Grants to help residents to better protect their homes.

Improving the Foss Barrier

Following the flooding in December 2015, the government allocated £17 million of funding to improve and upgrade the Foss Barrier.

The barrier was built as part of an extensive flood management programme in response to the floods of 1982 and was completed in 1987.

It forms part of York's city-wide flood defences and has protected the city on many occasions, notably during the floods of 2000 and 2012. The Foss Barrier - which is operated on average 5 times per year - prevents water from the River Ouse increasing river levels on the River Foss, which would cause flooding along the Foss Basin.

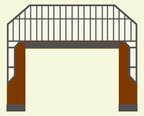
During the December 2015 floods, water from the River Foss entered the pumping station causing serious damage to the electrics. The barrier was back in operation in just over 2 days and has been used on a number of occasions since.

In April 2016, we started to repair and upgrade the barrier to make it more resilient to future floods, whilst making sure it fits into its surrounding environment.

As part of the improvement work, we've installed new pumps which have a higher pumping capacity that would be able to deal with the amount of water that came down the River Foss on Boxing Day 2015. During the next phase of work, we will raise the height of the building and further improve the pumping capacity. The substantial part of the upgrade will be completed by December 2017 and the barrier will continue to be fully operational throughout the work.

Artist's impression of the completed Foss Barrier

What we've done since the floods



Foss Barrier has been operated 4 times since the flooding

£45 million from the government for York's flood defences

8 new pumps installed at the Foss Barrier

Flooding has devastating effects on lives and livelihoods. Storms Eva and Frank in December 2015 caused record rainfall across Yorkshire.

The 627 households and businesses in York that were flooded on Boxing Day have spent most of this year dealing with its effects. Since then, we, City of York Council and our partners have taken action to reduce the risk of flooding.

January

Allocated £10 million from the government for an upgrade to the Foss Barrier.

Started inspecting our flood defences and carried out emergency repairs.

Attended and presented at 8 MP led meetings where councillors and constituents were present.

February

Started flood defence repairs.

Held 5 public drop-in sessions across the city.

Established a team to deal specifically with flood recovery.

March

The government announced an extra £45 million for York's flood defences.

A further £7 million from the government for Foss Barrier.

April

Announced City of York Council independent review panel.

Started improvements to the Foss Barrier.

Reviewed and updated the flood warning areas for York based on public feedback.

May

Published the Foss Barrier investigation report.

Held a 2-day public exhibition in the city.

June

Began scheme feasibility studies and assessments.

Published report on the feedback received from the public exhibition.

July

Carried out improvements to river level monitoring.

August

Continued repairs to flood defences.

September

Started installing 8 new Foss Barrier pumps.

October

Completed the York detailed model reports and results.

November

Second exhibition highlighting our 5 year plan for York's flood defences.

Completed installing 8 new Foss Barrier pumps.

Where we are looking at doing work

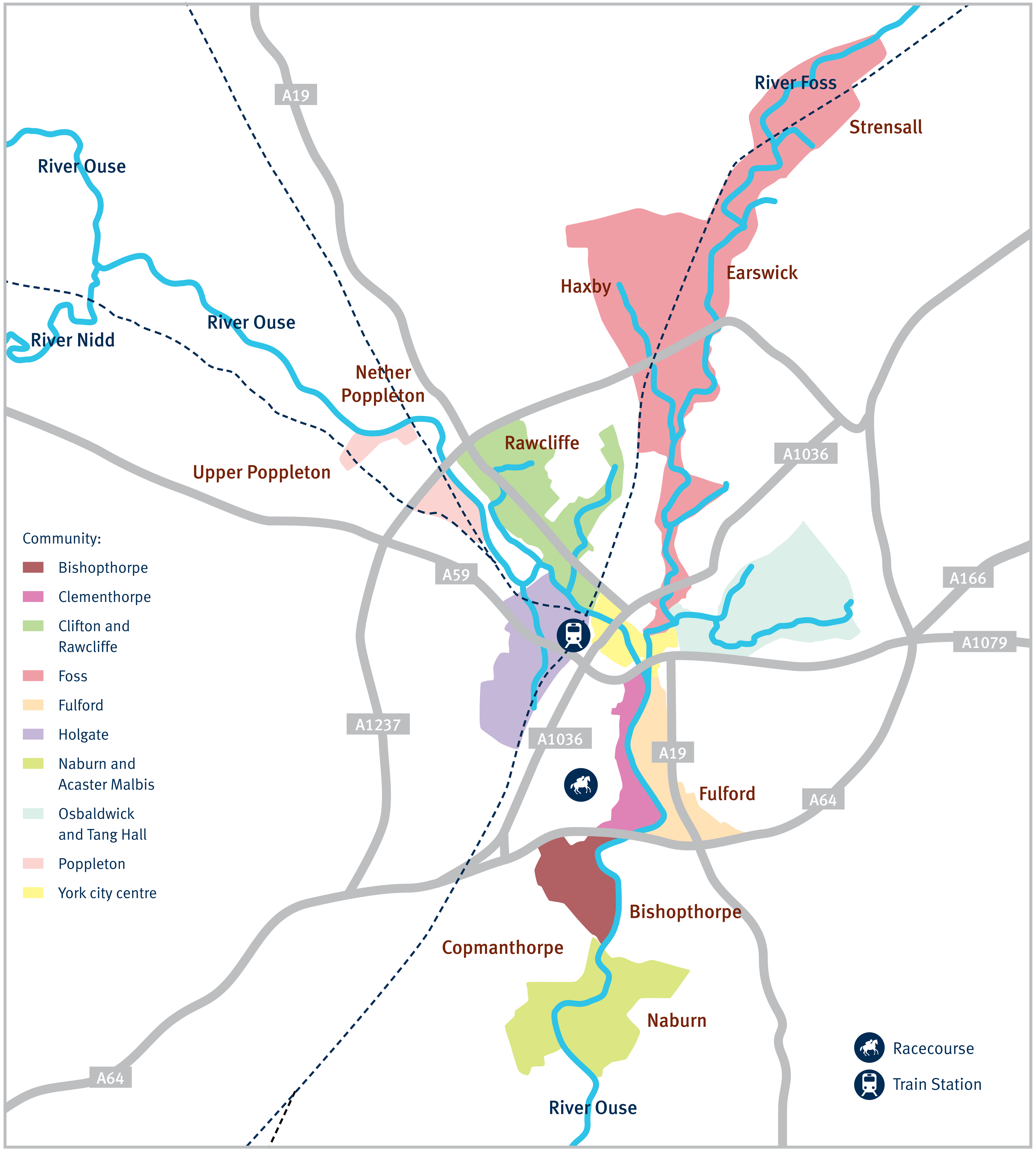
Our work over the next 5 years will focus on 10 'communities'.

These 'communities' are areas within York's administrative boundary, alongside the River Ouse, the River Foss and their tributaries, where there is a risk of flooding.

We have used historical flooding information and knowledge of the current flood defences to identify these. They are divided naturally by land features such as roads, rivers and high ground.

The next few pages outline a range of possibilities we are considering for each community to achieve a better standard of protection from flooding across York.

The following list of possible work has been created using historical information, an independent review and from suggestions by members of the public. This work shows what we would need to do to provide York with improved flood protection, but will require further analysis around their feasibility, cost and appropriateness for the community/area concerned.



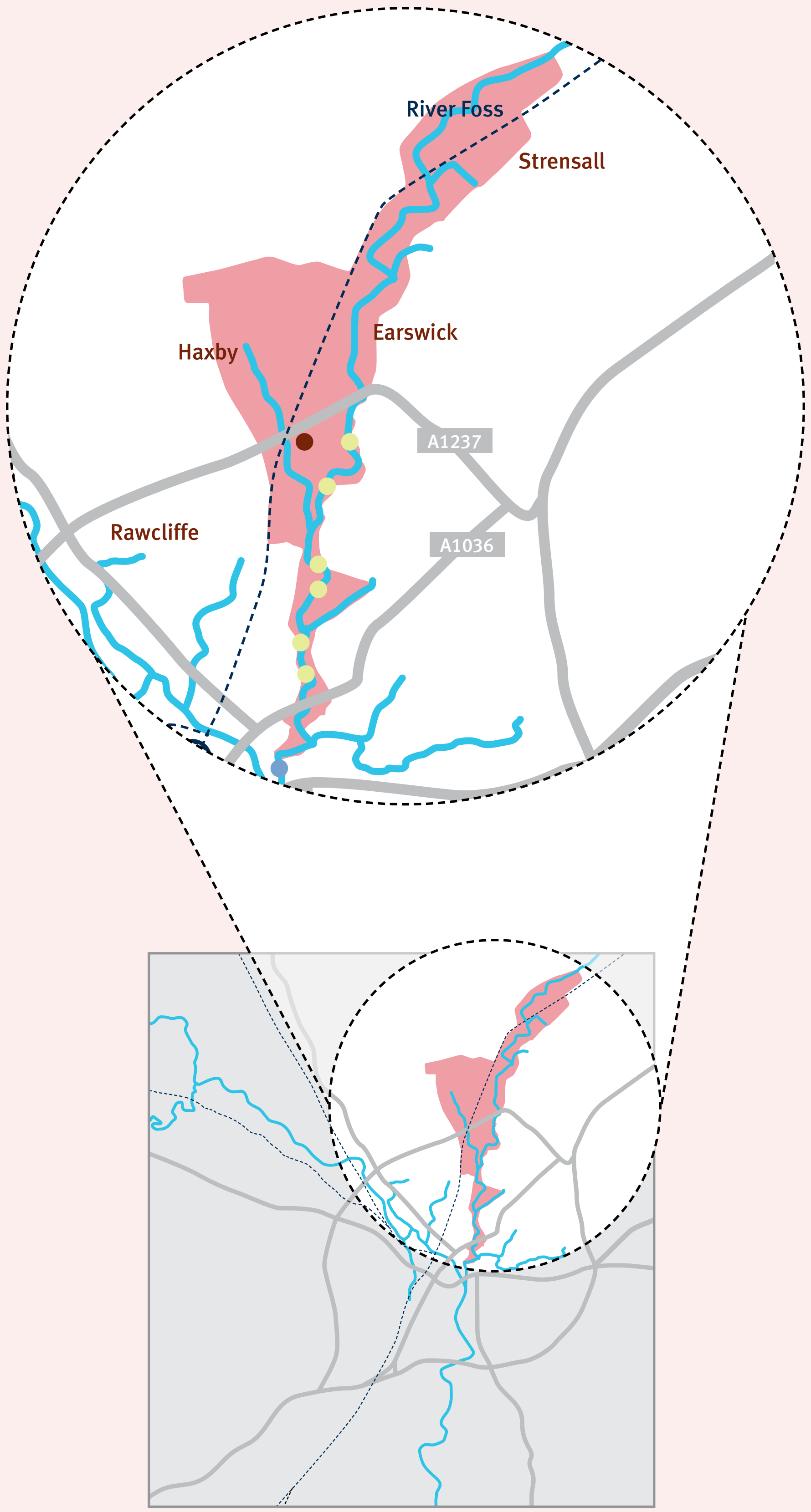
Foss community

Work we are doing:

- **Foss Barrier and pumping station**
  We are upgrading the Foss Barrier and pumping station which will significantly reduce the risk of flooding to the Foss Basin.

Possible work could include:

- **Create storage area**
  We will seek opportunities to temporarily store water upstream of the city which could slow the flow of the River Foss, reducing the need to construct further defences within the Foss Basin.
- **Improving the flow**
  In key locations we may carry out work in the channel to improve the flow of water along the Foss, particularly through the city centre.

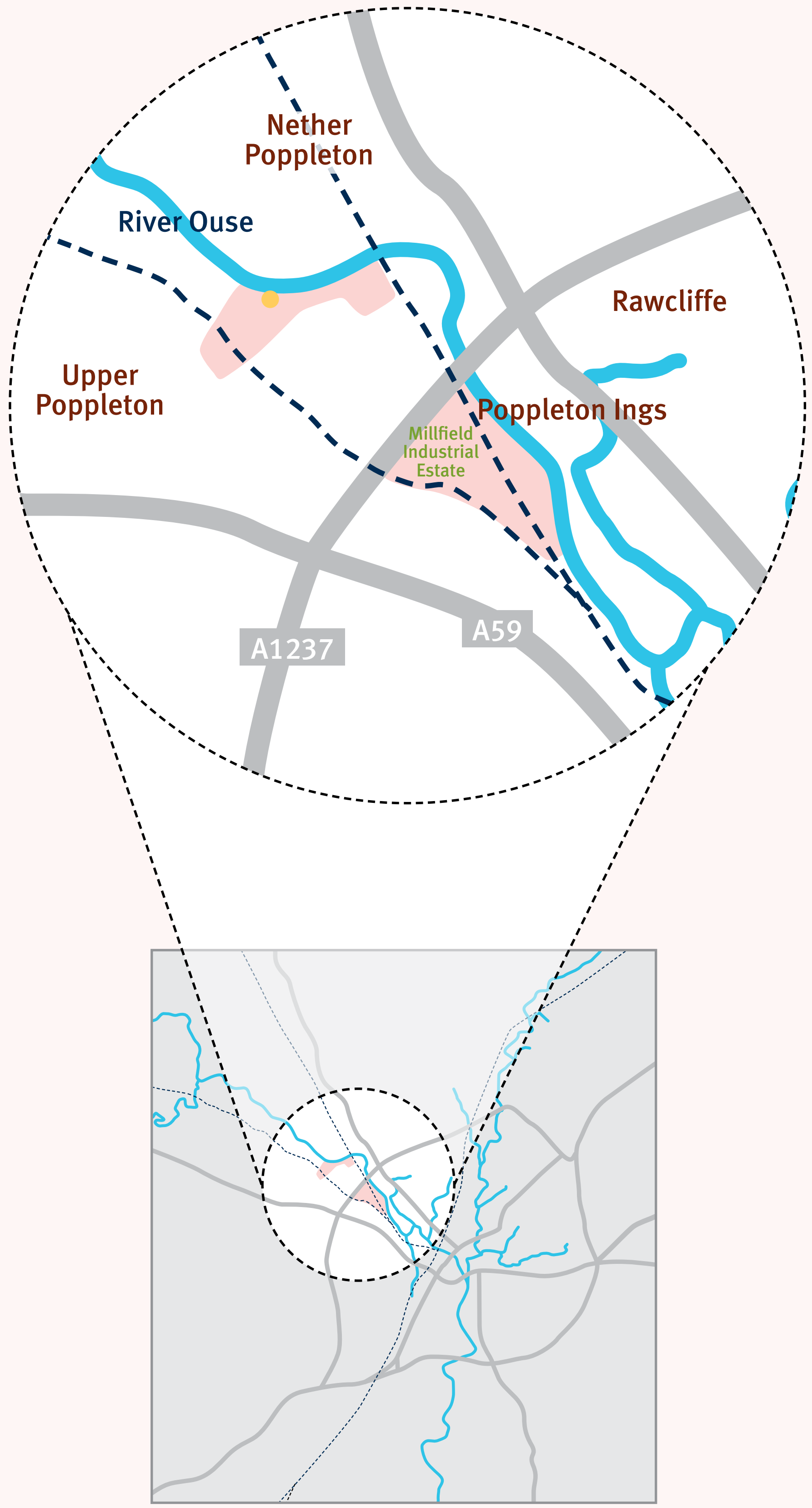


Poppleton community

Possible work could include:

- **Construct new flood walls**
  Build a wall of up to 2.5 metres in height to join the high ground north of Main Street to the high ground of the gardens of Ferrymans Walk.

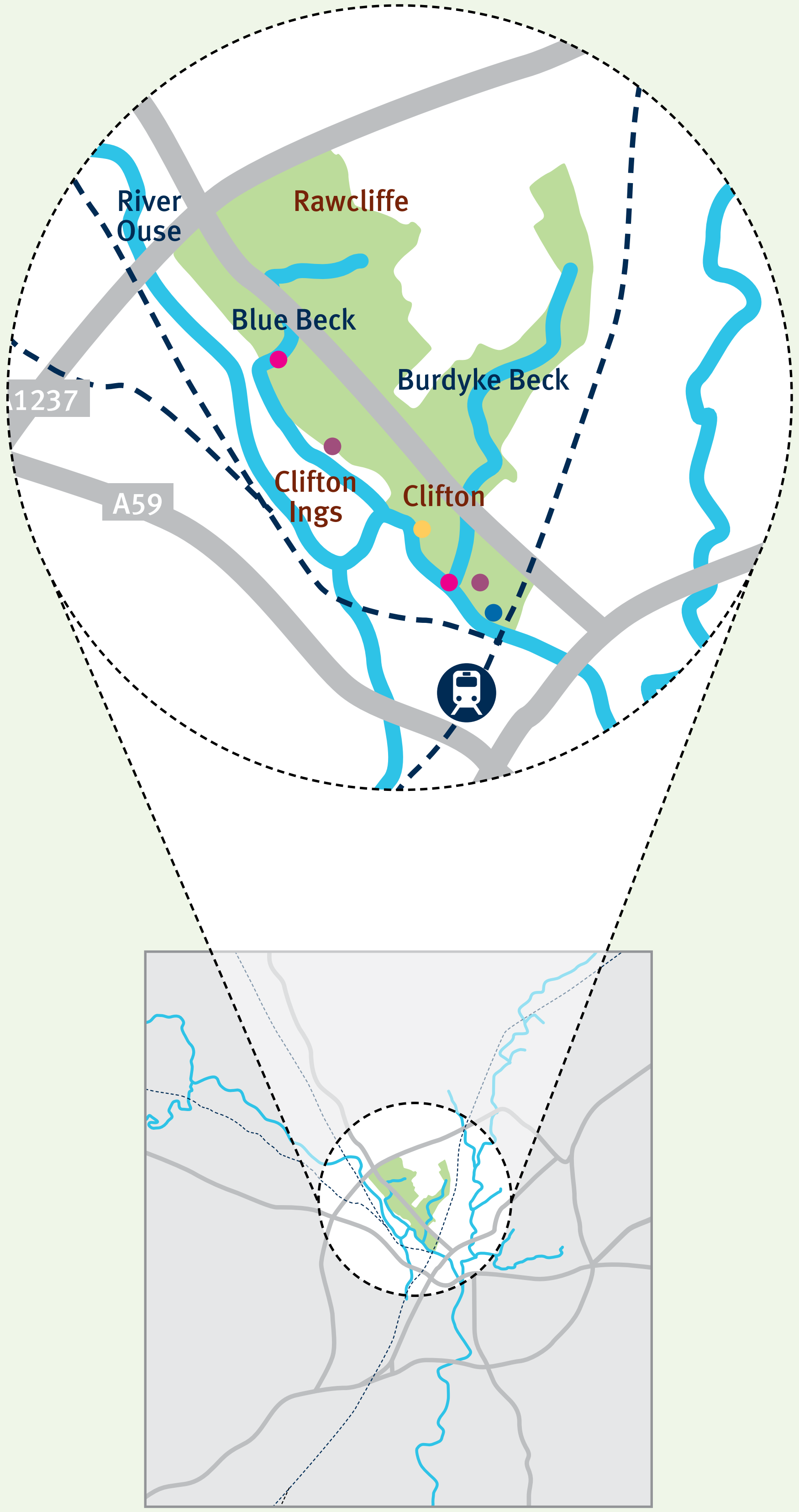
  We would also include flood gates for access. A new pumping station would also be needed in conjunction with the flood wall.



Clifton and Rawcliffe community

Possible work could include:

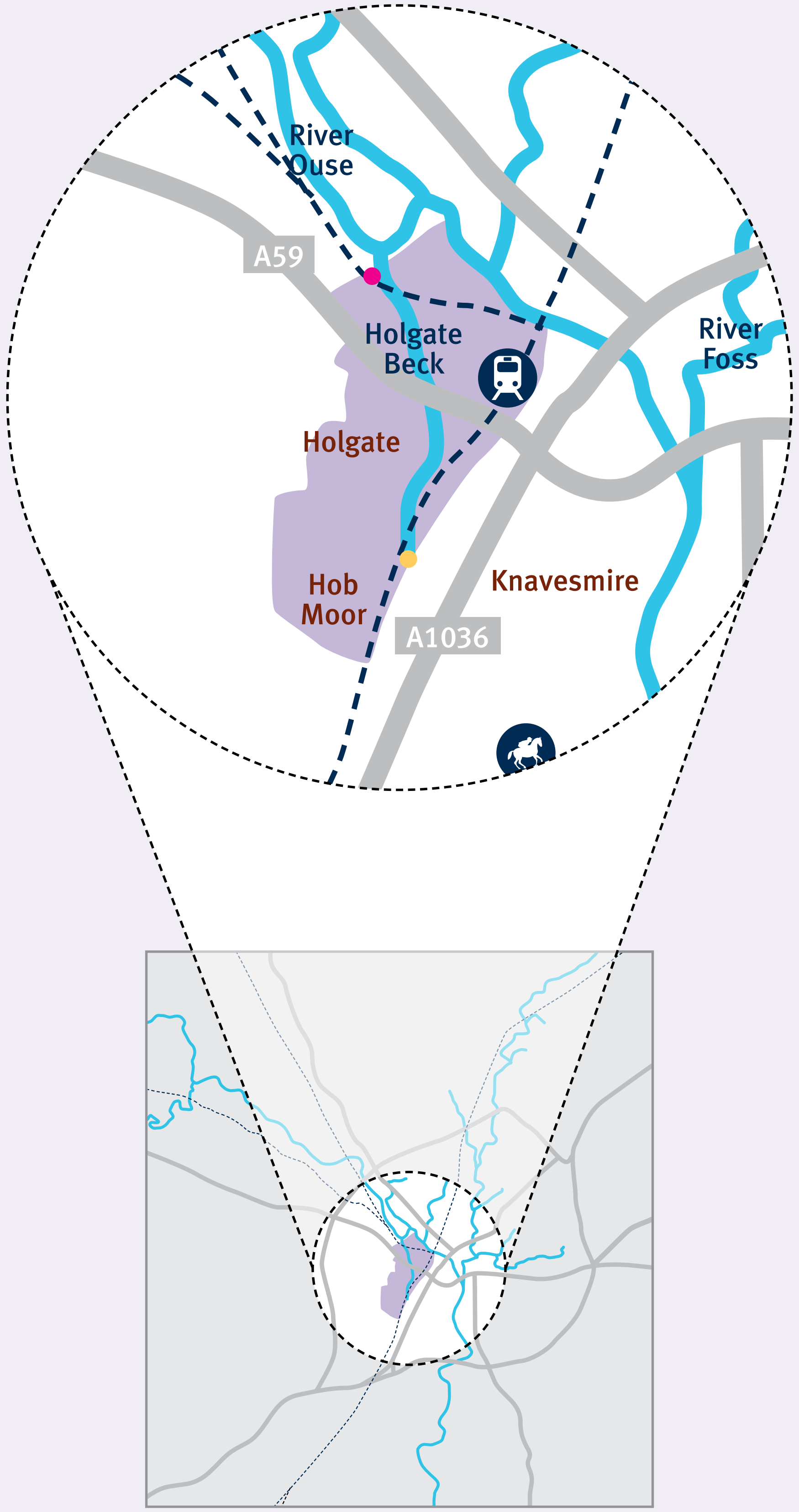
- **Increase pumping capacity**
  Construct a new fully automated pumping station where Blue Beck enters Clifton Ings. Increase the pumping capacity and resilience of the existing Burdyke Beck pumping station.
- **Raise embankments**
  Raise existing embankments by between 1.2 and 1.5 metres at Clifton Ings, Lower Bootham and St Olave's School.
- **Construct new embankments**
  Build a high earth embankment or flood wall to the rear of Government House Road.
- **Raise flood walls**
  Raise the height of the Almery Terrace flood wall by up to 1.1 metres using demountable defences.



Holgate community

Possible work could include:

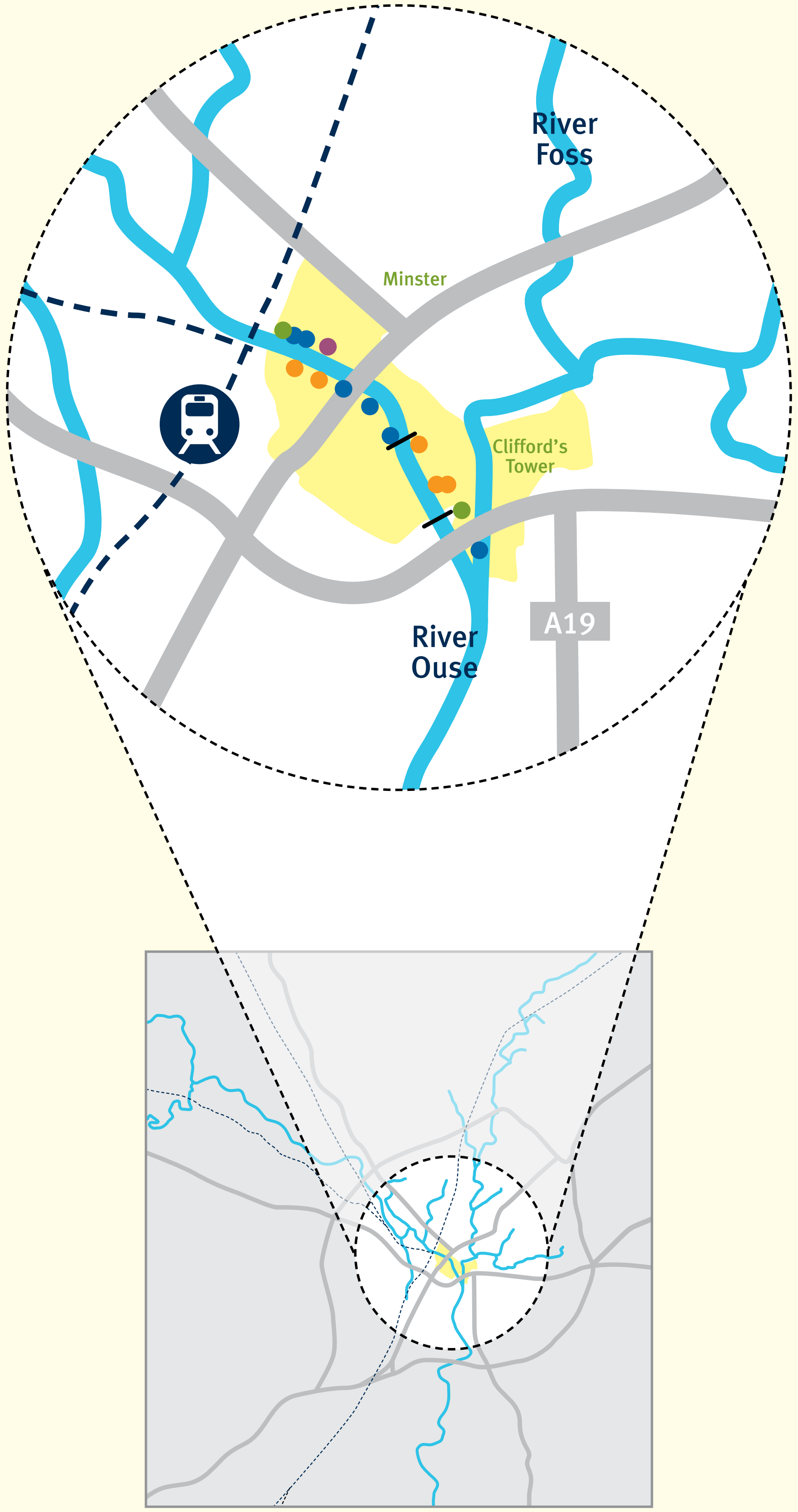
- **Construct new embankments**
  Build an embankment of up to 2.8 metres high along Gale Lane Drain to prevent water going over onto Hob Moor Drive.
- **Increase pumping resilience**
  Raise the height of the Holgate Beck pumping station and access road to improve its resilience to flooding.



York city centre community

Possible work could include:

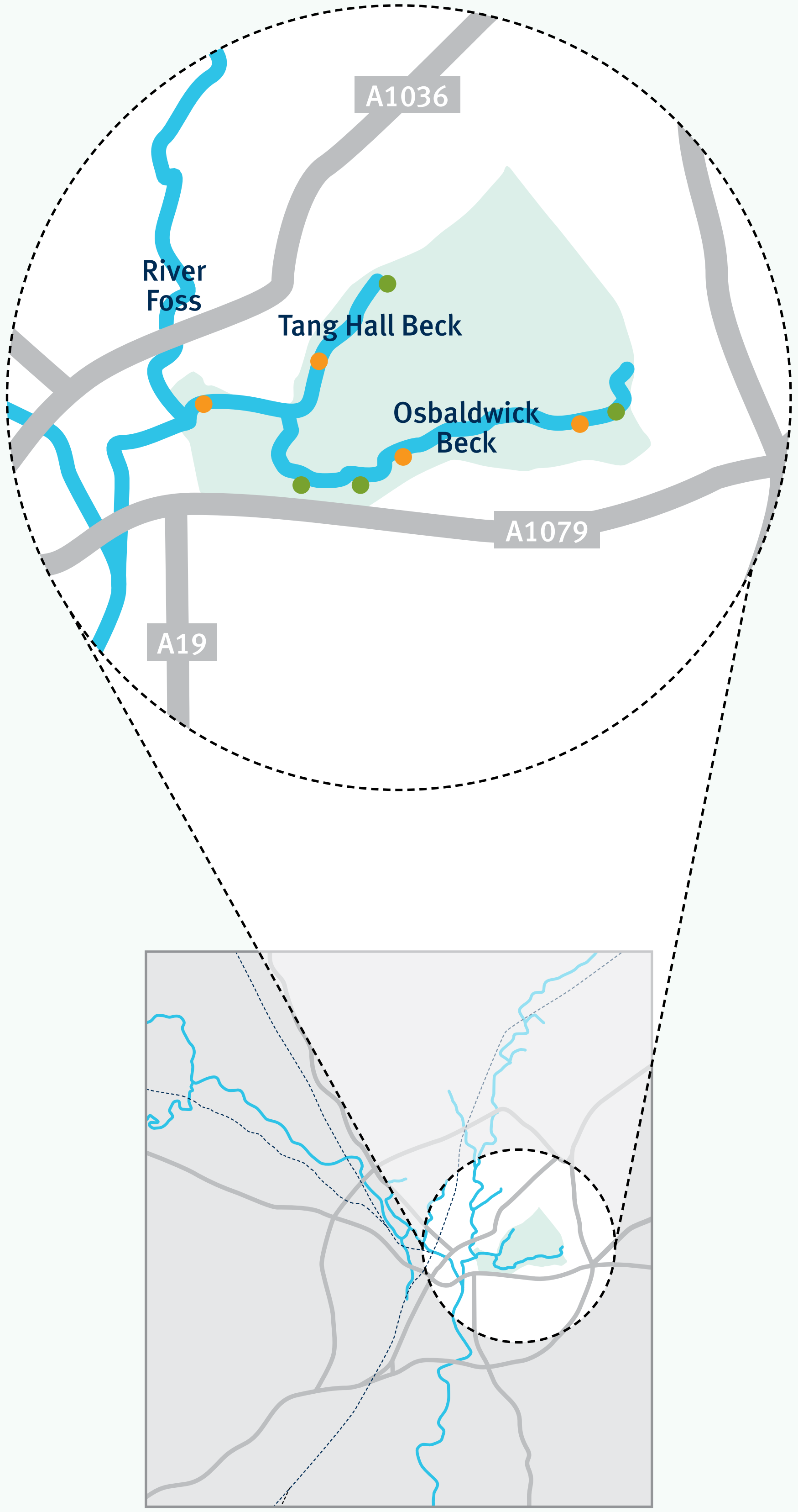
- **Raise land**
  Increase the height of the footpath between Scarborough Bridge footbridge and Earlsborough Terrace and the roundabout on Tower Street.
- **Construct new flood walls or gates**
  Build new flood gate and 1.3 metre high wall in the post office car park; build a 0.9 metre high wall and gates at Memorial Gardens; build demountable walls along Skeldergate, Queen Staithes and Kings Staithes; install new defences from Lower Friargate to South Esplanade and install flood gates; build a 0.8 metre high wall and flood gates along edge of Tower Gardens
- **Raise embankments**
  At Museum Gardens by up to 1 metre.
- **Raise existing flood walls/gates**
  Replace the existing gate at Marygate with one that has a height of up to 2.1 metres; replace 12 flood gates at Earlsborough Terrace; raise the wall at Earlsborough Terrace by up to 0.6 metres; increase the height of the flood gate at Lendal Bridge by 0.7 metres; raise the wall at Wellington Row and North Street and inside the car park at Park Inn by 0.55 metres; raise the wall at St George's Field car park and access ramp by up to 0.5 metres.



Osbaldwick and Tang Hall Beck community

Possible work could include:

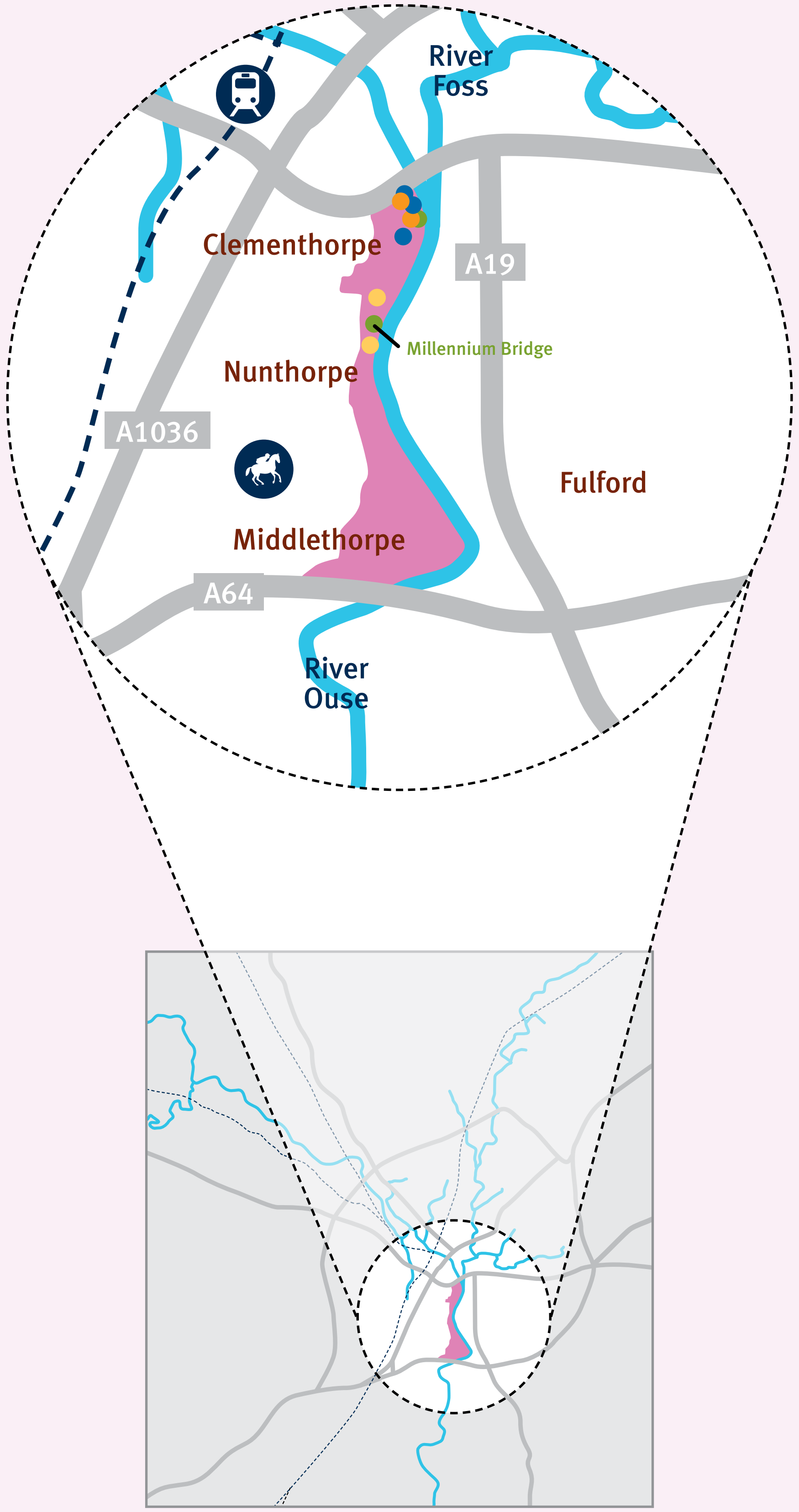
- **Raise land**
  Increase the height of both banks of Osbaldwick Beck at Melrosegate between 0.1 and 1.4 metres; on the left bank of Osbaldwick Beck at Burnholme Drive and Millfield Lane; on the right bank of Osbaldwick Beck at Outgang Lane commercial units.
- **Construct new flood walls or gates**
  With heights between 0.6 and 1.8 metres, we will look to install a gate at the entrance to James Street traveller site; build a wall along the right bank of Tang Hall Beck; build a new wall along Osbaldwick Beck at Tang Hall Lane crossing; build a wall along both banks of Osbaldwick Beck along Murton Way and Osbaldwick Village – this would also require approximately 22 flood gates to allow access to estates and properties.



Clementhorpe community

Possible work could include:

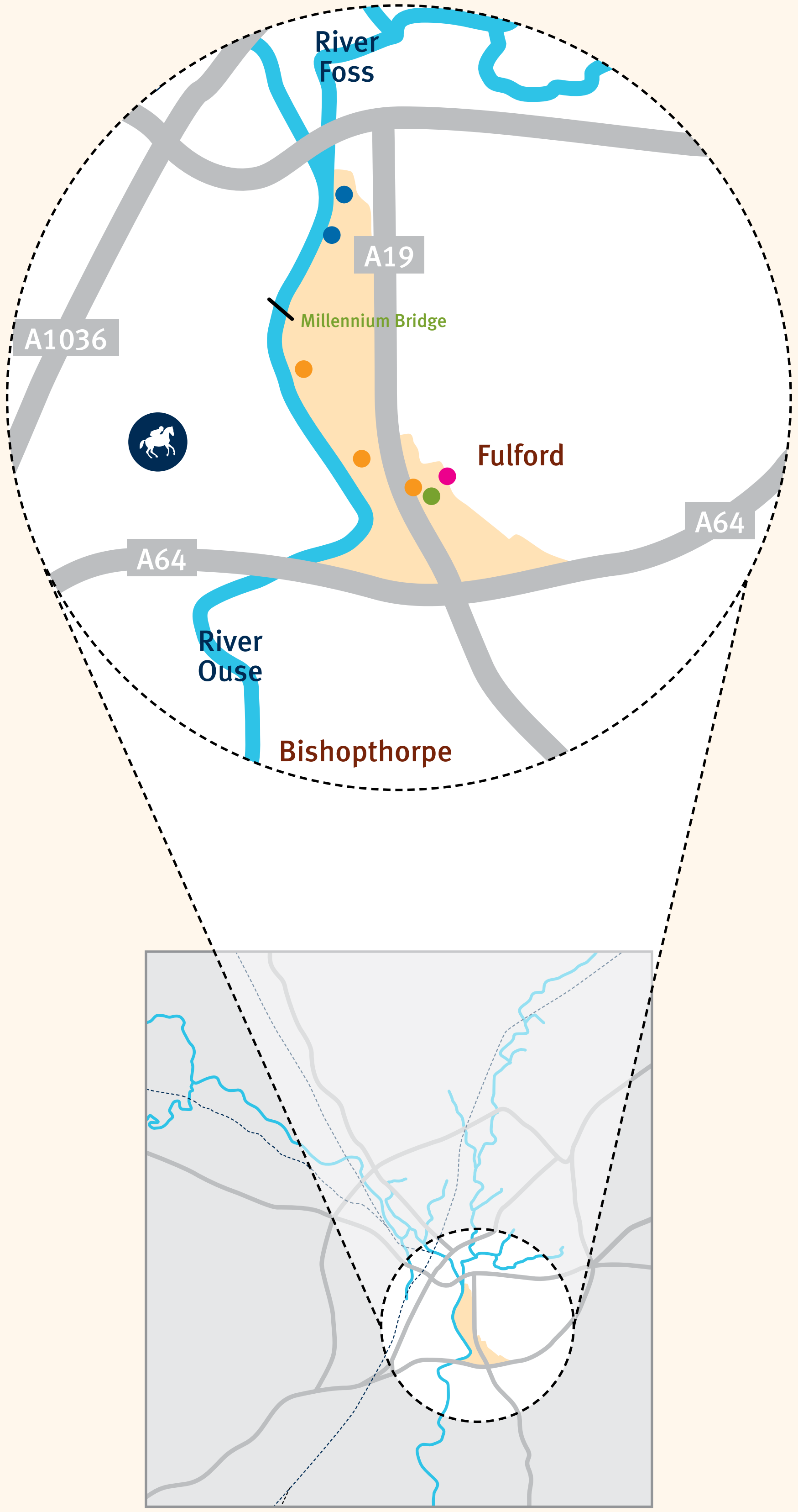
- **Raise land**
  Raise the access to the bridge across the floodplain and install an access ramp.
- **Construct new embankments**
  Build a 1.5 metre high embankment downstream of Rowntrees Park to reduce the risk of flooding to Butcher Terrace and Terry Street. Build a second embankment to reduce the risk to Reginald Grove.
- **Raise flood walls**
  Increase the height of existing walls at Terry Avenue and Postern Close by between 0.5 and 0.8 metres; the threshold of the steps at Dukes Wharfe, increase the south defence wall and the road way platform entrance; increase the existing defences at Lower Ebor St and extend the flood wall to near Bewlay Street. Raise the height of the flood defence by 0.5 metres along Waterfront House on Terry Avenue.
- **Construct new flood walls or gates**
  Build a new flood wall 0.6 metres high to the rear of Waterfront House; build a new demountable barrier around 2 metres high across Clementhorpe Street which could connect into the existing defences.



Fulford and Germany Beck community

Possible work could include:

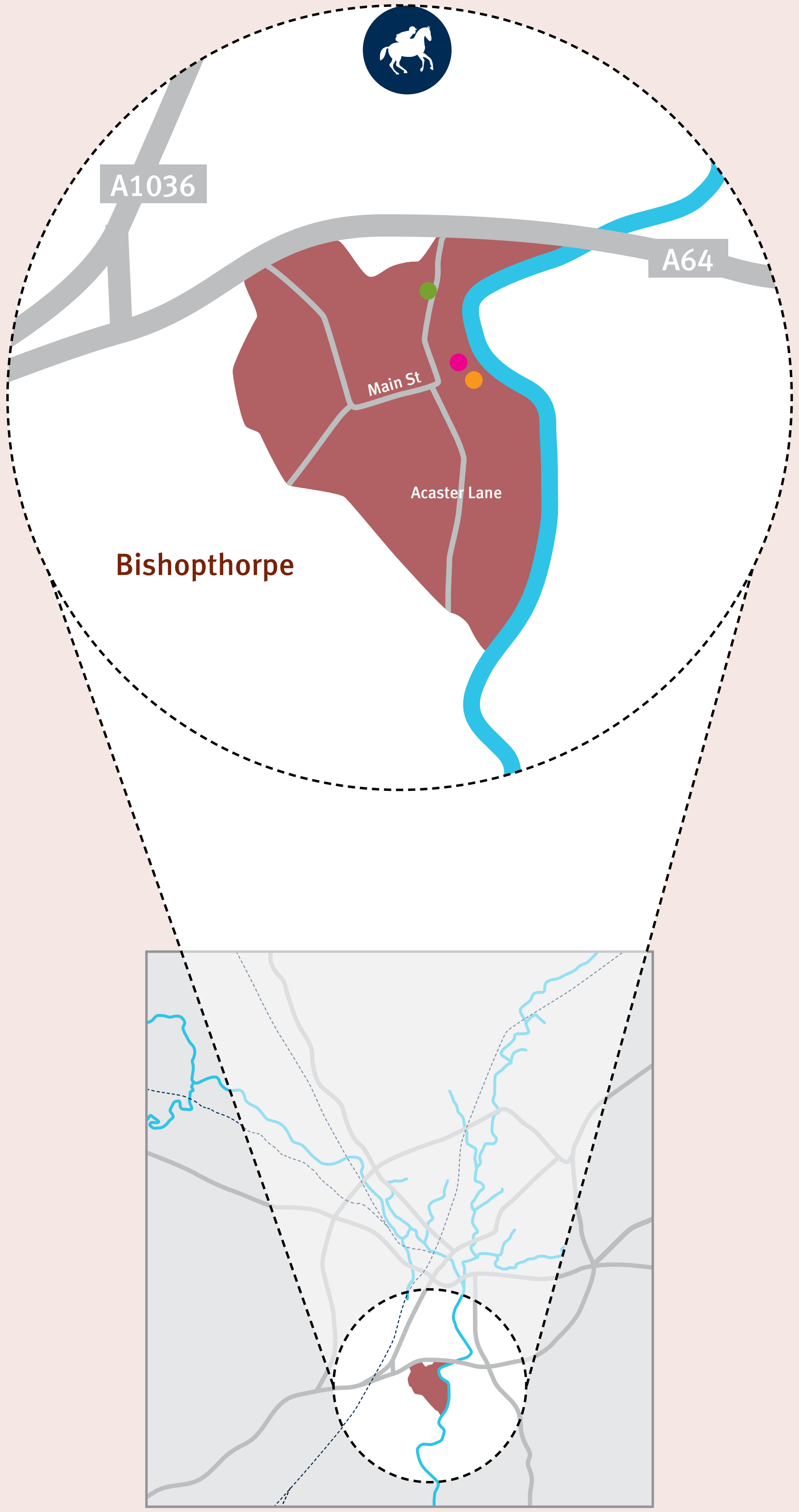
- **Increase pumping capacity**
  Improve the outfall of Tunnel Drain.
- **Raise land**
  Raise a section of Fordland Road where it crosses Germany Beck (also replacing the culvert structure and raising parapets) and join this into the new Germany Beck spine road to hold back water from the River Ouse.
- **Raise flood walls**
  Increase the height of the retaining walls by between 1 and 1.2 metres at Grange Garth and Alma Terrace running along New Walk and include 2 new flood gates.
- **Construct new flood walls**
  Build a new flood wall around 1.3 metres high with 2 floodgates on St Oswald's Road; extend the existing floodwall on both sides of Landing Lane and extend the existing flood wall on Fordlands Road.



Bishopthorpe community

Possible work could include:

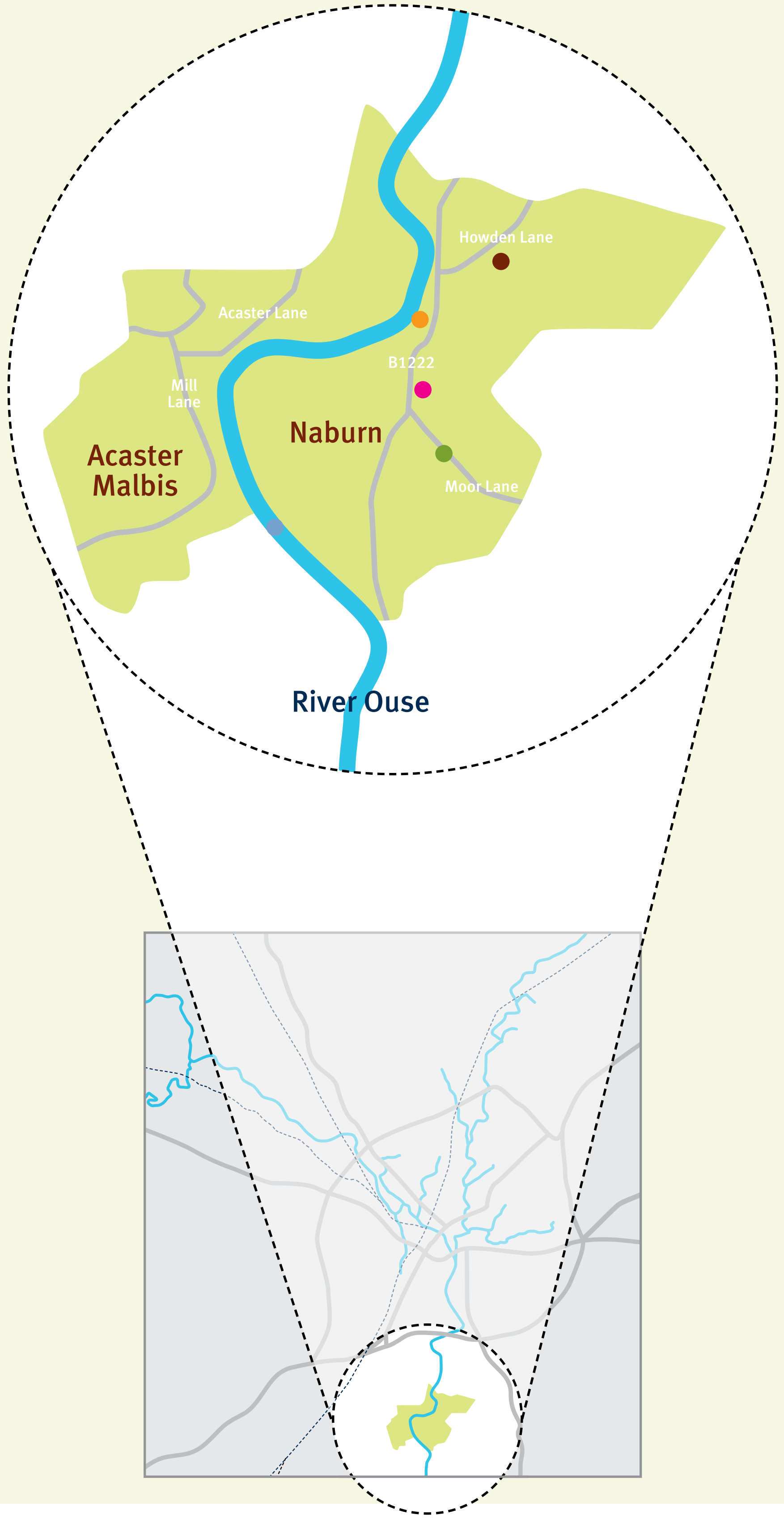
- **Raise land**
  Build up a section of Bishopthorpe Road to remove an existing depression where water gathers.
- **Construct new flood walls or gates**
  Build a new flood wall about 0.5 metres high around the Dell, joining the high ground at Bishopthorpe Palace and raising the bottom end of Chantry Lane; install a penstock to the Chantry Lane manhole.
- **Increase pumping capacity**
  install a small pumping station at the end of Chantry Lane to pump surface water over the new flood wall.



Naburn and Acaster Malbis community

Possible work could include:

- **Raise land**
  Increase the height of the land at Moor Lane by up to 1.2 metres.
- **Construct new flood walls**
  Build a new defence along the river bank adjacent to Front Street and Maypole Grove.
- **Increase pumping capacity**
  Install a new pumping station in the low spot on the B1222 road.
- **Create storage area**
  Build a new embankment in the field that's west of the railway line on Howden Dyke.
- **Naburn Weir**
  We will look to modify Naburn Weir if it is seen to reduce river levels.



How this could look

These are illustrations of the type of things we could do. We will agree the most suitable option for each location by working closely with City of York Council and the relevant communities.

Permanent walls and gates

These defences remain fully in place and are built into the natural surroundings. During a flood, little action is required other than closing gates.

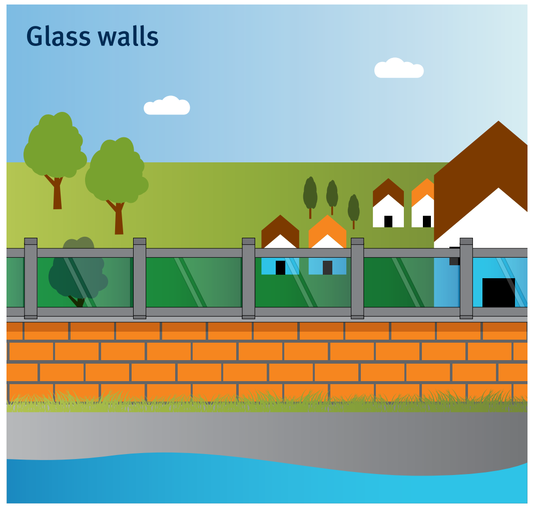
York has several areas protected by flood walls and gates such as Wellington Row, North Street and Lower Bootham.

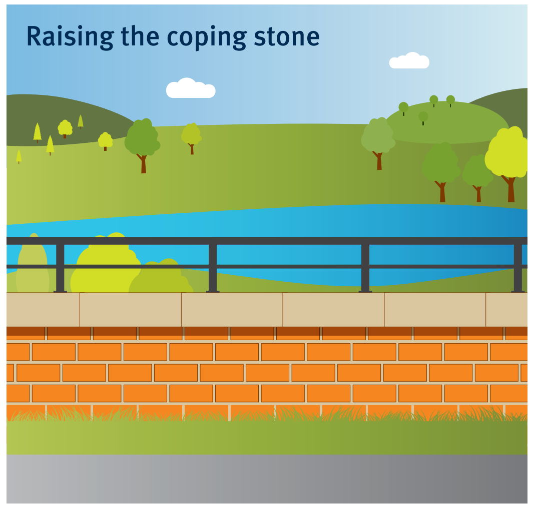
We can raise these walls by simply building them higher by raising the level of the coping stones or using glass panels or demountable elements on top of the fixed structure.

- **Raising with glass panes**
  Sometimes, it may be possible to increase the height of walls using glass panels to maintain the view.
- **Raising the height of the flood walls with coping stones**
  Many modern flood walls such as those used at Water End are constructed in a way that allows them to be easily raised in the future.

  This involves removing the coping stones at the top and adding additional rows of bricks.

  This requires strong foundations built to withstand the increased load from higher walls, so it is not always possible for older walls.



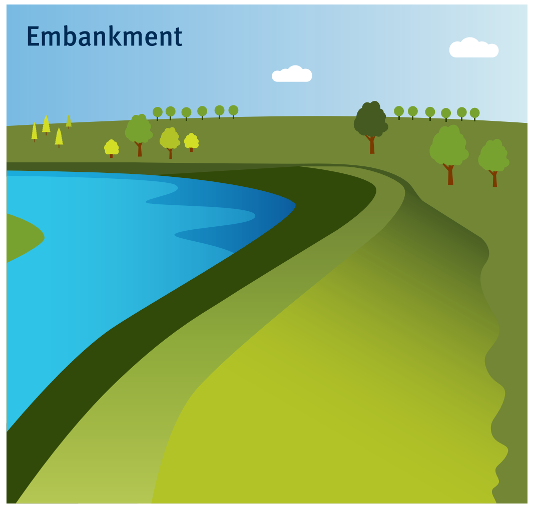


Embankments

This is a permanent raised bank of earth. They usually require more space, compared to a wall and therefore tend to be built in open spaces and rural areas.

York is protected by earth embankments such as those at Clifton Ings and the banks around St Olave's School and in Museum Gardens.

Where there is space, we could raise these embankments with earth material and where there is not the space we could build a raised defence along the top.



Permanent part walls and demountables

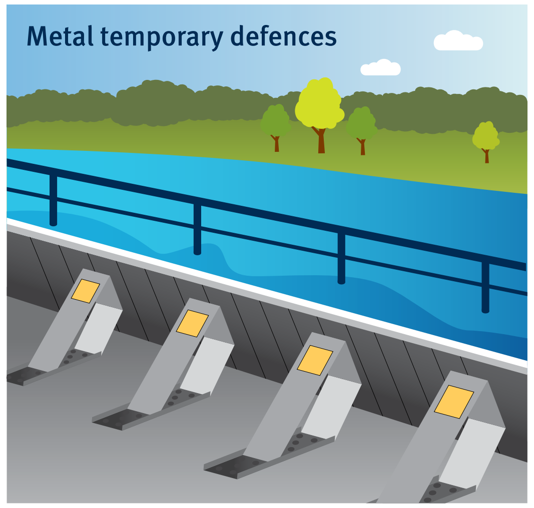
Some permanent flood defences can be raised when a flood is expected by adding a demountable section that can be removed when not needed. It has pre-installed foundations and supports which require operation prior to a flood. We would look to use demountable defences where we need access or open space when there is no flooding.

Temporary defences

These freestanding frames can be installed prior to a flood and removed when water levels have dropped.

The opportunities for using temporary barrier systems in York is limited and they are not the most effective solution.

If we can't justify the use of permanent defences on technical or economic grounds then we may consider using temporary defences.



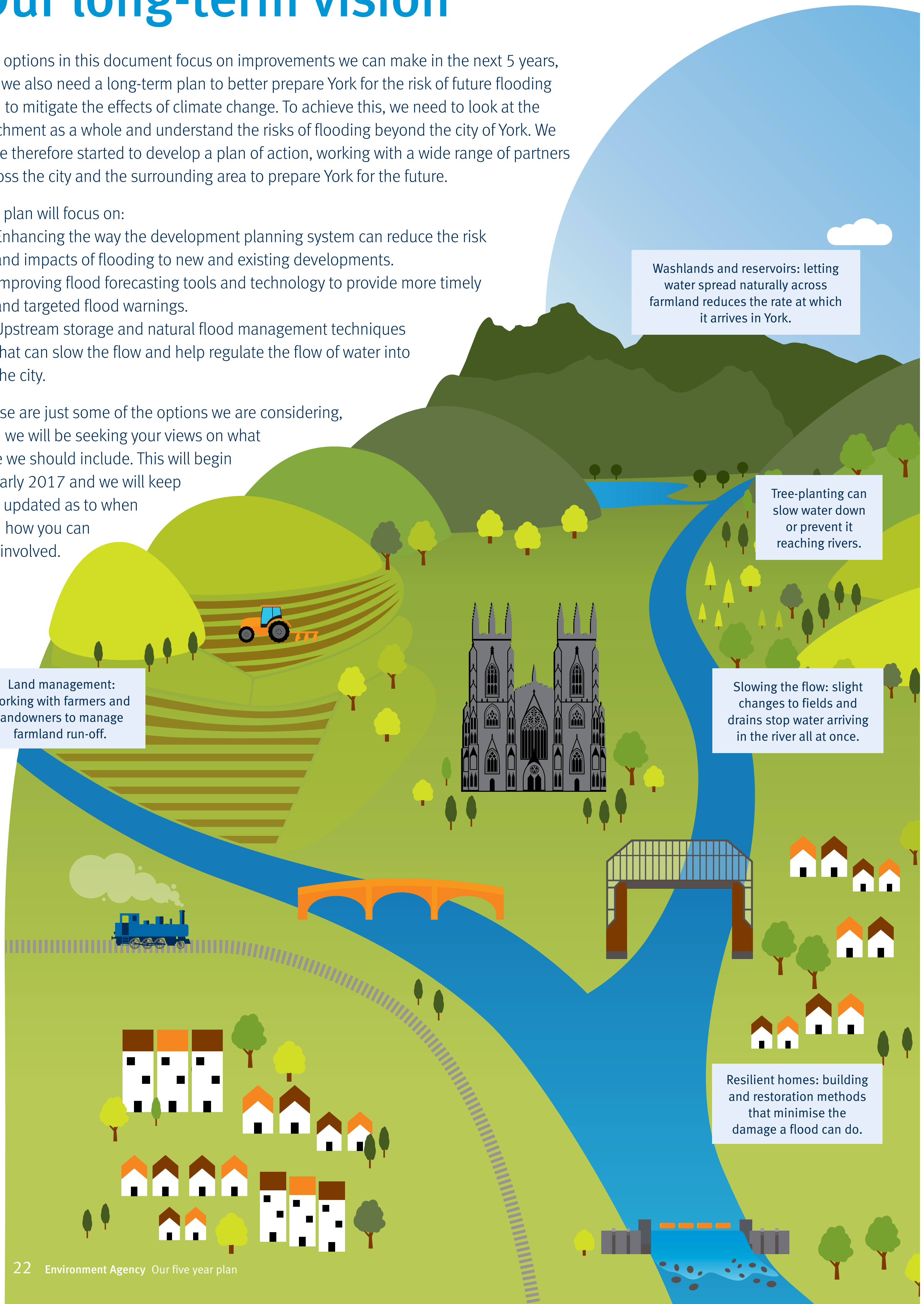
Our long-term vision

The options in this document focus on improvements we can make in the next 5 years, but we also need a long-term plan to better prepare York for the risk of future flooding and to mitigate the effects of climate change. To achieve this, we need to look at the catchment as a whole and understand the risks of flooding beyond the city of York. We have therefore started to develop a plan of action, working with a wide range of partners across the city and the surrounding area to prepare York for the future.

The plan will focus on:

- Enhancing the way the development planning system can reduce the risk and impacts of flooding to new and existing developments.
- Improving flood forecasting tools and technology to provide more timely and targeted flood warnings.
- Upstream storage and natural flood management techniques that can slow the flow and help regulate the flow of water into the city.

These are just some of the options we are considering, and we will be seeking your views on what else we should include. This will begin in early 2017 and we will keep you updated as to when and how you can get involved.



What you can do next

This plan has been developed in response to the December 2015 flooding and sets out the main actions we have already taken and intend to take to reduce the risk of flooding in York over the next five years.

In the meantime, we are encouraging people living in York to be better prepared for the risk of flooding in the future.

Here are some important things you can do now:

- Find out if you're at risk of flooding and sign up for flood warnings – call Floodline on **0345 988 1188** or visit **www.gov.uk/flood**
- Familiarise yourself with our flood warnings system and what you should do when you receive a warning.

- Make your home more resilient to flooding – advice is available on **www.gov.uk/flood**
- Share your local knowledge, suggestions and ideas at **yorkfloodplan@environment-agency.gov.uk**

To find out more information visit **www.gov.uk/flood**

Would you like to find out more about us, or about your environment?

Then call us on
08708 506 506 (Mon-Fri 8-6)

email
enquiries@environment-agency.gov.uk

or visit our website
www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)
floodline 0845 988 1188

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LIT 10519

D5 Wastewater networks - summary table of solutions

Site Ref in SHELAA	Site	Gary Collins Comments	No of Units	Next to river/surface sewer	Surface Water sewer Near by	Covered by model	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Formula A (l/s)	Foul solution	Surface water solution	Proposed Solution for Costing	Alternate Solutions considered but not costed (Talk about options and level of confidence in options)	Modelled
H1	H1 Former Gas Works, Heworth Green	FW ok SW, the sewer is likely to be a future spur put in at the start of the new development	336	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	234	x	1.5	12.2	Connect to nearest foul sewers half site to connected to 450 dia sewer, half site to 490 dia	Existing runoff to be reduced by 30 % and discharged to the existing surface water sewer	As described left	N/A, relatively close to river	Yes
H10	H10 Barbican	FW to Barbican Road SW to wherever site currently drains	187	more than 50 meters from nearest watercourse	Combined	Yes	Yes	Brownfield	35	x	0.8	6.8	Connect to nearest 830Ø combined sewer in Paragon Street	Existing runoff to be reduced by 30 % and discharged to nearest 830Ø combined sewer in Paragon Street	As described left		Yes
H29	H29 Land at Moor Lane, Copmanthorpe	OK both FW and SW	88	Through the site/on the edge	Yes	No	Yes	Greenfield	x	12.4	0.4	3.2	Connection to 150 dia foul sewer	Connection to 300 dia Surface sewer sewer Approx. 8l/s of SW flow at greenfield rates into 300Ø sewer should not pose a major issue.	As described left	Nearby field ditch considered, however connectivity is unknown and it may be cut-off by railway, therefore not considered.	No
H3	H3 Burnholme School	OK both FW and SW	81	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	185	x	0.4	2.9	Connect to nearest foul sewer sewer with 225 dia	Existing runoff to be reduced by 30 % and discharged to the nearest existing SW sewer. Flooding found on nearest SW sewer, therefore upsize nearest SW sewer from 225Ø to 375Ø from the site down to river (approx. 500m). It is noted that this site is at the edge of the model and the model has a much smaller impermeable area feeding into it from this site than Arup have measured independently. When Arup introduced the actual impermeable area, with a 30% reduction, then the flooding occurred. Therefore the sewer size increase is still recommended.	Flooding found on nearest SW sewer, therefore upsize nearest SW sewer from 225Ø to 375Ø from the site down to river (approx. 500m)	SW - Rainscape has been considered, but the distance to the river is relatively short and the upstream catchment is relatively small small (it is at the head of the system) however, some street planters in adjacent roads could releave the capacity issues.	Yes
H31	H31 Eastfield Lane, Dunnington	FW, ok SW check capacity of sewer to convey flows to local river	84	more than 50 meters from nearest watercourse	Yes	No	Yes	Greenfield	x	11.3	0.4	3.1	Connection to 150 dia foul sewer	Looking at the site it appears to be informal development that is currently on the site, with the exception of 1 private house. Therefore it is likely that no formal connection to sewer exists and the site will be judged to be greenfield. Therefore, connect greenfield runoff to 300 dia Surface sewer sewer. Downstream sewer sizes are significant so should not pose a problem.	As described left	N/A	No
H46	H46 Land to North of Willow Bank and East of Haxby Rd, New Ears	FW - Haxby Road PS, New Earswick - ok SW - into Foss	104	more than 50 meters from nearest watercourse but laid adjacent to existing YW rising main	Yes	No	Yes	Greenfield	x	27.8	0.5	3.8	Connection to 150 dia foul sewer	New 225Ø sewer to river (100 meter sewer from the edge of the site). Sharing the easement with the existing rising main)	As described left	Connecting SW to "rising main" (Gary Collins advised it is likely to be gravity by this point) discharging to river - not recommended.	No
H5	H5 Lowfield School	OK both FW and SW	137	more than 50 meters from nearest watercourse	Yes	No	Yes	Brownfield	191	x	0.6	5.0	Developer to connect their sewer to existing 450 dia combined sewer that passes through the site	Existing runoff to be reduced by 30 %. New development's connection point to replicate existing site's sewer connection point. This is unclear, therefore new 525Ø connection to existing 600 dia Surface sewer sewer across adjacent green area.	As described left	N/A	No
H56	H56 Land at Hull Road (Former site E15)	FW OK SW sewers ok, except when Tang Hall Beck is high/flooding.	190	more than 50 meters from nearest SW sewer	Yes	Yes	Yes	Greenfield	x	18.7	0.9	6.9	Connect to nearest 225Ø combined sewer. Downstream, adjacent to the beck, the model predicts flooding in baseline scenario as well as after adding developments (in this case the flooding increased by about 7 %). Proposed solution (to be modelled) will be attenuating surface water from a recent upstream development draining to the combined sewer. The solution will require increasing the restiction on the hydrobrake currently installed there - by decresing allowed flow passing to the system to 8 l/s from 10 l/s. The hydrobrake is in Sails Drive.	Green field runoff calculated using ICP SUDS method feeding to the nearest 225Ø surface water sewer. Modelled as ok.	As described left	N/A	Yes
H57	H57 Poppleton Garden Centre (former site E16)	SW - The adjacent park and ride site had to deal with repairing/replacing a culvert. YW are not responsible for the SW here so hence no sewers. However, the current site (garden centre) is drained so the site should have a method for SW drainage.	93	more than 50 meters from nearest watercourse	No	No	Yes	Brownfield	170.5	x	0.4	3.4	Connection to existing 150 dia foul sewer	Developer to make connection to existing developed site's SW drainage point (suspected to be local field drains). This is in line with how the recent park and ride development drained it's SW. YW has no SW drainage in this area.	As described left	N/A	No
H7	H7 Bootham Crescent	OK both FW and SW	86	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	96	x	0.4	3.1	Developer to connect their sewer to existing 225Ø foul sewer that passes through site	Existing runoff to be reduced by 30 %. Connect to the existing 480Ø surface water sewer to the south of the site in Grosvenor Road, which has been modelled as acceptable. This is instead of maintaining the suspected existing SW connection from the site to the north, as shown in the model.	As described left	N/A	Yes
H8	H8 Askham Bar Park and Ride	OK both FW and SW	60	more than 50 meters from nearest watercourse/next to the Pond	Yes	No	Yes	Brownfield	161	x	0.3	2.2	Connection to 900 dia combine sewer running across site	Existing runoff to be reduced by 30 %. New development's connection point to replicate existing site's sewer connection point into SW sewers that cross the site (It is unclear exactly which sewers are currently used but it is suspected to be the 300 dia Surface water sewer running north west into adjacent culverted watercourse.	As described left	N/A	No
ST1	ST1 British Sugar	OK both FW and SW FW check for interaction with York Flood Defence Pumps.	1140	less than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	1992.5	x	5.7	41.9	Connect to nearest 450Ø combined sewer with 225Ø connection. It is worth noting that downstream, adjacent to the river, some flooding has been observed when the river is very high. However, the YW Flood Defence Pumps are activated during this sort of event and interaction is complex. Awaiting further information from YW. No additional flooding occurs when river levels are normal.	Existing runoff to be reduced by 30 %. New development's connection point to replicate existing site's suspected sewer connection point into 1800 dia. SW sewer that cross the site in the south east. SW sewer not in model, however capacity is not considered an issue with the 30% reduction applied.	As described left	N/A	Only foul
ST14	ST14 Land to West of Wigginton Road	SW - keep SW from development away from Westfield Beck as it has known flooding issues and is pollitically sensitive to Haxby residents. FW - Rawcliffe WwTW has issues with odours. Arup to check with process. Gary to check how Rawcliffe might cope with the extra flows.	1348	Through the site/on the edge	No	No	No	Greenfield	x	255.6	6.6	49.4	New pump station at low point in the site and new rising main to Rawcliffe WwTW.	Development to discharge surface water to adjacent ditch on eastern boundary at greenfield runoff rates	As described left	It may be possible to tap new foul rising main into existing 350 dia foul rising main to south that runs along the A1237. This would reduce the length of new rising needed by over half. However not recommended in this study as it would require more detailed investigations of the the existing rising main undertaken during a more detailed study.	No

Site Ref in SHELAA	Site	Gary Collins Comments	No of Units	Next to river/surface sewer	Surface Water sewer Near by	Covered by model	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Formula A (l/s)	Foul solution	Surface water solution	Proposed Solution for Costing	Alternate Solutions considered but not costed (Talk about options and level of confidence in options)	Modelled
ST15	ST15: Land to west of Elvington Lane	He is happy with the proposals for the FW and SW discussed. Elvington has river flooding so avoid SW flows going there.	3339	Through the site/on the edge	No	No	No	Greenfield	x	686.7	15.6	121.6	New pump station at low point in the site and new rising main to Naburn WwTW. This is if a new WwTW for this development is not undertaken. New WwTW also considered.	Development to discharge surface water to adjacent ditches on various boundaries at greenfield runoff rates	As described left	It may be possible to tap new foul rising main into existing 450 dia foul rising main to north that runs along the A64. This would reduce the length of new rising needed by approximately two thirds. However not recommended here as would require more detailed investigations of the the rising main undertaken during a more detailed study.	No
ST16	ST16 Terrys (Extension Sites 1&2)	OK both FW and SW	89	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	124	x	0.3	2.0	Connect to nearest 225Ø foul sewer with 150 new connection. FW sewer in model and can cope with the development.	Existing runoff to be reduced by 30 % at least, however the site may be classed as greenfield now so an even greater reduction in flow rates may be applied. New development's connection point could replicate existing site's suspected sewer connection point into 300 dia. SW sewer along Bishopthorpe Road to the north east. SW sewer not in model, however capacity could be an issue as brownfield rates likely to be 122l/s even with the 30% reduction applied, where as the sewer capacity may only be 64l/s. Therefore, unless greenfield rates can be imposed with confidence a new 450Ø sewer down to the river, along an existing field boundary, is recommended and this could serve future development to the south and south east.	New 450Ø SW sewer down to the river. Foul as described left.	N/A	Only foul
ST17	ST17 Nestle South	OK both FW and SW	315	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Brownfield	107	x	1.3	11.6	Developer to connect their sewer to existing 300Ø combined sewer that is on the north eastern corner of the site	Two potential scenarios: 1st, best case for YW is existing runoff is reduced by 30 % from existing impermeable site of just 1 remaining building connected to the surface water sewer to the north eastern corner of the site. 2nd: Worst case for YW, developer may successfully argue that the runoff should be reduced by 30% from previous site's use (site in 2002 was covered by Nestle factory) directed to the same SW sewer. For both sites we suggest connecting to the 525Ø SW sewer just off the site and undertaking some extensive silt removal downstream.	As described left	As described left	Yes
ST2	ST2 Civil Service Sports Ground	Portal Road and Trenchard Roads both suffer from SW flooding as field drains connect in upstream. Upsizing Borough Bridge Road sewer should improve this flooding.	292	more than 50 meters from nearest watercourse	Yes	No	Yes	Greenfield	x	52.7	1.2	10.8	Connection to 300 dia foul sewer. Minor increase in flows to Pump Station downstream should not cause issue	Tricky site with poor access to river. Approx. 33.84 l/s greenfield rate could cause problems to sewer as it is at the head of the sewer. No model in this area. Request a lower green field flow rate, but this is not guaranteed. Options are: New 300Ø SW sewer to existing 375Ø sewer in Low Poppleton Lane which is to be upsized to 450Ø down to Borough Bridge Road. Plus Then either Upsize 600 and 750Ø sewer in Borough Bridge Road for 1Km to outfall into watercourse. This road is a main artery road. or Use upstream field drains at end of Portal Road to attenuate some flows to accommodate new development and reduce local flooding.	FW as described left New 300Ø SW sewer to existing 375Ø sewer in Low Poppleton Lane which is to be upsized to 450Ø down to Borough Bridge Road. Plus Use upstream field drains at end of Portal Road to attenuate some flows to accommodate new development and reduce local flooding. WOuld require 500m of ditches increasing in size and a flow control installing on the downstream connection to the SW sewer.	High confidence - Upsize the 600 and 750Ø sewer in Borough Bridge Road for 1Km to outfall into watercourse. This road is a main artery road.	No
ST31	ST31 Land South of Tadcaster Rd, Copmanthorpe	OK both FW and SW The Foul flows generated by this site should not affect the overloading that that has been seen at the Sawyer's Crescent Pump Station	170	Through the site/on the edge	Yes	No	Yes	Greenfield	x	38.9	0.8	6.2	New PS from low point of development site and new rising main, along track and Ploughman's Close to existing sewer on junction of Farmers Way	Development to discharge surface water to adjacent ditch on southern boundary at greenfield runoff rates	As described left	Various routes that could be taken by the Foul rising main.	No
ST32	ST32 Hungate (Phases 5+)	OK both FW and SW	305	Through the site/on the edge	Yes	Yes	Yes	Brownfield	173	x	1.4	11.1	Connection to existing combined or foul sewers running across site	Existing runoff to be reduced by 30 %. New development's connection point to replicate existing site's suspected sewer connection point into surface water sewers within site. Where a plot boarders the river then the development should discharge directly to the river.	As described left	N/A	Yes
ST33	ST33 Station Yard, Wheldrake (Previously included as a non strateg	SW Fine. FW, the local Courtney's PS is unreliable (due to operational issues and not capacity issues) aside from this it should be able to cope with the increased flows this development will send to it.	147	Through the site/on the edge	Yes	No	Yes	Greenfield	x	27.2	0.6	5.4	Connection to 150 dia foul sewer within the site	Development to discharge surface water to adjacent ditch on eastern boundary at greenfield runoff rates. Other YW SW sewers also discharge to the same ditch	As described left	N/A	No
ST4	ST4 Land adj Hull Road	SW check capacity of local sewer. Once at detention basin then fine. FW, Field Lane PS, Gary to check operation, should be ok to take DWF.	211	more than 50 meters from nearest watercourse	Yes	Yes	Yes	Greenfield	x	34.2	1.0	7.7	Connection to nearest foul sewer sewer with dia 150 sewer coming from new development. Existing Foul sewer is deep in this location hence gravity connection is possible - necessary to upgrade size of pump station to 13l/s from 10l/s	Connection to surface water sewer dia 300, not modelled - sewer not in the model - likely to capacity issues. 22l/s approx. greenfield run-off into head of a system, 300Ø with capacity of 64l/s (estimated) could cause an issue. Downstream into large basin fine but potentially >500m upsizing may be needed. Request a lower green field flow rate, but this is not guaranteed. In addition site levels will mean that it is going to struggle to accept gravity flows into existing sewer, which is suspected to be relatively shallow, with best information available, Therefore, upsize downstream sewer to 375Ø (to increase capacity) and lower by 1 m to approx. 3m deep until it reaches the deeper 900Ø downstream sewer (to assist gravity flows).	FW as described left. Upsize downstream sewer to 375Ø (to increase capacity) and lower by 1 m to approx. 3m deep until it reaches the 900Ø downstream sewer.	Low confidence (due to in ability to enforce) - Force the development to drain their site across the surface (like the University campus next door) and provide a swale or ditch, passing shallow beneath the road, to connect into the SW sewer at it's existing depth. The swale can be used to attenuate flows further to avoid the need to upsize sewers downstream. Low confidence - SW Pumping station to then feed into existing SW sewer. Large energy and storage costs needed would rule this out.	Only foul
ST5	ST5 York Central	Check if the York Flood Defence Pumps operating won't cause problems. Subject to the above. SW out falling into 3 existing SW sewers should be fine. FW should be ok.	1500	Through the site/on the edge	Yes	Yes	Yes	Brownfield	8210	x	7.0	54.6	Development to connect foul to existing combined sewers crossing the site (proportion of site to north to existing 300 dia and majority of site to southern 675 dia). There may be some interaction with the YW York Flood Defence Pumps operating, still awaiting details from YW.	Existing hard standing runoff to be reduced by 30 % and discharged to the nearest of 4No. existing SW sewers/culverted watercourses that cross the site and discharge to the river. For the west and south west, discharge to the culverted watercourse of Holgate Beck. To the north boundary with the river, there are 3No. SW sewer outfalls (400 dia, 540 height and 730) that could be used to drain the site. Install 1 extra large crossing beneath the railway to the river. The boundary of the site also includes the river front so the development could install their own connections as well. The Holgate Beck and the 400dia are not within the model also, the likely SW discharge points for the development are not known, so exact splits of SW drainage was not able to be modelled.	FW, As described left. SW, addition of a new 900Ø sewer under the railway and to the river to provide extra capacity to the main part of the site and avoid being land locked by the railway.	N/A	Only foul

Site Ref in SHELAA	Site	Gary Collins Comments	No of Units	Next to river/surface sewer	Surface Water sewer Near by	Covered by model	Covered by Odyssey	Brown/Green Field	Brownfield surface water runoff (l/s) at 50 mm/hr intensity	Greenfield surface water runoff (l/s) with ICP SUDs method	Foul water DWF (l/s)	Formula A (l/s)	Foul solution	Surface water solution	Proposed Solution for Costing	Alternate Solutions considered but not costed (Talk about options and level of confidence in options)	Modelled
ST7	ST7 Land East of Metcalfe Lane	FW - Pump site to Murton Way PS, however need to check (modelling) if the PS needs upsizing to cope with the extra flows as he suspects it may be on the limit. SW - to field drains?	845	Through the site/on the edge	No	No	Yes	Greenfield	x	162.8	3.8	30.6	New pump station and rising main to Murton Way pump station and upsizing of Murton Way PS to accept new flows as YW advised it is suspected to be on the limit of capacity.	Development to discharge surface water to adjacent watercourse on northern boundary and/or ditch on western boundary at greenfield runoff rates	As described left	Option considered to take foul flows north, across river to nearest gravity sewers. However capacity of gravity sewer would be an issue here plus all flows are then pumped to Murton Way PS anyway, so no major benefit. It may be possible to tap new foul rising main into existing 300 dia foul rising main that passes the site to the west. This would reduce the length of new rising needed by approximately half. However not recommended here as would require more detailed investigations of the the rising main undertaken during a more detailed study.	No
ST8	ST8 Land North of Monks Cross	FW, no issues SW - YW has no records of how the drainage system, and ponds in particular have been designed. No YW maintenance has been performed on these.	968	more than 50 meters from nearest watercourse (However small watercourse needs to be verified than on the edge of watercourse)	Yes	Yes	Yes	Greenfield	x	182.4	4.4	35.1	Connect new 150 dia foul sewer to nearest foul pump station including upsizing existing pump station to 18 l/s and increasing the emergency storage volume at the station. Rising main may also require upsizing.	Discharge the development at greenfield rates and connect new 450 dia SW sewer from low point on development to 1000 dia existing SW sewer just upstream and draining into existing YW pond. It is worth noting that YW has no records of how the existing drainage system, and ponds in particular have been designed. No maintenance has been performed on these. There may be need to increase the size of the pond slightly, however this was not necessary when modelled so has not been costed.	As described left	Considered connecting to nearest SW sewer manhole to the boundary, however this would restrict the development using the south eastern cornerdue to topography, therefore discounted. Field drains do exist but this assessment considered them potentially too small for this size of development. More detailed investigations may find it possible to use them.	Yes
ST9	ST9 Land North of Haxby	FW - It appears that FW flows will go to Landing Lane PS which has capacity. Avoid any flows going to Old Orchard PS as this is already at capacity SW ok	735	Through the site/on the edge	Yes	No	Yes	Greenfield	x	161.4	3.3	26.7	New pump station at low point of development and rising main to existing 300 dia sewer at junction of Usher Park Road and Swarthdale.	Development to discharge surface water to adjacent ditches on various boundaries at greenfield runoff rates	As described left		No

Part of Appendix 8l:
vii. Cost Adjustment Claim Research - Redacted Report
Author: Qa Research

YorkshireWater

Cost Adjustment Claims Research Report

For Yorkshire Water

27 April 2018

RESEARCH

MRS Awards 2016
Highly Commended
Public Policy/
Social Research

MRS Operations Awards 2016
Finalist
Best Data Collection
(face-to-face)

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MARKET RESEARCH SERVICES ISO 20252 Cert No. 0475

UKAS PRODUCT CERTIFICATION 036

Contents

Project number:	SKILL02-8098
Title:	Cost Adjustment Claims
Location:	S:\ProjectFiles\Y\Yorkshire_Water\SKILL02-8098_Cost_Adjustment_Claims_2018\Reports\YW_Cost_Adjustment_Claims_Research_2018_Full_Report_V1f.doc
Date:	April 27 2018
Report status:	Draft
Approved by:	Nick Lynch
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This research has been carried out in compliance with the International standard ISO 20252, (the International Standard for Market and Social research), The Market Research Society's Code of Conduct and UK Data Protection law

RESEARCH

Table of figures

1. Introduction

This report reveals the key findings of a study undertaken with Yorkshire Water's domestic customers conducted by Qa Research.

The study focused on the level of priority that customer's gave towards 7 Cost Adjustment Claims (CACs) that Yorkshire Water is considering re-submitting to the water industry regulator, Ofwat.

The outcomes of the research will enable Yorkshire Water to consider a final set of CACs that will then be re-submitted to Ofwat as part of its final draft of its 5 year Business Plan 2020-2025.

The research was conducted using a combination of quantitative and qualitative research methods with customers throughout the region.

The quantitative research provided a statistical assessment of the levels of priority that customers gave to each claim and ranked them in order of importance.

The qualitative research provided insight in to customers' attitudes to each of the 7 claims and the reasons why they did or did not support each claim.

2. Aims and objectives

The overall aim of the research was to:

'Identify the level of support customers have for cost adjustment claims proposed by Yorkshire Water and the timeframe they would prefer to pay for these and the bill as a whole.'

We believe that the specific research objectives were to:

- Gauge customers understanding of cost adjustment claims and the extent to which they support the rationale for YW's making these claims
- Reveal customers level of support for each of the claims being put forward, specifically
    - Reasoning for supporting/not supporting a claim and drivers behind this
    - Which of the claims customers prioritise over others and why
    - How opinions towards each claim may change once impact on bills are known
- Investigate factors that may make customers any more likely to support claims
- Assess when customers would like to pay for cost adjustment claims
- Explore the timeframe in which customers would like to pay: at the time of receiving service improvements, spread over a period of time or costs put back in to the future.

3. Methodology

A mixed method of quantitative and qualitative research was applied to the project. In this section we detail the approach used within each of these methodologies.

3.1 Quantitative research

An online survey was carried out with a sample of 1,000 Yorkshire Water customers via a commercial access panel. All respondents were bill payers (either jointly or solely) and to ensure the sample was representative, quotas were set of age, gender, region and presence of water meter in the home. Interviews were completed between Friday 6 April and Monday 16 April 2018.

The survey mainly consisted of two MaxDiff trade-off models which were used to determine the level of support for each of the 7 Cost Adjustment Claims. The first version of the model (Model A) included a description of the reasons for each claim, the benefit it would bring and the overall level of investment required. This model was then repeated, but the second time round each Claim included details of the associated cost increase to an average household bill.

Findings from both models were then analysed to determine the level of support respondents had for each Cost Adjustment Claim (both before and after the bill impact was included) and this analysis is outlined below.

3.2 Qualitative research

The qualitative research included two core methodological approaches, focus groups with domestic customers and in-depth interviews specifically with vulnerable domestic customers.

Focus groups

We conducted a total of 7 focus groups with domestic customers across the region. The segments recruited and locations covered were as follows:

Figure 1. Summary of focus group sample

Group	Region	Type	Location	Lifestage	SEG
1	North	Rural	Ripon	Family	ABC1
2	North	Rural	Ripon	Older	ABC1
3	East	City	Hull	Future Bill Payers	ABC1
4	East	City	Hull	Older	C2DE
5	West	Town	Bradford	Pre Family	C2DE
6	West	Town	Bradford	Family	C2DE
7	South	Town	Barnsley	Pre Family	C2DE

Respondents were recruited free find by specialist recruiters in each locality.

Group participants each received £50 cash incentive for taking part.
Sessions were audio recorded with permission from respondents and lasted 2 hours each.

The moderator used a discussion guide that had been developed in conjunction with Yorkshire Water. To enable participants to understand each Cost Adjustment Claim the moderator provided a series of showcards with each claim fully described allowing respondents to debate their views towards them.

The showcards also included a range of bill phasing scenarios to enable customers to decide which of them they preferred.

In-depth interviews

Qa conducted 12 in-depth face-to-face interviews in the homes of vulnerable customers.

Customers were recruited to interview according to vulnerability criteria provided by Yorkshire Water. The table below reveals how each of the 12 interviews were split according to location and vulnerability category:

Figure 2. Summary of depth interview sample

Interview	Region	Location	Type
1	North	York	75+
2	North	York	Disability/health
3	North	York	Income/benefit/bill issues
4	East	Hull	75+
5	East	Hull	Disability/health
6	East	Hull	Income/benefit/bill issues
7	West	Leeds	75+
8	West	Leeds	Disability/health
9	West	Leeds	Income/benefit/bill issues
10	South	Sheffield	75+
11	South	Sheffield	Disability/health
12	South	Sheffield	Income/benefit/bill issues

Respondents were recruited free find by specialist recruiters in each locality. Interview participants each received £50 cash incentive for taking part.

Sessions were audio recorded with permission from respondents and each lasted approximately 1 hour.

The interviewer used an interview script that was adapted from the focus group discussion guide and developed in conjunction with Yorkshire Water. Participants were also shown the same set of showcards that were used within the focus groups to enable them to understand each CAC and bill phasing scenarios.

4. Key findings

4.1 Quantitative research findings

4.1.1 Model A (Excluding Bill Impact) – Total Sample

The first MaxDiff model respondents were asked to complete included details of the overall investment that Yorkshire Water would need to make for each Cost Adjustment Claim, but it did not include details of the impact on customer bills.

Essentially, customers were being asked to make choices about which of the investments they supported based on the benefit that investment would bring and the overall cost to Yorkshire Water, but without any indication of the level of additional contribution the average household customer would need to make to support the investment.

Respondents were shown the 7 Cost Adjustment Claims in groups of 3 and from each group they were asked to simply choose the one they *supported most* and the one they *supported least*. For this model, they were asked to give their views on 7 different groups of 3. By controlling exactly which Claims are included in each group of 3 and which respondents see which group, we can build up a picture of how much support there is for each one.

From responses, levels of support are calculated and to make interpretation easier a % Share of Support figure is calculated as a proportion of 100%. The % Share of Support score also tells us how much more/less support one of the Cost Adjustments Claims has than the others.

The table below outlines the findings from *Model A (Excluding bill impact)* amongst all respondents[1];

Figure 3. Model A (Excluding bill impact) Share of Support

	Model A (Excluding bill impact)	
	% Share of Support	Rank
Maintaining Drinking Water Quality	29.4%	1
Reducing Water Lost Through Leaks	23.7%	2
Improving River Water Quality	16.3%	3
Reducing Flood Risk in Hull	10.5%	4
Infrastructure for New Towns	7.8%	5
Reducing Cellar Sewer Flooding	7.6%	6
New Customer Management System	4.6%	7
Base: All respondents - clean (938)		

[1] *The data is actually based on a 'clean' sample of respondents, rather than all 1,000 respondents who completed the survey. This is because when we model the data, we get a model fit score that tells us how well the model can predict each respondent's answers. A low fit score suggests that a respondent didn't give meaningful answers/responded randomly. These respondents have been removed from the MaxDiff analysis and interpretation has been carried out on the 'clean' sample only.*

The previous table indicates that between them, 2 Claims have more than 50% of the % Share of Support and these are;

- **Maintaining Drinking Water Quality** – 29.4% Share of Support
- **Reducing Water Lost Through Leaks** – 23.7% Share of Support.

In simple terms, these are the most well supported Cost Adjustment Claims.

Additionally, the data also tell us that with a % Share of Support of 29.4%, there is almost twice as much support for Maintaining Drinking Water Quality than there is for the third most well supported Claim, which is **Improving River Water Quality** (with a 16.1% Share of Support) and three times as much support as the fourth most well support one, which is **Reducing Flood Risk in Hull** (with a 10.5% Share of Support).

At the other end of the scale, the least well supported is the **New Customer Management System**, with only a 4.6% Share of Support, and comparatively low levels were also recorded for **Infrastructure for New Towns** (7.8%) and **Reducing Cellar Sewer Flooding** (7.6%).

Another way to analyse the data is to examine the proportion of respondents that have each Claim in their *Top 2* or *Bottom 2*, based on their MaxDiff scores. These metrics are interesting because they show us how polarising an investment is, whereas the % Share of Support score does not. A summary of this data is below;

Figure 4. Model A (Excluding bill impact) – Top 2/Bottom 2 CACs

	Model A (Excluding bill impact)	
	% of Respondents including in their Top 2	% of Respondents including in their Bottom 2
Maintaining Drinking Water Quality	79.3%	1.7%
Reducing Water Lost Through Leaks	52.7%	8.3%
Improving River Water Quality	26.2%	17.9%
Reducing Flood Risk in Hull	16.3%	31.0%
Infrastructure for New Towns	10.3%	38.7%
Reducing Cellar Sewer Flooding	8.3%	37.5%
New Customer Management System	6.8%	64.8%
Base: All respondents - clean (938)		

Supporting the % Share of Support scores, we can see that more than half the sample made choices that put **Maintaining Drinking Water Quality** and **Reducing Water Lost Through Leaks** in their Top 2.

In particular, support for Maintaining Drinking Water Quality is very strong, as this was in the Top 2 for 79.3% of all respondents and in the Bottom 2 for only 1.7%.

Similarly, the findings reinforce levels of support for Reducing Water Lost Through Leaks (52.7% had this in their Top 2 and 8.3% in their Bottom 2).

Consequently, these findings reinforce that customers are most likely to support the Cost Adjustment Claim for Maintaining Drinking Water Quality and Reducing Water Lost Through Leaks.

The data also highlight that **Improving River Water Quality** (which had the third highest % Share of Support at 16.1%) is quite polarising, with differences of opinion evident amongst respondents. Specifically, 26.2% had this Claim in their Top 2, but 17.9% had it in their Bottom 2. As a result, the case for this Claim is less clear cut, as contrasting views clearly exist amongst household customers.

The other 4 Cost Adjustment Claims all had a % Share of Support of c.10% or less and this is reinforced by the findings in the table above, with respondents more likely to have each one in the Bottom 2 than there Top 2.

In particular, a **New Customer Management System** was in the Bottom 2 for the majority of respondents (64.8%), further confirming that there is limited support for this when compared with the 6 other Cost Adjustment Claims.

4.1.2 Model A (Excluding Bill Impact) – Key Sub-Groups

This section explores Model A amongst key-groups.

The % Share of Support amongst different age groups is detailed below;

Figure 5. Model A (Excluding bill impact) Share of Support – by age

	Model A (Excluding bill impact)			
	Total Sample	Aged 18-44	Aged 45-64	Aged 65+
	% share of support			
Maintaining Drinking Water Quality	29.4%	28.3%	29.5%	30.6%
Reducing Water Lost Through Leaks	23.7%	21.8%	24.2%	25.3%
Improving River Water Quality	16.3%	17.2%	16.9%	14.6%
Reducing Flood Risk in Hull	10.5%	10.7%	10.3%	10.6%
Infrastructure for New Towns	7.8%	8.8%	7.3%	7.4%
Reducing Cellar Sewer Flooding	7.6%	8.2%	6.9%	7.9%
New Customer Management System	4.6%	5.1%	5.0%	3.5%
Base: All respondents - clean	**938**	**305**	**351**	**273**

As shown above, there was little variation between age groups regarding the Cost Adjustment Claims that recorded the highest levels of support.

Specifically, between them **Maintaining Drinking Water Quality** and **Reducing Water Lost Through Leaks** had more than 50% of the Share of Support amongst each group, while **Improving River Water Quality** had the third highest level of support and **Reducing Flood Risk** in Hull the fourth highest.

That said, older respondents were slightly more likely to support Reducing Water Lost Through Leaks (with a 21.8% Share of Support amongst 16-44 year olds and a 25.3% Share Amongst those aged 65+), while Improving River Water Quality was supported slightly more by those aged 16-44.

One other area to highlight here is at the bottom of the ranking. Although, a **New Customer Management System** is the least supported Cost Adjustment Claim amongst each age group, support was higher amongst those aged 16-44 (5.1%) or 45-64 (5.0%) than those aged 65+ (3.5%).

The table below outlines the % Share of Support amongst respondents living in the 4 Yorkshire Water regions;

Figure 6. Model A (Excluding bill impact) Share of Support – by Region

	Model A (Excluding bill impact)				
	Total Sample	North	East	South	West
	% share of support				
Maintaining Drinking Water Quality	29.4%	30.2%	27.3%	30.1%	29.3%
Reducing Water Lost Through Leaks	23.7%	24.4%	22.8%	23.8%	23.7%
Improving River Water Quality	16.3%	17.8%	14.3%	15.8%	16.6%
Reducing Flood Risk in Hull	10.5%	8.7%	18.0%	9.3%	9.9%
Infrastructure for New Towns	7.8%	8.3%	6.4%	8.8%	7.4%
Reducing Cellar Sewer Flooding	7.6%	7.2%	6.0%	7.0%	8.6%
New Customer Management System	4.6%	3.5%	5.4%	5.2%	4.4%
Base: All respondents - clean	**938**	**152**	**111**	**252**	**414**

With one exception, respondents in each Region answered in a very similar way, resulting in similar ranking of the 7 Cost Adjustment Claims and a broadly similar % Share of Support for each.

The one exception was amongst respondents in the East, who had Improving **Reducing Flood Risk in Hull** ranked third with a % Share of Support of 18%.

In fact, compared with respondents in the other regions, those in the East were almost twice as likely to support this claim. Given that the East region comprises respondents living in the local authority areas of Hull and East Yorkshire it's perhaps not surprising that they place more emphasis on the situation in Hull.

In line with this, 38.7% of respondents in the East Region had Reducing Flood Risk in Hull as one of their Top 2 most supported claims – in the other 3 regions around a third of respondents had it as one of their Bottom 2.

4.1.3 Model B (Including Bill Impact) – Total Sample

To evaluate the impact of the likely increase in bills associated with each Cost Adjustment Claim, a second model was undertaken (Model B). It mirrored Model A in every way except that a short description was included which outlined the increase to the average household bill. By replicating the original exercise but introducing bill impact, the effect of bill increases on support for each Claim can be determined.

The table below shows the % Share of Support for each Cost Adjustment Claim for Model A (the same figures as shown in Section 5.1.1); alongside these, are the equivalent figures for Model B along with an indication of which direction the % Share of Support has gone as a result of the introduction of the bill impact;

Figure 7. Model B (Including bill impact) – comparison with Model A

	Model A (Excluding bill impact)		Model B (Including bill impact)		% Share of Support - direction of travel
	% Share of Support	Rank	% Share of Support	Rank	
Maintaining Drinking Water Quality	29.4%	1	29.9%	1	
Reducing Water Lost Through Leaks	23.7%	2	17.9%	2	
Improving River Water Quality	16.3%	3	*Removed from Report*		
Reducing Flood Risk in Hull	10.5%	4	13.6%	3	
Infrastructure for New Towns	7.8%	5	9.9%	4	
Reducing Cellar Sewer Flooding	7.6%	6	6.1%	6	
New Customer Management System	4.6%	7	6.4%	5	
Base: All respondents - clean (938)					

As a reminder; the following bill impacts were included in Model B;

- £1.20 a year (10p a month) - Maintaining Drinking Water Quality
- £24.40 a year (£2.03 a month) - Reducing Water Lost Through Leaks
- 40p a year (3p a month) - Reducing Flood Risk in Hull
- 80p a year (7p a month) - Infrastructure for New Towns
- £12.20 a year (£1.02 a month) - Reducing Cellar Sewer Flooding
- £1.20 a year 10p a month - New Customer management System.

What's most obvious from a comparison of Model A and Model B is that introducing the bill impact has a minimum impact of the % Share of Support overall. The top 4 ranked Cost Adjustment Claims in Model A remain the top 4 in Model B, with only the two least supported swapping round.

However, some small differences are apparent. It's notable that support for **Maintaining Drinking Water Quality** actually increases slightly (from 29.4% to 29.9% Share of Support), perhaps reflecting the fact that the impact on bills for this Claim is comparatively low.

Support also increases for **Reducing Flood Risk in Hull** (from 10.5% to 13.6%); this is the Claim with the lowest bill impact and it's evident that it becomes easier for customers to support this Claim once the financial implications of doing so are made clear.

Additionally, 2 of the other 4 Claims that recorded the lowest % Share of Support in Model A also recorded slight increases in the % Share of Support in Model B and in both instances these were ones with a comparatively low likely increase in the average household bill;

- **Infrastructure for New Towns** - (from 7.8% to 9.9%)
- **New Customer Management System** - (from 4.6% to 6.4%).

In contrast, once bill impact was introduced support declined for the 3 Claims that had the highest associated bill impact. In particular, while **Reducing Water Lost Through Leaks** remained the second most well support claim, it's % Share of Support declined from 23.7% to 17.9%, indicating that £24.40 a year (£2.03 a month) to *'Reduce Water Lost Through Leaks by a further 40%'* makes this claim more difficult to support for some customers.

Similarly, support declined slightly for **Reducing Cellar Sewer Flooding** (from 7.6% to 6.1%).

Repeating the analysis undertaken for Model A, the table below shows the proportion of respondents who had each Cost Adjustment Claim in the their Top 2 or Bottom 2 for Model B and compares this to Model A;

Figure 8. Model B (Including bill impact) – Top 2/Bottom 2 CACs

	% of Respondents including in their Top 2		% of Respondents including in their Bottom 2	
	Model A	**Model B**	**Model A**	**Model B**
Maintaining Drinking Water Quality	79.3%	79.6%	1.7%	1.2%
Reducing Water Lost Through Leaks	52.7%	37.3%	8.3%	22.2%
Reducing Flood Risk in Hull	16.3%	25.5%	31.0%	24.2%
Infrastructure for New Towns	10.3%	17.2%	38.7%	34.3%
Reducing Cellar Sewer Flooding	8.3%	6.3%	37.5%	46.9%
New Customer Management System	6.8%	8.3%	64.8%	57.5%
Base: All respondents - clean (938)				

This analysis is informative, as it tells us a little more about the impact of additional bill costs on each Claim. It tells us that introducing the bill impact for **Maintaining Drinking Water Quality** makes no difference to the degree of support – 79.6% have this in the Top 2 for Model B.

It also demonstrates that the introduction of the bill impact to the second most well supported Claim (**Reducing Water Lost Through Leaks**) has a polarising effect. Specifically, in Model A (which excluded the bill impact) 52.7% had this in their Top 2 and 8.3% in their Bottom 2, but introducing the bill impact at Model B results in 37.3% having this in their Top 2 and 22.2% having it in their Bottom 2.

Essentially, respondents become less supportive of this claim once bill impact is introduced because some consider the increase per year to be unacceptable (which at £24.40 a year is the highest amount for any Claim).

In contrast, the introduction of bill impact for **Reducing Flood Risk in Hull** has a positive impact on support, which is likely to reflect the fact that the increase to the average annual household bill is lower for this Claim than any other. Specifically, in Model A 16.3% had this in their Top 2, but this proportion increased to 25.5% in Model B.

The data also highlight that when it's explained to respondents that **Reducing Cellar Sewer Flooding** would mean an increase to the average household bill of £12.20 per household per year (or £1.02 per month) this serves to reduce levels of support overall because more respondents have this Claim in their Bottom 2 (46.9% in Model B compared with 37.5% in Model A).

For the other Claims, this data confirms that the introduction of bill impact makes only a small difference to the choices that respondents made in the MaxDiff model.

4.1.4 Model B (Including Bill Impact) – Key Sub-Groups

This section highlights the result of introducing bill impact into the model (Model B) on responses amongst key sub-groups. The table below shows a comparison of the % Share of Support amongst different age groups from Model A and Model B;

Figure 9. Model B (Including bill impact) Share of Support – by age

	Total Sample		Aged 18-44		Aged 45-64		Aged 65+	
	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
	% Share of Support							
Maintaining Drinking Water Quality	29.4%	29.9%	28.3%	29.1%	29.5%	30.1%	30.6%	30.8%
Reducing Water Lost Through Leaks	23.7%	17.9%	21.8%	15.2%	24.2%	17.7%	25.3%	21.3%
Reducing Flood Risk in Hull	10.5%	13.6%	10.7%	14.4%	10.3%	13.7%	10.6%	12.7%
Infrastructure for New Towns	7.8%	9.9%	8.8%	10.9%	7.3%	10.0%	7.4%	8.7%
Reducing Cellar Sewer Flooding	7.6%	6.1%	8.2%	6.4%	6.9%	5.5%	7.9%	6.3%
New Customer Management System	4.6%	6.4%	5.1%	7.2%	5.0%	7.0%	3.5%	4.8%
Base: All respondents - clean	**938**		**305**		**351**		**273**	

Introducing bill impact into the MaxDiff model has the similar impact amongst each age group as it does amongst the total sample.

Essentially, the % Share of Support increases slightly for **Maintining Drinking Water Quality**, while support also increases for **Reducing Flood Risk in Hull**, **Infrastructure for New Towns** and a **New Customer Management System**. However, it declines for **Reducing Water Lost Through Leaks**.

The table below compares the % Share of Support for Model A and Model B amongst respondents living in each Region;

Figure 10. Model B (Including bill impact) Share of Support – by Region

	Total Sample		North		East		South		West	
	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B
	% Share of Support									
Maintaining Drinking Water Quality	29.4%	29.9%	30.2%	30.9%	27.3%	29.0%	30.1%	30.6%	29.3%	29.5%
Reducing Water Lost Through Leaks	23.7%	17.9%	24.4%	19.9%	22.8%	16.4%	23.8%	17.4%	23.7%	17.9%
Reducing Flood Risk in Hull	10.5%	13.6%	8.7%	11.3%	18.0%	19.7%	9.3%	12.9%	9.9%	13.3%
Infrastructure for New Towns	7.8%	9.9%	8.3%	9.6%	6.4%	9.3%	8.8%	10.5%	7.4%	9.8%
Reducing Cellar Sewer Flooding	7.6%	6.1%	7.2%	6.0%	6.0%	4.4%	7.0%	5.4%	8.6%	6.9%
New Customer Management System	4.6%	6.4%	3.5%	5.2%	5.4%	7.2%	5.2%	7.3%	4.4%	6.2%
Base: All respondents - clean	938		152		111		252		414	

Again, the impact of introducing the increase to an average household bill has similar results amongst respondents living in each Region as it does amongst the sample as a whole.

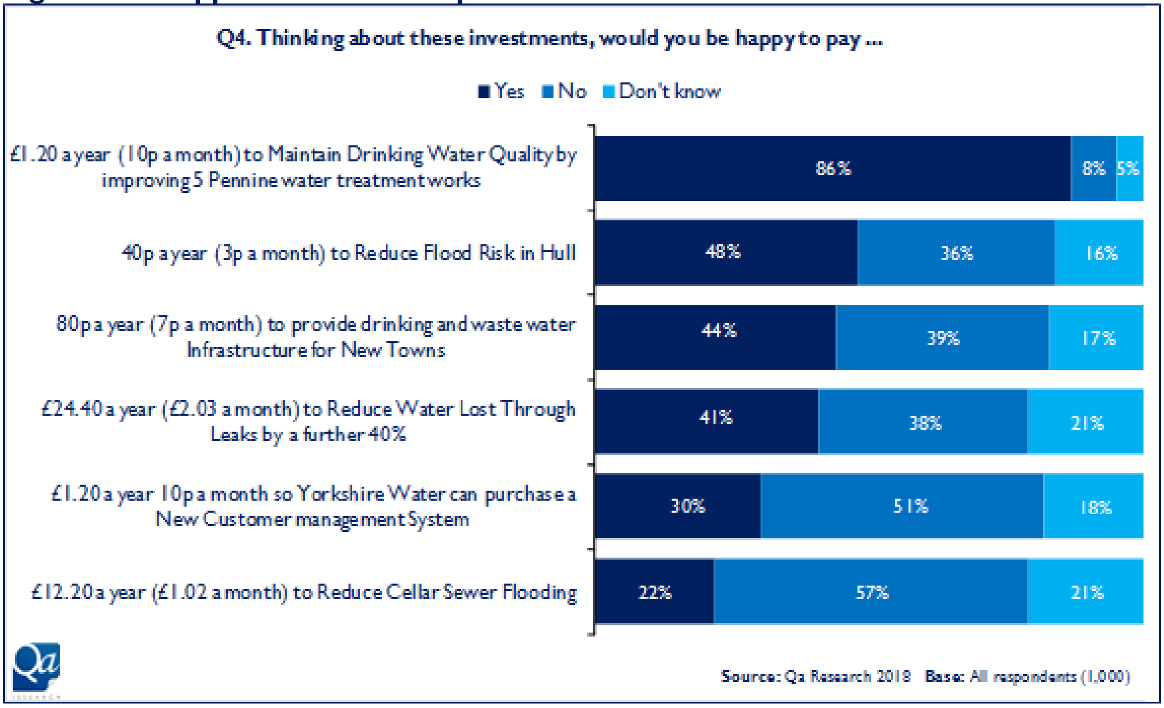
Notably, amongst those living in the East, clarifying the bill impact entrenches support for **Reducing Flood Risk in Hull** still further with the % Share of Support increasing from 18.0% for Model A to 19.7% for Model B.

As a result, amongst respondents in the East, this Cost Adjustment Claim is the second most well supported once bill impact is included in the description, although this situation is also driven by a decline in support for **Reducing Water Lost Through Leaks**.

4.1.5 Happiness with the Bill Impact of Each Cost Adjustment Claim

At the end of the survey a question was included which simply asked respondents whether they would be happy to pay the additional amount on their bill that would be required for each Cost Adjustment Claim and responses were as follows;

Figure 11. Happiness with bill impact of each CAC



This is a very simple question and doesn't ask respondents to make trade-offs of decide between one claim or another (they can say *'yes'* or *'no'* to them all should they wish to).

It's very clear from this data that respondents are happy to pay the £1.20 extra per year required to **Maintain Drinking Water Quality** and this aligns with the findings of both MaxDiff models.

The situation is less clear cut for the other Claims, but respondents were more likely to say *'yes'* than *'no'* for the two that would require an increase to the average annual household bill of less than £1 (namely **Reducing Flood Risk in Hull** and **Infrastructure for New Towns**).

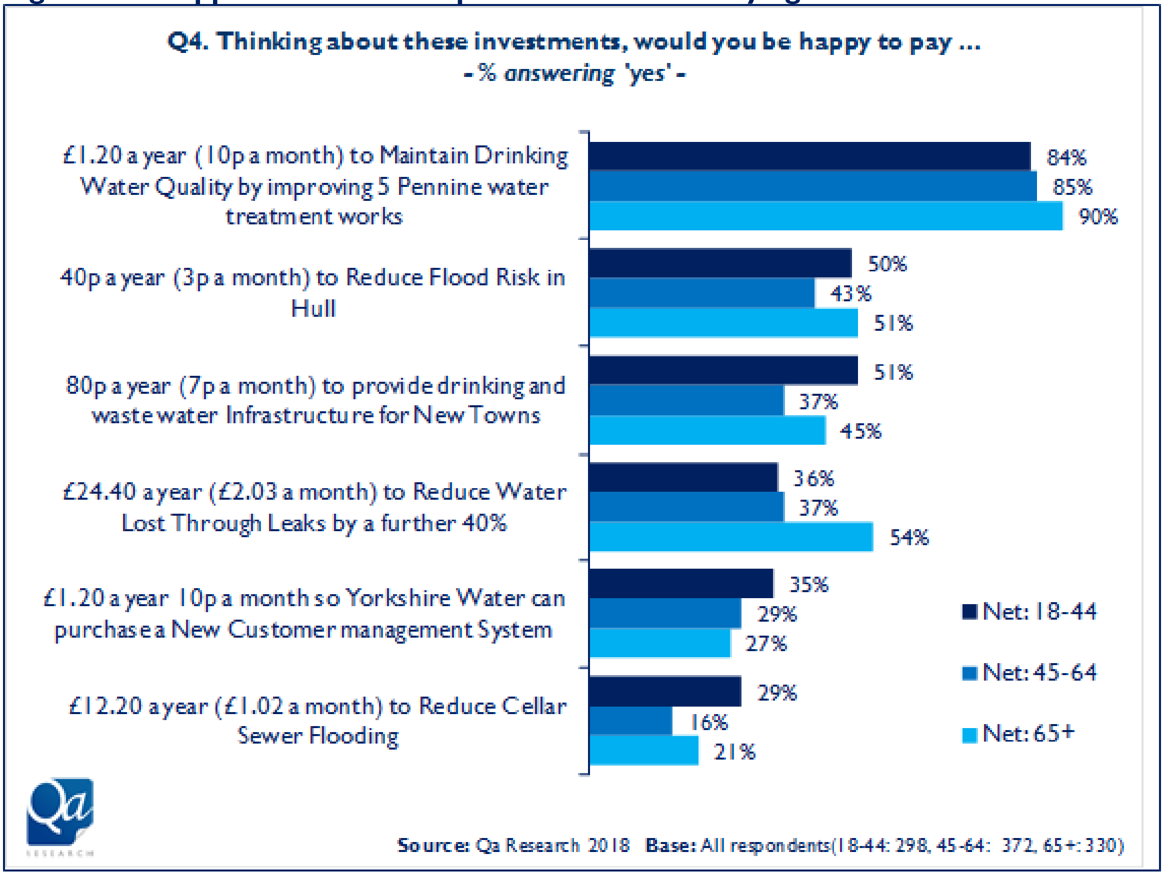
The amount required for **Reducing Water Lost Through Leaks** (£24.40 a year) were polarising with broadly equal proportions saying *'yes'* and *'no'* (41% vs. 38%).

However, the majority of respondents said *'no'* when asked about the amounts required for **Reducing Cellar Sewer Flooding** (57%) and a **New Customer Management System** (51%). These are neither the most expensive or least expensive Claims for customers, so other considerations clearly influenced responses here apart from the bill impact.

4.1.6 Happiness with the Bill Impact of Each Cost Adjustment Claim – by age

The chart below summarises response by age;

Figure 12. Happiness with bill impact of each CAC – by age



Responses to this question amongst different age groups are broadly similar, but significant differences were noted.

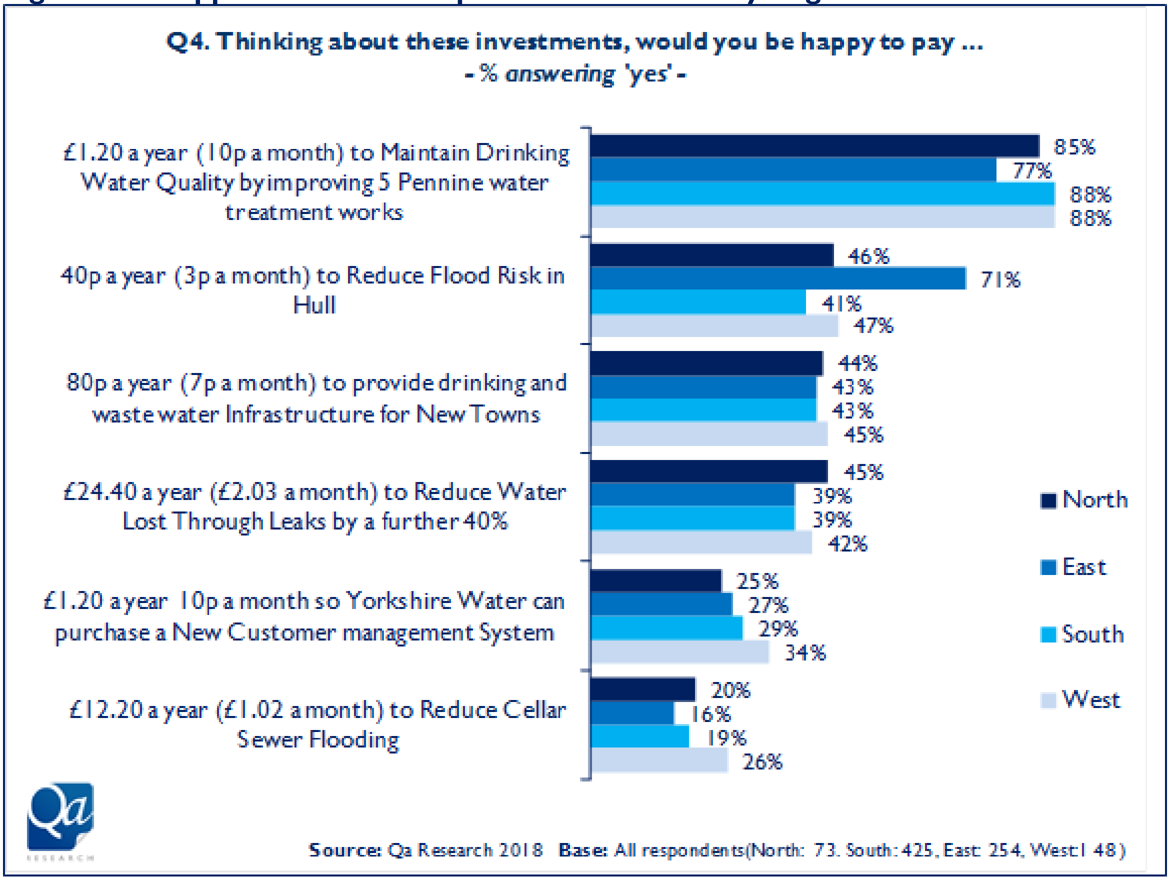
Specifically, £12.20 a year (£1.02 a month) to **Reduce Cellar Sewer Flooding** was a cost that younger respondents were significantly more likely to indicate that they would be happy to pay than older ones (18-44: 29%, 45-64: 16%, 65+: 21%). That said, the majority of all age groups said they would *not* be happy to pay this amount.

Also, when considering 80p a year (7p a month) to provide drinking and waste water **Infrastructure for New Towns**, it was respondents in middle aged groups who were the least happy to pay this amount and the least likely to respond *'yes'* (18-44: 51%, 45-64: 37%, 65+: 45%) - in fact respondents aged 45-64 were more likely to say *'no'* (46%) than *'yes'* (37%) to this question.

The other notable and significant differences is that older respondents were the only age group where the majority said they would be happy to pay £24.40 a year (£2.03 a month) to **Reduce Water Lost Through Leaks** by a further 40% (18-44: 36%, 45-64: 37%, 65+: 51%).

The chart below shows respondents amongst respondents in the 4 Regions;

Figure 13. Happiness with bill impact of each CAC – by Region



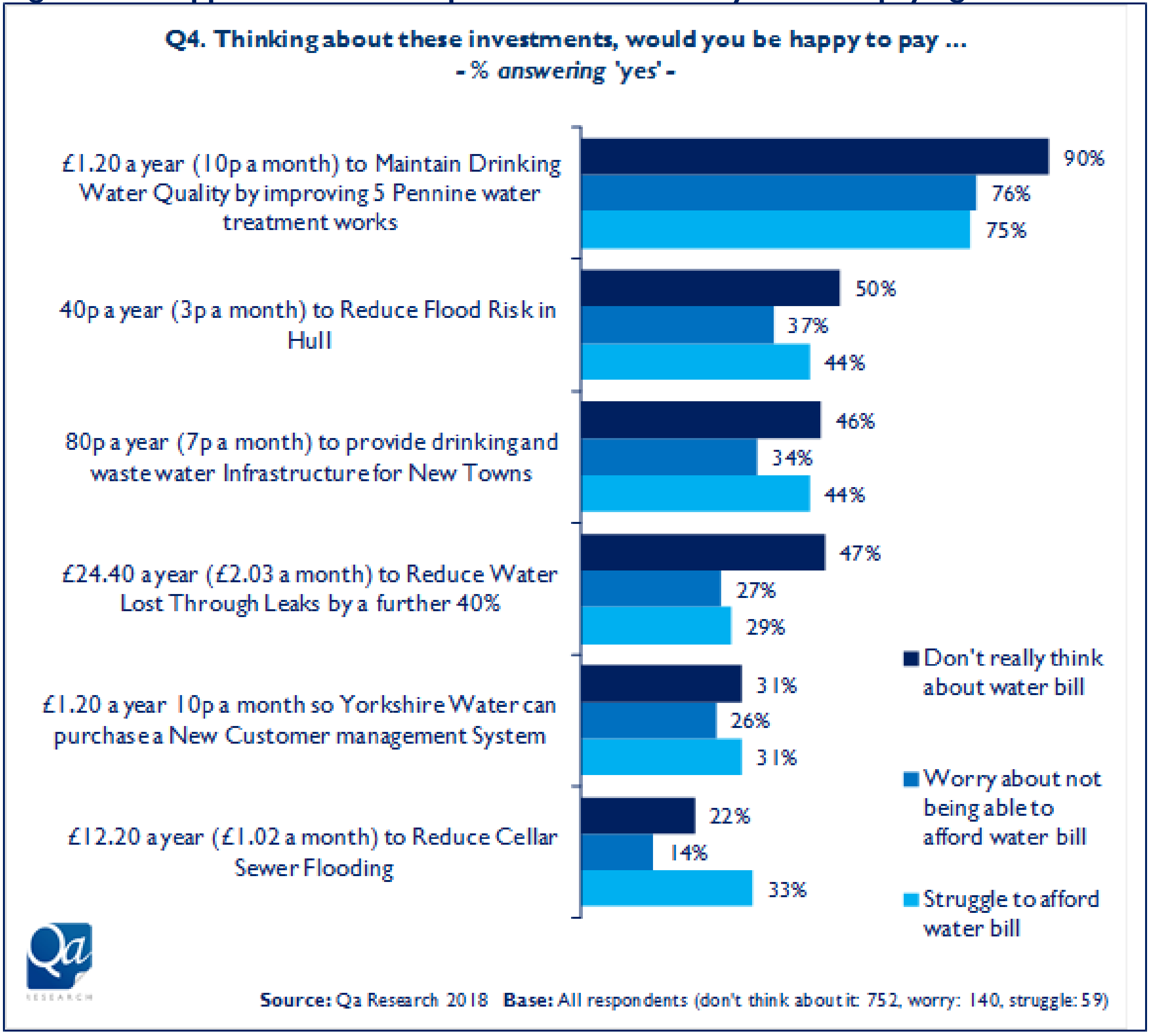
There is generally a consistent pattern of responses amongst respondents in each Region, but some exceptions were noted.

Clearly, respondents in the East Region were significantly more likely than those in the other regions to answer *'yes'* to 40p a year (3p a month) to **Reduce Flood Risk in Hull** (North: 46%, East: 71%, South: 41%, West: 47%). This aligns with the increased % Share of Support noted amongst these respondents in the MaxDiff models.

Additionally, respondents in the West Region were significantly more likely to be happy with £12.20 a year (£1.02 a month) to **Reduce Cellar Sewer Flooding** (North: 20%, East: 26%, South: 19%, West: 16%) – although it should be stressed that the majority of respondents in each Region did say *'no'* to paying this amount.

Finally, a question was included in the survey which asked respondents to indicate how they viewed the cost of their water bill by choosing from 1 of 4 statements. The chart below shows responses to this question based on this question. It should be noted that a fourth option was included at this question which allowed respondents to say if they actually receive help with paying their water bill, but only a handful of respondents said this and their response are not shown on the chart below.

Figure 14. Happiness with bill impact of each CAC – by views on paying water bill



It is perhaps surprising that not a lot of difference was recorded between these 3 categories of respondents. We might have expected that those who *worry* about paying their bill or admit that they *struggle* to do so would be more reluctant to accept these additional charges than those that said they *'don't really think about my water bill it's just something I have to pay'* but this isn't evident. One key difference is that respondents who don't worry were significantly more likely to say *'yes'* to the additional amounts for **Maintain Drinking Water Quality** and **Reduce Water Lost Through Leaks** than those who ether worry or struggle.

4.2 Qualitative research findings

4.2.1 Perceptions of and attitudes towards Yorkshire Water

Few participants across the groups and depth interviews had any reason to be in contact with the water company so their perceptions tended to based on the supply and quality of the water that came out of their tap, which for the vast majority was positive.

> *"As long as I can have a hot shower in the morning." – Hull, FBP, ABC1*

> *"I like Yorkshire Water but I don't have a lot to do with them...it would be nice to know a bit more about what they do." – Ripon, Older, ABC1*

> *"We have lived up here well over 50 years... I can honestly say, no, we haven't had a problem [with Yorkshire Water]." – Vulnerable customer*

> *"I have never had any problems with them [YW]" - Bradford, Pre family, C2DE*

> *"Unless you have got a problem and that is very very rare" - Barnsley, Pre family, C2DE*

The small number that had experienced any incidents or problems with their water felt YW had been quick to respond and so reinforced their high level of satisfaction towards the overall service they received.

When asked what they thought of when asked to think about 'Yorkshire Water' a number of people cited the YW vans. Some had seen the vans because of a need to fix a problem at their property or within their local community. Others had seen or them in the news during reports of flooding incidents.

> *"A pipe had been knocked out by BT...I then got a £600 bill for the month! Then I got a call for Yorkshire Water saying I didn't have to pay it...I felt absolutely brilliant." – Ripon, Older, ABC1*

> *"I had to call out Yorkshire Water...my garden got flooded with sewerage...they came out in forty minutes...fantastic response, so quick." – Ripon, Family, ABC1*

But overall most had rarely given much thought as to how happy they were towards YW and some admitted they took water for granted as it was always there when they needed it and was of a good quality. Many also agreed that the water quality in the region was of a high standard, particularly those that had lived elsewhere in the UK or overseas.

> *"You don't really hear about water companies." – Ripon, Family, ABC1*

> *"I just turn the tap on and don't think about it." – Hull, FBP, ABC1*

> *"I think we have nice water in Yorkshire, it's quite soft, it tastes nice." – Vulnerable customer*

A small number of customers across the qualitative research were aware that they had no choice who to use for their water service so to some extent felt this also dictated by they had no reason to contact YW. However, a large number appeared to have rarely thought about whether they could use another provided and certainly hadn't ever looked in to switching.

> *"[A low profile because] They [YW] are not fighting against anybody else. Gas and electricity companies are all scrapping against each other trying to get your custom but Yorkshire Water don't. It is a closed shop. You have no choice" - Bradford, Family, C2DE*

A consistent unprompted discussion that occurred across the focus groups was the varied prices customers' were paying for their water bills. Some were paying far more than others and most wondered why this was the case.

Some were on meters and living alone and reported paying a low bill, others were paying far more on a fixed bill but with only two in the household so wondered why they were not on a meter. Others reported moving in to a house that already had a meter and ended up paying more than they were in a house with a fixed bill. So this created real confusion amongst group participants with most asking why things were so different within each household.

> *"I'm paying seventy three pounds a month...they haven't called me...and I'm not on a meter, why? – Ripon, Older, ABC1*

Whilst there was some confusion about metering and bill impact, the majority of customers in the qualitative research appeared to think their water bill was reasonably priced and was one of the lowest of their household bills.

However, for a small number of those on very low incomes within the vulnerable customer interviews and focus groups the water bill was more noticeable and less affordable. These individuals also reported mixed experiences regarding the support they had received from YW to address bill affordability.

Some cited YW staff being extremely helpful when contacting the call centre to see what support might be available. One example was somebody that had been advised to go on to the WaterSure tariff and had then had their overall debt wiped clear after a few months of contributing to reduce it. However, another individual had the opposite experience and felt the call centre provided limited options and was quite formulaic and lacking a human touch. These two experiences suggest some level of inconsistency with how those in water debt are handled.

> *"I think they [YW] are brilliant. I have had a good experience with them ... they have been really helpful. I am on that WaterSure tariff ... I was getting sky high bills" - Bradford, Family, C2DE*
>
> *"I always find Yorkshire Water really quite difficult to deal with. You can't just ring them up and ask them. I always find the customer services talk down to you so I don't like dealing with them. Telephone conversations… I just find their attitude is quite arrogant." – Vulnerable customer*

4.2.2 View towards the wider services provided by Yorkshire Water

When asked about the broader services they felt YW offered most struggled to suggest anything beyond providing water to drink, taking waste away and fixing leaks. When probed as to what else they felt YW offered most struggled to say much more.

Some appeared surprised when they heard a small number of customers mention 'sewerage' and 'leak fixing' as YW services as they had only ever associated YW with supplying water. When probed about this it was clear some were unsure as to whether it may have been other organisations that were responsible for taking away waste, such as their local authority.

> *"I don't think they do anything else, just water (supply)...and maybe sewers and pipes?" – Ripon, Older, ABC1*

When looking through a list of the range of services (see Appendix 6.2.1) that YW offer some were a little surprised by *'ensuring there is always enough water supply'*. This was because they had never thought about the prospect that at some point there may not be enough water available. It echoed the feeling of a number of customers earlier in the discussion when they admitted taking water provision for granted as they hadn't experienced a time when there was no supply and assumed it would always be there.

> *"I suppose I knew in the back of my head, that they did all that but I'd never really thought about it in any depth." – Vulnerable customer*

> *"That's quite scary, 'ensuring there's enough water'." – Ripon, Family, ABC1*

A large number of customers were also surprised by *'protecting and improving the water environment (rivers and sea)'*. This was because most hadn't realised that YW's role included environmental protection. For example, those in the Future Bill Payers (FBP) group in Hull thought that services relating to the environment per se were undertaken by other bodies such as the local authority. Others wondered whether this service was undertaken more by the likes of the Environment Agency or was something the Government should be responsible for.

> *"I thought (environmental aspects) might be a different company or Council." – Hull, FBP, ABC1*

Those living in more rural locations such as Ripon were pleased to see YW had a focus on rivers. This was because rivers appeared to be much more of a feature of the lives of customers living in a location like this when compared to those living in more urban locations.

> *"Keeping the rivers safe has a knock on effect to the environment." – Ripon, Older, ABC1*

> *"Rivers...money well spent, I'm a fisherman." – Ripon, Older, ABC1*

> *"I thought Yorkshire Water was just delivering household water… but I hadn't realised they dealt with the rivers and sea." – Vulnerable customer*

When discussing the *'water environment'* role in more depth most were particularly surprised by the notion of YW playing a role in protecting the sea as struggled to work out why or how the organisation did this. Some wondered why YW role was stretched so far as to include improving sea water and felt it should be something the Government should be funding.

> *"I'd have thought the sea...the Government would have paid for this not Yorkshire Water." – Ripon, Family, ABC1*

When considering the service *'protecting you and the environment from sewer flooding'* some were a little surprised that YW was responsible for this and felt they may have contacted another organisation such as the local authority if they had any problems relating to this.

> *"I just didn't think that somebody had to protect us from the environment, from flooding excess, and I didn't know it was Yorkshire Water's job to do that. So I am a little surprised." – Vulnerable customer*

Others recalled YW leaflets being posted through their doors promoting drainage insurance. While a small number of people revealed they had taken up the offer the majority admitted throwing it in to the bin each time it came through.

> *"They [YW] are always trying to flog the insurance" - Bradford, Family, C2DE*

> *"If the drains were all blocked, I'd probably ring the council first." – Vulnerable customer*

> *"Moved house and had to contact them [YW] to set up a new account ... took emergency cover for £1 per month for drains and stuff ... straight forward" - Bradford, Pre family, C2DE*

With a large number of customers in the qualitative research admitting they had only previously thought about YW as their provider of water, knowing more about the wider role of the organisation made them feel like they were getting more value for money than they had thought.

> *"It makes you feel good they are doing all these things." – Ripon, Family, ABC1*

4.2.3 Introducing the business planning cycle and Cost Adjustment Claims

Customers were then informed about YW's 5 business planning cycle, the need to meet the regulatory obligations of Ofwat and the role that 'special factor' cost adjustment claims play as part of this process.

The vast majority of customers were not aware that water companies had to produce a 5 year business plan as part of their requirements to the regulator but most agreed that this appeared to be a sensible and common sense approach to making investment plans and setting bills.

A large number of people were not fully aware that water companies were regulated although some felt they had heard of Ofwat as it reminded them of other similar sounding regulators such as Ofcom and Ofgem, which tended to be in the news more often.

When discussing their views towards the fact that water companies were regulated, most felt reassured as they thought customers would be more likely to get a fairer deal and that prices would be less likely to get out of control especially as they had no choice who to use for their water service.

"It makes sense, they're setting out a business plan for where they're spending the money for the next five years, and obviously that's regulated by the watchdog." – Vulnerable customer

"(Regulation) It's reassuring." – Ripon, Family, ABC1

When discussing views towards the notion of *'special factors'* most felt they understood that unexpected things can happen that are out of the control of an organisation. But a number of customers across the qualitative research were keen to know what the claims were before they passed any judgment as to whether they supported the notion and also to see what the impact might be on them.

"Well I knew about Ofwat and they're the regulators… I don't quite know how these special circumstances suddenly come to life and what they mean." – Vulnerable customer

4.2.4 Cost Adjustment Claims with no bill impact shown

Customers were presented with each of the 7 Cost Adjustment Claims (see Appendix 6.2.2) and provided their views towards each. Once they had been through each Claim customers were then asked to prioritise them by placing them in order of most to least important.

This section reveals customers views towards each of the 7 Cost Adjustment Claims. In the analysis we refer to the main positive and negative aspects, reasons for supporting or not supporting a claim and any areas of confusion or questions that customers posed to YW.

Within the analysis of each Claim we also indicate broadly where it featured during the prioritisation exercise. For the purpose of the qualitative analysis we use the terms 'top', 'middle' and 'bottom' to help you gauge a sense of where each featured during the prioritisation discussions.

Maintaining Drinking Water Quality (DWQ)

Prioritisation level: top

This Claim featured as the highest in the prioritisation exercise for the vast majority of customers in the focus groups and depth interviews.

Main positives

- Drinking water was seen as essential to life and something that nobody could do without
- It was vital that drinking water was safe and didn't affect anyone's health negatively
- Most supported the need not to have to take more water from rivers, although a number of people didn't realise that YW had to source water in this way as they thought reservoirs were used for water supply

- Some cited having lived in other areas where the water was not as good in terms of taste and quality as it was in Yorkshire so further investment in DWQ appeared to explain why this may be the case

- Some also felt that in other parts of the world drinking water was of scare resource and lacking in quality so supported the need to ensure customers in Yorkshire and across the UK were always provided with enough quality water

"Very important, you don't want to drink manky water so you?" – Hull, FBP, ABC1

"Vital...in places like South Africa they don't have this luxury." – Ripon, Older, ABC1

"You can't beat Yorkshire water. I've lived in other areas of the country, so I know." – Vulnerable customer

"Nice clean water. Very tasty" - Bradford, Family, C2DE

"I wouldn't mind paying more on my bills if the quality of the water was higher ... usually I only drink bottle water because I don't like tap water" - Bradford, Pre family, C2DE

"Health, for a start. It's vitally important for that one reason alone." – Vulnerable customer

"It needs to be a claim if it's going to get really bad." – Ripon, Family, ABC1

Main negatives

- The investment figure of £93m looked very large to a number of customers. This was because most hadn't really seen figures of this scale and struggled to appreciate what would be the right level of investment for an initiative they had no real knowledge of

- A number of customers thought YW should have already been preparing or working on this particular initiative so couldn't understand how it had become a '*special factor*' that wouldn't have already been factored in to investment plans

- A small number of customers on very low incomes felt YW should be covering much of this cost with its own profits rather than expecting customers to foot the bill

- A small number of customers were concerned as to why YW and its customers should be paying for the work to be done as they felt that there could be other stakeholder groups that may have contributed to the problem such farmers and councils

"It doesn't start deteriorating suddenly so why didn't they factor it in?" – Ripon, Family, ABC1

"So how much water are they taking from rivers?" – Ripon, Older, ABC1

"I would have thought would have been one of their priorities of Yorkshire Water… I don't believe that suddenly because of all that [rain water running off the peatlands], they now need to spend 93 million pounds to improve it when they should have been doing that all along." – Vulnerable customer

"Have you known anybody getting ill in England just through water?" - Barnsley, Pre family, C2DE

"For £93 million I would go round every single house in Britain and I would sort the water out" - Barnsley, Pre family, C2DE

"93 million in funding, is that all gonna come from the customers? Nowadays, it's all about making a profit. Maybe they could lose a bit of the profit and put it back in." – Vulnerable customer

"It is to do with farmers further up the hills ... actually cut away trees and everything else and that is part of the reason so I would be a bit miffed at paying for that" - Bradford, Family, C2DE

Questions posed

- Customers were interested to know more specifics about what was actually causing the discolouration – for example, why are the peatlands deteriorating in quality?

- Some asked how bad the water quality was really going to be? If it was discoloured did that mean you couldn't drink it? Could you still bath or shower in it? Some suggested they would consider bathing in yellow water but wouldn't drink it. Did YW therefore need to spend as much on the improvement to make it crystal clear?

  "Whose responsibility is it to maintain the peatlands? It's almost as if the cost for their responsibility is being passed onto people because of their water." – Vulnerable customer

Reducing Water Lost Through Leaks

Prioritisation level: top

This Claim was mostly ordered in position 2 or 3 during the prioritisation exercise for the majority of customers in the focus groups and depth interviews. However, for the Bradford, Family, C2DE group this claim appeared near to the bottom of the prioritised list.

Main positives

- Customers were interested but particularly surprised to learn about the volume of water that YW supplied (1.2 billion litres). Then when considering that even at Ofwat's target, 23% of this amount of water would still be lost to leakage, customers were therefore keen to see improvements as they were shocked by the level of waste

- The majority of customers were in agreement that wasting water was not a good thing and that we should not be complacent about leakage. Some referred back to their comparisons of *developing nations* overseas where sourcing water was particularly difficult and it was therefore wrong that we should waste any and take it for granted that we have an (perceived) ample supply

- A small number of customers felt that reducing the amount of water wasted through leaks would help the environment as we would be taking less water from source (reservoirs, rivers)

- A large number of customers had either experienced or seen the implications of leaky pipes themselves or knew others that had. For example, seeing YW vans undertaking emergency road works were often associated with a burst pipe or some kind of leakage going on underground

- Those in the Future Bill Payer group in Hull felt they could see a return on investment. By spending an additional £325m to fix more leaks they hoped that in the long run money would be saved as less water would be lost

- A minority were also proud to see the potential for Yorkshire Water to be one of the best in the country for leaks.

"Twenty three percent every day, that is huge." – Ripon, Family, ABC1

"We've had a lot of leaks...it's the age of the pipes." – Hull, Older, C2DE

"I am all for not wasting water" - Bradford, Pre family, C2DE

"I have heard about phosphorous over the last couple of months and apparently it can be quite damaging can't it" - Barnsley, Pre family, C2DE

"I'm not sure they're doing enough about that… I have seen a lot of occasions where a lot of leaks have just been leaking and leaking and leaking for ages… I'm not saying it's a big issue, but it is an issue." – Vulnerable customer

"It could work out more beneficial...over the years your bill could come down as there would be less leakage from your pipes." – Hull, FBP, ABC1

"It [reducing leaks] should really save us money in the future ... but it [bill] won't go down" - Bradford, Pre family, C2DE

"If they are losing less water then you would like to think that in the long term that their charges are going to come down." – Vulnerable customer

Main negatives

- Some felt that YW should continually invest in leak prevention as a core part of their responsibility so wondered why customers should have to pay extra for something YW should be doing anyway

- Those who hadn't seen or experienced a leak were less concerned than those that had

- How was this investment a special factor? Some felt that as fixing leaks would be a core responsibility of the water company how did YW not already know this was needed?

- The £325m investment seemed like such a lot of money so a number of customers were concerned about the potential hit to their bills if they supported this

- As YW was already hitting Ofwat's target some wondered why there was really a need to go any further? Some suggested whether YW could consider reducing the '*additional 40%*' ambition to a lower level as this might then have less impact on customer bills but still improve on the current leakage position

- With some perceiving the UK to have so much free water available falling from the sky customers wondered whether we should worry too much about leakage and therefore didn't see the point in spending more than was needed to fix additional leaks

- The notion of being '*one of the best in the country*' seemed irrelevant to a number of customers as it didn't make any difference to them and was seen as more of a badge of honour for the water company itself

- Some wondered whether YW and customers should be the only ones paying to fix more leaks as felt the problem of broken / burst pipes may also be caused by other stakeholders. One example was the Highways Agency, blamed for under investment in roads causing an eventual negative knock on affect to the pipe system

  "The thing is we have plenty of rain here, it might be a naïve attitude, but water running off is not particularly costing them anything is it? They get all their product for free, it doesn't worry me." – Vulnerable customer

  "If you're already hitting a target ... why?" - Bradford, Family, C2DE

  "It does seem extortionate (£325m)." – Ripon, Family, ABC1

  "That seems to me that they want to glorify themselves to be one of the leading water companies ...you can't just take - that is all it seems to be to me: take, take, take, you pay, you pay. What are we getting back from it?" - Bradford, Family, C2DE

  "Surely this is something that's built in? …Why are they maintained enough to lose so much water? Why aren't they putting more money in themselves to reduce these leakages? Again, it's all coming onto the customer." – Vulnerable customer

  "Take it out of profits" - Bradford, Family, C2DE

  "It (causing leakage) could sometimes be down to bad road maintenance." Hull, Older, C2DE

  "Best in the country for leakage – does it really matter?" – Ripon, Family, ABC1

  "Quite frankly unless you've got a leak you don't give a toss!" – Ripon, Older, ABC1

Questions posed

- With so much water being wasted a small number of people wondered where it all went. They wondered what was the implication was of so much water being wasted, who was it affecting?

Infrastructure for New Towns

Prioritisation level: top to middle

This Claim was mostly ordered in the higher to middle position of 2 or 3 and was only positioned towards the bottom by those in the Hull, Older, C2DE focus group.

Main positives

- Providing water for new towns was essential as those living there could not live without water
- Many customers, particularly FBPs, pre-family and family customers saw this investment as important in order to provide for the housing needs of future generations
- Some of those in the older customer groups, whilst they were more fearful of the growth in population figures and the notion of more new housing projects, felt that such developments were inevitable so supported the need for water infrastructure to be provided
- A number of customers felt the £57m investment cost seemed lower in comparison to some of the other claims such as river water and leakage especially as they could clearly see how many people (1 million) would actually benefit from the development and how many towns would be supported (3 new towns)
- Receiving bills from an additional 1 million people would help to cover the £57m cost so some customers felt there would be a guaranteed return on investment

"It seems like a lot bigger job than making 3km of river water better." – Hull, FBP, ABC1

"Fifty seven million doesn't sound a lot compared to the others." – Ripon, Family, ABC1

"It's for the long term...it would help future children." – Hull, FBP, ABC1

"Don't know about important, it's more a necessity." – Ripon, Family, ABC1

"I am surprised you have asked us about that one: it has got to be done ain't it. You have no choice" - Bradford, Pre family, C2DE

"It (population) can't help but expand...so it's quite important really." – Ripon, Older, ABC1

"There is going to be more house and more paying the bill anyway so it should even itself out" - Bradford, Pre family, C2DE

Main negatives

- The majority of older customers in the Hull and Ripon focus groups were initially against supporting investment to support new towns. This appeared mainly due to their frustration with regards to the rapid population growth and aversion to the development of new towns in general

- Those in the Ripon older customer group felt that the population growth was partly due to the lack of immigration controls so showed a sense of anger when seeing the estimated levels of increase in people likely to be living in the region in 2045. They hoped that the need for, and associated costs of, such developments would be reduced if tighter immigration controls could help to restrict the growth in population

- Some of those on very low incomes from the vulnerable customer interviews wondered where the forecasted figure of 1 million more people had come from. They were concerned it may have been made up to create fear so that customers would feel obliged to contribute

- A number of older customers were also initially less supportive of this development as they didn't think they would be alive to see them happen. So if it didn't affect them personally they were a lot less likely to support it. However, on reflection when prioritising all of the claims, those in the Ripon older customer group moved it nearer to the top of the list as felt that the population growth was going to happen anyway and therefore people needed houses and water to drink

- A number of customers in the family and older customer focus groups as well as low income vulnerable customers wondered why YW and its customers would be the only ones paying the bill for the water infrastructure to support the new developments. This would, they thought, surely also be covered by contributions from builders, property developers and local authorities as they were the ones responsible for the decision making and implementation of the developments.

- Others also felt the Government and UK tax payer should also be contributing to the bill as this was an issue that affected society at large

  "Some of the costs would be saved if we didn't have to take all these immigrants in." – Ripon, Older, ABC1

  "I would expect the developers to contribute" - Bradford, Pre family, C2DE

  "Go to the builders on that one, let them pay for it." Hull, Older, C2DE

  "I think it should be the developers themselves. They make enough money out of building houses anyway" - Bradford, Family, C2DE

  "I'm not going to get any benefit from them new towns; I'm probably not going to be here anyway in 2045" – Vulnerable customer

  "People are dying off, people are emigrating, I do wonder whether these figures are scaremongering to get people to do what is wanted of them." – Vulnerable customer

  "The people in these towns should be the ones paying for it not us… I don't see why it should all be down to Yorkshire Water to provide; surely it should be down to Government costs." – Vulnerable customer

Questions posed

- Customers were interested to know where the new towns might be located?

Improving River Water Quality

Prioritisation level: middle

This Claim was mostly ordered in the middle position 3 or 4 and was only placed in the bottom tier (position 6) by those in the Hull, FBP, ABC1 focus group.

Main positives

- Enabling wildlife to flourish was seen as important to customers. A number of them felt torn between the notion of birds, fish, plants and the wider environment potentially being allowed to squander at the behest of other factors that seemed only to be of the benefit of humans (new towns, DWQ)

- Customers in the Ripon focus groups appeared to have a stronger connection with rivers compared to those in other locations covered in the research, so were keen to ensure they were kept clean and maintained as if not then they felt it may affect the general quality of life for them and their fellow residents

- A number of customers across the groups and depth interviews seemed to connect healthy rivers with a healthy society. They expected that if river water was of poor quality there would be some sort of knock on affect to human health

- It was also perceived by a small number of participants that human health could also be affected if rivers were being used as a source for drinking water – some were concerned that if river water quality was poor then it might be unsafe and therefore unusable for drinking water provision

- A small number of people perceived phosphorous to be a dangerous chemical so appreciated the need to remove it from rivers

- A small number of those in the 75+ vulnerable customer depth interviews felt investing in river water quality would help return rivers to their former glory. There was a perception that river water was generally not as good as it used to be many years ago so they were supportive of schemes to improve them

  "We live by them so we want them to be as clean as possible." – Ripon, Family, ABC1

  "Newts, tadpoles...you don't see them anymore." – Ripon, Older, ABC1

  "I agree with that entirely, it's for me a big issue and it should be looked at, principally for the wildlife. If we start losing the wildlife then we start losing life… Did the Environment Agency instruct Yorkshire Water?" – Vulnerable customer

  "I have heard about phosphorous over the last couple of months and apparently it can be quite damaging can't it?" - Barnsley, Pre family, C2DE

  "I'd rather spend money on that, we are losing the environment too quickly anyway we are losing rainforest and hedgerows." – Vulnerable customer

Main negatives

- Some of those in Hull felt rivers near them were already too far gone to be improved so didn't think any level of investment would help
- Those in the Sheffield in-depth interviews felt that rivers near their city had already been significantly improved since times when heavy industry had polluted them. They therefore felt that investments may be best spent on other factors that were more likely to affect people
- The volume of river water being considered for improvement at 3km seemed very little to the majority of customers. When reading that Yorkshire has over 6,000km of rivers improving only a fraction of this at 3km seemed very strange with most wondering why it was such a small amount
- Then when considering the amount of investment required and the volume of river water that would be improved, a large number of customers felt this did not offer value for money. This was especially the case for those in the Hull, FBP, ABC1 focus group who felt the maths didn't add up when compared to the amounts being considered for DWQ (£93m) and New Towns (£57m) which were also seen as more important in principle
- There was also concern about who was responsible for causing river pollution. YW was seen to be having to fix problems caused by other stakeholders such as farmers and heavy industry. Therefore a number of customers felt those who cause the problem should be contributing to the paying for it to be fixed
- Others also thought that improving rivers was more the responsibility of the Environment Agency so wondered why YW was having to invest in this
- With YW already '*one of the best in the UK'* many wondered why it needed to spend so much money to be any better

"I don't think we'll ever improve the quality as we've got the Humber and it's going to be like that forever, forever and forever." – Vulnerable customer

"They need to work with other people that affect the water source as well, chemicals, building and farming…it needs to be a team effort" – Vulnerable customer

"I thought the rivers had improved significantly in the last few years, anyway?" – Vulnerable customer

"Three kilometres out of six thousand is not a lot." Hull, FBP, ABC1

"They have already 6000km classed as good so it is only a small element." – Vulnerable customer

"I thought the rivers had improved significantly in the last few years, anyway?" – Vulnerable customer

"A lot of it comes from treatment from farms." Hull, Older, C2DE

"They are already meeting the standard, is it really worth the money?" Ripon, Family, ABC1

Questions

- The majority of customers wondered what phosphorous really was and how dangerous it was. To what extent was it a public health risk?
- Some wondered which river or river would be improved?

  "What stretch of water are we talking about?" - Barnsley, Pre family, C2DE

Reducing Flood Risk in Hull

Prioritisation level: middle

This Claim was mostly ordered in the middle position 3, 4 or 5.

Main positives

- Many agreed that nobody should have to experience internal flooding and especially if that meant sewerage entering people's homes. So any investment looking to reduce this prospect was worth considering
- Most of those in the Hull groups recalled serious flooding incidents in the city around 10 years previously so were more alert to this Claim than customers in other locations
- Some saw this as an investment that should protect households in the long term so could be a worthwhile consideration
- A number of customers were buoyed by the fact that YW would be partnering with other organisations to address the issue as they felt the problem was unlikely to have been the fault of YW in the first place
- Some were encouraged to see some of the ideas put forward for preventing future flooding. Permeable paving (for the minority who knew what this was) for example was seen as an excellent way to drain water back in to the land rather than hold it up on the surface and therefore contribute to flooding
- Those on low incomes in the focus groups and vulnerable customer interviews felt this investment would really help those who couldn't afford flood insurance or to fix problems associated with flooding

  "It's more personal to us (in Hull)...it affected so many last time...to prevent it happening again...it's a long term investment." - Hull, FBP, ABC1

  "They've got to be a priority as we're lucky not to have that." – Ripon, Older, ABC1

  "If I lived somewhere like that, I'd want to know that I was safe." – Vulnerable customer
  "An aging infrastructure ... we need to upgrade" - Bradford, Pre family, C2DE

"I have a friend who lives in that area whose house floods regularly… You just can't begin to imagine how somebody copes with their house being flooded." – Vulnerable customer

"It's got to be a priority, that's 5,000 families, where their homes will be ruined, especially if it is social housing with vulnerable people, those who can't afford to replace what is lost has more impact than just the water damage…if it happened to me I wouldn't be able to afford to replace anything." – Vulnerable customer

Main negatives

- The majority of customers taking part in the qualitative research hadn't and didn't expect to ever get flooded. Many were therefore initially likely to say '*this doesn't affect me'* so were quick to suggest it was a lower level of priority

- This also extended to a number of customers in Hull, whilst they knew about the floods a decade ago, most had been unaffected so didn't see this as a very high priority

- One of the main issues cited by the Hull, Older, ABC1 group was that they associated the *flooding in Hull problem* with other organisations such as building firms for developing properties on flood plains, the Council's town planners for allowing the developments to go ahead in the first place, solicitors for backing the developers – a number of them therefore felt that YW and customers should not have to cover the cost of this and that those who made the problem in the first place should fund the scheme

- Others outside of Hull also felt that flooding was an issue affecting so many places that the Government should be providing much more funding to fix the problem rather than YW solely covering the bill

- Customers in locations outside of Hull also wondered why other towns and cities (such as York) that had experienced and were still vulnerable to flooding were not being considered for the same kind of investment

- Many agreed that the volume of properties that might be helped by the investment (400 and 550 out of 5,000) didn't seem high enough with many asking *'why so few?'*

  "What about all the other areas that flood all the time?" – Vulnerable customer

  "400 out of 5000 is not very many, is it? It's a very small proportion of the houses which flood up there." – Vulnerable customer

  "In Hull? Well how can I comment on that?" – Vulnerable customer

  "For £30m you could buy Hull!" - Barnsley, Pre family, C2DE

  "Why should it just be down to Yorkshire Water...the Government should be ploughing money in." – Ripon, Older, ABC1

  "What about the town planners (who said) 'oh it won't flood for years'?" – Hull, Older, C2DE

  "I say go back to the builders who did it." – Hull, Older, C2DE

"Not a good Claim, 400 properties compared to how many are in the Yorkshire Water area." – Ripon, Family, ABC1

"It's unfair that everybody has to pay for it." – Ripon, Family, ABC1

"It is like asking me to pay for somebody in Wigan" – Bradford, Family, C2DE

"If you want to live in area that might get flooded, more fool you" – Barnsley, Pre family, C2DE

Questions posed

- How will YW decide which houses receive the support?

Reducing Cellar Sewer Flooding

Prioritisation level: middle to bottom

This Claim was mostly ordered in the lower middle positions 4 to 6.

Main positives

- Cellar sewer flooding had similar reactions to the Hull flooding claim as many felt this should not happen to anyone as they expected the level of distress to be extreme and the health risk to those living in such properties to be severe
- Many also agreed that cellar sewer flooding would not only be a risk to the individuals within the property but also might have a wider negative effect on the surrounding environment and therefore to society i.e. germs in to the environment creating viruses and disease
- Those in the Hull, FBP, ABC1 group felt that preventing cellar flooding would help to ensure that pubs and local shops would be more protected as these facilities provided services to a large number of people within communities
- Reducing sewer flooding in properties by 70% was seen as a high volume of households that would be receiving help. This seemed like better value for money when compared to other claims such as river water quality which could cost more than £700m but only improve 3km of river

"Contamination, disease, ergh!" – Ripon, Family, ABC1

*"I wouldn't want my cellar to be full of sh**t" - Bradford, Pre family, C2DE*

"It is a serious problem. If you had backing up into your cellar you would be like, please help me" - Bradford, Family, C2DE

"It would help the community." – Hull, FBP, ABC1

"It would help out pubs and local shops if they're storing food (in cellars)." – Hull, FBP, ABC1

"Because of the health risk, I'd [rank] that pretty high, especially if you get some of the more contagious nasty diseases." – Vulnerable customer

"I agree with it....when you say sewers...dirty water." – Hull, Older, C22DE

Negatives

- As with the Hull Flooding claim, very few people had cellars or knew anyone else that had a cellar. They therefore struggled to support something that they thought wouldn't affect them or anyone they knew
- The cost of £163m seemed like a lot of money to fix a problem that most people didn't really know about or expect to happen to them
- A large number of customers also didn't think there could be that many cellars in Yorkshire so didn't expect the investment would help too many households, even though they thought the 70% reduction proposition was high
- One key issue was the fact that all YW customers would have to contribute to the investment as a large number of customers felt it was the property owner's / occupant's responsibility to pay for insurance as they chose to live in a house with a cellar in the first place

"I am not going to pay for someone else's problem" - Bradford, Pre family, C2DE

"They need to move into house without a cellar" - Bradford, Family, C2DE

"I think there are more important things to do than to reduce cellar flooding...because I don't really know anyone that has one." – Ripon, Older, ABC1

"Insurance companies could benefit as they won't have to pay out." – Vulnerable customer
"My bill is high enough but this will affect other people and their families."– Vulnerable customer

"Although I would feel sorry for those people, I wouldn't think it would be my responsibility to pay for it." – Vulnerable customer

"Is it worth 163 million?" – Vulnerable customer

"That [£163m] is taking the schmichael" - Barnsley, Pre family, C2DE

"It sound to me like it's something that's just come to life because of Ofwat's requirements." – Vulnerable customer

"If you have got a property suffering from flooding you get your own drain-off fitted yourself in that property" - Barnsley, Pre family, C2DE

New Customer Management System

Prioritisation level: bottom

This Claim was ordered at the bottom (number 7) of the prioritisation list for vast majority of customers in the qualitative research.

Main positives

- Dealing with call centres, within the water industry and in other sectors, was something that a small number of customers didn't enjoy. They cited the frustration of automated responses, pressing a number of different options to then hopefully getting through to the right person
- Therefore the idea that a new customer management system might reduce the need to contact YW by phone was welcomed by a small number of customers
- A number of customers liked the idea of receiving more text based communication particularly to raise awareness of incidents such as burst pipes, flooding and any other water related problems
- A small number of customers that were in or had experienced water debt liked the idea of receiving a text to remind them of an overdue payment. This was particularly for those who tended to pay their bill weekly and were not on direct debit
- A number of customers, particularly those in the Ripon, Older. ABC1 focus group also felt the idea of receiving more email based communication would be helpful as a medium they tended to use more regularly than other channels

  "I think it's a good thing actually, if they hadn't have got in touch with me I'd have paid six hundred pound (unnecessarily)." – Ripon, Older, ABC1

  "If I got a text message to remind me to pay my weekly instalment, then it would help definitely. It would probably remind me and I would pay what I could afford to pay" – Vulnerable customer

  "The Council (Harrogate) email you about stuff and they're amazing." – Ripon, Older, ABC1

Main negatives

- Whilst the notion of receiving communication in more personalised ways was welcomed, the majority of customers felt this claim was a little unnecessary compared to the others being considered, particularly as most rarely felt they had any need to be in contact with YW
- Most felt the communication they received from YW was already very good so didn't see a need to pay to make it any better
- A number of customers agreed that an investment such as this should be covered by YW themselves as it was seen as standard for any organisation to pay for any updates to their own internal systems
- A large number of customers, whilst agreeing that call centres were generally frustrating, still liked to talk to a human being, particularly if they have a problem that needs sorting out

- Some of the older customers engaged in the focus groups and 75+ segment of the vulnerable customer depth interviews felt they and others like them were not so confident dealing with digital formats such as email, text or social media so preferred the option to be able to call

- Whilst many accepted that society was moving more towards an automated world a number of customers admitted they felt less comfortable with a shift towards customer services (water and other sectors) becoming entirely digitised. This was because digital channels could lack the human touch, often be anonymous so potentially less trustworthy, reduce the option to interact and address the nuances of a customer's circumstances

- Those in the pre-family C2DE focus groups in Barnsley and Bradford also showed a level of fear towards automation as potentially replacing jobs for them, people in their community and across the region. Others across the focus groups and vulnerable customer depth interviews were concerned as to whether this investment might also see jobs being cut at YW as the call centre would become less required

- The level of investment at £53m seemed extremely high for such a system to be implemented. Some wondered whether YW could try to get a better deal

"The amount of times Yorkshire Water has ever contacted me, it wouldn't worry me whether I'd prefer a text or an email…it's once every two years so it wouldn't be a bugbear." – Vulnerable customer

"How often do we contact them? Very rarely! It is not like it is somewhere you have to call every day." - Bradford, Pre family, C2DE

"I don't see why I should pay for them to get their system in place, shouldn't that come out of the profits they are already making? – Vulnerable customer

"I think they (YW) should pay ... it is their customer service. Why should we pay for that?" - Bradford, Family, C2DE

"The principle beneficiary of that is Yorkshire Water." – Vulnerable customer

"Instead of spending £53m I would rather they invest in people. Proper English people, get more jobs back for Britains ... you will be able to speak to someone on the phone rather than this 'please press one' and then sat on hold for god knows how long ... I would rather speak to somebody" - Barnsley, Pre family, C2DE

"That's a lot of money for a new computer system if that's what it is, surely it can't cost that much?" – Vulnerable customer

"It's automation I have an issue with; well how much of the calling does the company have to do at the moment? Now I think with a lot of the big companies the loss of the personal touch is a mistake… Especially in the older end like myself and my wife, we like to talk to someone." – Vulnerable customer

"Automation… what does that mean? Are more people going to lose their jobs?" – Vulnerable customer

"It's our age group, we're old school." – Hull, Older, C2DE

"Let the people [in contact centre] keep their jobs" - Bradford, Pre family, C2DE

4.2.5 Cost Adjustment Claims with bill impact shown

Once customers had reviewed the Cost Adjustment Claims they were then shown each of them again but this time with the impact on their bill revealed (see Appendix 6.2.3)

Reactions to claims with the bill impact known

When gauging reactions to the bill impact most were surprised by how low the impact on bills would be on each Claim.

As the size of each of the investments required by YW to deliver each of the Cost Adjustment Claims were perceived to be so high most were expecting to see the impact on their bills to be significant.

This led a large number of those within the focus groups to suggest they may be happy to cover most, and in some cases all of the Claims, as they quickly worked out that the overall impact would be approximately £5 per month.

"You lose that (amount of money) down your carpet" - Bradford, Pre family, C2DE

"Just do it all." – Hull, FBP, ABC1

"If we had all of them it's only sixty pounds per year." – Ripon, Older, ABC1

"It doesn't sound like a lot when you break it down like that." – Ripon, Family, ABC1

The most surprising bill impact was that of the Drinking Water Quality claim. This was seen as the most important claim for the vast majority but yet was one of the lowest in terms of bill impact (10p per month).

"It [drinking water] has got to be number one" - Bradford, Family, C2DE

A number of customers who were also initially reluctant to have to pay for claims for services that would never affect them became slightly more altruistic and were much more likely to support them. The main example was the Reducing Flood Risk in Hull whereby a large number of customers who did not live in Hull were initially much less supportive before they knew of the bill impact.

"Let Hull get rid of the poo." - Bradford, Pre family, C2DE

"Give them [Hull] a chance" - Bradford, Family, C2DE

However, for a number of those on low incomes, particularly some of the vulnerable customers and C2DE focus group participants, Reducing Cellar Sewer Flooding was a cost they felt should be covered by the insurance of those with cellars rather than all YW customers.

"If you want to live in area that might get flooded, more fool you" - Barnsley, Pre family, C2DE

When looking at all of the costs those on very low incomes, in some of the groups and particularly the vulnerable customer depth interviews, even though they agreed the amount of bill increase on each claim was lower than expected they made it clear that any increase on the bill at all would be noticeable and add to the pressure of covering household bills in general.

> *"It might be only 3p but 3p adds up with everything else" - Bradford, Family, C2DE*

> *"I'm on a low income, and that sort of level of increase would really create problems for me." – Vulnerable customer*

A number of customers wondered what would happen after the work had been complete? How long would the impact on the bill last? Over what timeframe would the work be implemented? Some also wondered whether they may be asked to pay more again later.

> *"How long is the extra? Once they have done the work and they have paid for it. Then what do they do then? Do we pay the same?" - Bradford, Pre family, C2DE*

A number of those on lower incomes also wondered how much of the investments would be covered by YW's own profit? Some felt that YW should be covering all of the investment cost and that customers should not have to contribute any more than they were already paying.

> *"Why should Yorkshire Water pass the cost onto me?" – Vulnerable customer*

> *"If I'm putting 10p in, then I think Yorkshire Water should do as well. How's this going to impact on the profits? Are they going to reduce profits by that much?" – Vulnerable customer*

Re-ordering claims once the bill impact was known

Customers were asked to consider whether they wanted to change the position of any of the claims that they had previously prioritised now that they knew the impact on their bill of each claim.

For the vast majority of customers the Drinking Water Quality claim remained at the top of the list as it was still seen as the most important. And once they also realised the bill impact would be lower than some of the other claims (10p per month) it made the case for it to remain at the top even stronger.

The Customer Management System also remained at the bottom of the list for the majority. Whilst the bill impact was seen as low it was still seen as less important than the other claims and something that YW should be considering paying for themselves.

Fixing Leaks also remained towards the top end of the prioritisation list for most of the focus group respondents in the ABC1 segments but also remained nearer to the bottom for some of the lower income participants in the Bradford C2DE pre-family and family groups as well as some of the vulnerable customers interviewed. For the higher income respondents the notion of fixing leaks was still important. For the lower income groups the price for his claim was the highest of all (£2.03 per month) so had much less appeal.

"Take it (leaks claim) out of profits" - Bradford, Family, C2DE

The main aspect of movement in prioritisation amongst the other claims related to Reducing Flood Risk in Hull and Reducing Cellar Sewer Flooding.

Reducing Flood Risk in Hull moved slightly higher up the list as it was lowest of all the claims at 3p per month and was seen as a reasonable price to pay to help those in need.

"It's only three pence per month to help four hundred families." – Ripon, Family, ABC1

Reducing Cellar Sewer Flooding moved lower down the prioritised list as a number of customers felt the price was so much higher than other claims at £1.02 per month compared to DWQ at 10p per month.

"When you buy a house you should be made aware of that and bought it with that risk" - Bradford, Pre family, C2DE

"I am not going to pay for someone else's problem" - Bradford, Pre family, C2DE

A small number of customers swapped the position of River Water Quality (to a lower position) and New Towns (to a higher position). This was particularly from those in the Ripon, Family, ABC1 group who were initially much more supportive of the RWQ claim due to living in a rural setting alongside rivers. However, the cost of improving RWQ was much higher than Infrastructure for New Towns (7p per month) so they felt it seemed fair to swap the position of these two claims.

"Due to the cost of such a small amount of river." – Ripon, Family, ABC1

"Some of the [total] amounts are ridiculous: an extra four hundred and seven hundred million quid to clean three kilometre of river" - Bradford, Family, C2DE

5. Conclusions

Generally, the qualitative exploration of customers views indicated that they supported the idea that Yorkshire Water would have to consider investing in *'special factors'*, as businesses and individuals alike often had to deal with unexpected events that were out of their control. But when reviewing the Claims some did wonder why many of them were seen as *special factors* and why Yorkshire Water hadn't known about them and already planned investment to cover them.

The qualitative also explored how customers assess the Claims and this provides context for the way the MaxDiff exercises were viewed and undertaken by online survey respondents. Throughout their assessment of the Claims, customers often initially struggled with the notion of supporting and paying for something that they felt would not affect them or anyone they knew. *'I am unlikely to be flooded'*, *'I don't have a cellar'*, *'I haven't seen any leaks'* were typical initial reactions. But when seeing the impact on their bills (which most agreed were very low in comparison to the high levels of investment) customers did become slightly more altruistic and supportive of Claims that would not affect them (i.e. Bradford customers supporting Reducing Flood Risk in Hull).

For most of the Claims, customers often wondered why only Yorkshire Water and its customers would be covering the full cost of each investment. They expected certain stakeholders that may have been responsible for causing some of the problems in the first place to contribute such as farmers, developers, the Government and councils.

Customers also often struggled to comprehend the size, scale and variation of the investment levels required for each Claim. Why did the Drinking Water Quality one cost so much less than the River Water Quality one? And why was there such a variation within the River Water Quality investment estimation? Why did it cost so much less to provide water infrastructure for three new towns compared to reducing flooding in cellars? None of these points were clarified in the online survey, so these considerations are likely to have influenced how respondents selected Claims to support.

The online survey data and MaxDiff modelling provides an assessment of levels of support for each Claim when respondents are asked to choose between them and clearly indicates how well supported one Claim is compared to another, allowing us to determine customer preferences. It doesn't provide detail on the degree of support per se, as respondents *had to* make a choice between Claims.

Indeed, other data from the survey suggests that many customers aren't really that comfortable with paying the additional amounts to support the Claims, with the exception of **Maintaining Drinking Water Quality**. Probably because of this the data highlight that, consistently, there is strongest support for Maintaining Drinking Water Quality both before and after the bill impact has been revealed to respondents. Indeed, if anything the bill impact strengths support for this Claim which probably reflects that this is one of the cheaper Claims to fund and the qualitative highlighted that this Claim consistently remains top of the list as it is seen as essential to life.

The modelling also identifies strong support for **Reducing Water Lost Through Leaks** although support is weakened once customers are made aware that it would costs £24.40 a year on the average household bill to fund this claim. Including bill impact means that support for Reducing Water Lost Through Leaks declines to be only marginally higher than for Improving River Water Quality (which is the Claim that consistently generates the third highest level of support). In the qualitative customers explained how leakage remained near to the top of the order as most didn't like the idea that water was being wasted and the investment would hopefully be returned over time once pipes had been fixed.

There was also consistent support for **Improving River Water Quality** and this was not altered by the introduction of the bill impact (it's third in the ranking in both models). Exploring this in the qualitative, highlights that improving river water quality is seen as important for the environment and a healthy society, although questions were raised about the fact that the return on investment seemed at odds with all of the other claims. Why was so little river (3km) being improved at such a high cost?

Support is consistently lower for the other three Cost Adjustment Claims, and while some increases were noted once the bill impact was introduced these did not have a dramatic impact and didn't move these Claims up the ranking in a significant way.

Reducing Flood Risk in Hull was the one Claim that recorded a notable increase in support once the bill impact was introduced (reflecting the fact this is was the lowest increase to a bill of any of the Claims).

A similar increase was recorded for **Infrastructure for New Towns**, which carries with it the second lowest increase to an average household customer's bill. More specifically, New Towns are seen as important for future generations and whilst older customers didn't like the notion of 1 million more people living in Yorkshire they accepted it as inevitable so felt providing water infrastructure was a necessity and supported it.

One Claim were the qualitative identified that customers' altruism would not stretch, was in terms of support for **Reducing Cellar Sewer Flooding** as it was seen as unfair that all Yorkshire Water customers should contribute and it was felt that this should be the responsibility of people living in those houses via their own insurance. This Claim recorded comparatively low levels of support and this only reduced further was it was made clear to respondents that it carried with it an annual increase of £12.20.

Along with Reducing Cellar Sewer Flooding, the least supported Claim was a **New Customer Management System**, although more support was forthcoming when the bill impact was included, probably reflecting that this is one of the cheaper ones for customers to fund. The qualitative identified that the CMS was consistently considered to be the least important as it is seen as an *internal* investment that Yorkshire Water should be covering itself.

Whilst most felt the impact on the bill would be minimal for the level of investment being made by Yorkshire Water for each Claim, those on very low incomes (whilst also agreeing that the increases were low in relative terms) felt they would still feel the pain of any increase in their bill as they were already struggling to stay on top of water bills.

6. Appendices

6.1 Appendix 1 – Online Survey

Before we begin, I'd like to reassure you that this interview will be carried out according to the Market Research Society's Code of Conduct and all your answers and information you provide will be treated as anonymous and confidential in accordance with the Data Protection Act 1998.

SCREENERS

S1. Which water company does your household pay its water bill to?
NOTE: If you pay two companies, please tell us which one you pay for your drinking water.
TICK ONE ONLY
SINGLECODE
Anglian Water – ***Thank and close***
Northumbrian Water – ***Thank and close***
United Utilities – ***Thank and close***
Yorkshire Water
Severn Trent – ***Thank and close***
Another water company – ***Thank and close***
Don't know – ***Thank and close***

S2. Are you personally responsible for paying the water bill for your household?
SINGLECODE
Yes – solely responsible
Yes – jointly responsible
Yes – included in your rent – ***Thank and close***
No – ***Thank and close***

S3. Do you, or any of the people you live with, work for Yorkshire Water?
SINGLECODE
Yes – ***Thank and close***
No
Don't know

S4. Do you, or any of the people you live with, work in any of the following professions? TICK ALL THAT APPLY
MULTICODE
Market Research – ***Thank and close***
Marketing/advertising – ***Thank and close***
Journalism – ***Thank and close***
Public relations – ***Thank and close***
None of the above
Don't know

S5. Please tell us how old you are?
WRITE IN
CHECK QUOTAS

S6. Are you male or female?
SINGLECODE
Male
Female
CHECK QUOTAS

S7. Does your home have a water meter?
SINGLECODE
Yes
No
Don't know – ***Thank and close***
CHECK QUOTAS

S8. Please tell us your postcode. (We will only use your postcode for analysis purposes to understand how customers in different areas answer and it will not be used to identify you).
WRITE IN
MATCH POSTCODE TO LA AND THEREFORE REGION FOR QUOTAS

Section 1: The Business Plan

Please read this background;

Every 5 years, water companies have to draw-up a Business Plan which explains how they will deliver their service over the next 5 years (2020-2025).

The Business Plan contains details of investments that the company will make in things like the quality of drinking water, sewers and waste water treatment, protecting the environment and building new infrastructure (e.g. storm water tanks).

The Business Plan also explains how customers' bills might change over the next 5 years. The plan and the price that customers pay for their bill has to be agreed with the water industry regulator Ofwat and the water company has to operate as laid out in the plan.

However, sometimes things happen that are out of Yorkshire Water's control which mean that the company needs to spend more on investments than it had planned and this also usually means they need to charge customers more to cover this extra investment.

Where a company identifies an additional investment not covered by its Business Plan this is called a 'special factor'.

Special factors mostly relate to changes affecting water companies following new or updated legislation from bodies such as the Environment Agency or the Drinking Water Inspectorate. A water company has to get agreement from customers and Ofwat to change their Business Plan due to special factors.

Yorkshire water has identified 7 special factors that it would like Ofwat to consider.

We would like to know your views on the special factors that Yorkshire Water has identified to understand which you think are the more important.

Firstly, please read each description in turn.

RANDOMISE ORDER OF SHOWING Q1a-Q1g

Q1a. Please read this and tick to confirm that you have.

Maintaining Drinking Water Quality - There is more colour in the water Yorkshire Water collects in its reservoirs and rivers now than ever before. It's caused by rain water running off the peatlands, which are deteriorating in quality.

Highly coloured water is more difficult and costly to treat and increases the risk of failing water quality standards. Action is needed now to prevent water quality failures in the near future.

Yorkshire Water will need to invest in new treatment processes at 5 of its Pennine water treatment works to tackle highly discoloured water to ensure a secure supply of water from these sites in future.

An additional £93 million in funding would be needed to improve water treatment at these 5 sites.

Benefits of making this investment:

- **Yorkshire Water's high standard for delivery of high quality drinking water will be maintained**
- **Reduced need to pump water from rivers.**

SINGLECODE
I have read this description.

Q1b. Please read this and tick to confirm that you have.

Reducing Cellar Sewer Flooding – This happens when sewers over flow and flood cellars. Ofwat wants all water companies to improve and to have a similar number of cellar sewer flooding incidents, but the Yorkshire region has more properties with cellars than the rest of the UK, making it a more costlier problem to fix.

To meet Ofwats requirements, Yorkshire Water would have to reduce sewer flooding in properties with cellars by 70%, this would cost an additional £163m.

Benefits of this investment:
- **Sewer flooding in cellars will be reduced by 70%, benefitting customers**
- **Less emotional and financial stress for customers experiencing cellar flooding.**

SINGLECODE
I have read this description.

Q1c. Please read this and tick to confirm that you have.

Reducing Flood Risk in Hull - Hull and its immediate surroundings are at risk from river and tidal flooding and it also has a more complex system of watercourses and sewers than elsewhere in the region.

In this area, there are roughly 5,000 properties that are at risk of internal sewer flooding once in a 5-year period (in other words, they have a 20% chance of being flooded each year). Yorkshire Water would like to reduce the risk of 400 of these properties flooding to a once in 75 year period

To help achieve this, it wants to use less traditional ways of reducing the amount of rainwater it must deal with (e.g. permeable paving, green roofs etc.). It also plans to work in partnership with other organisations who manage flood risk to combine expertise.

The cost of providing this increased level of protection is an additional £30 million.
Benefits of this investment:

- **Reduced chance of sewer flooding for approximately 400 properties during severe rain that might occur once every 5 years and 550 properties during severe rain that might only occur once every 30 years**
- **Contribute to the health and wellbeing of the community using sustainable methods of managing flood risk.**

SINGLECODE
I have read this description.

Q1d. Please read this and tick to confirm that you have.

Reducing Water Lost Through Leaks - Yorkshire Water finds and fixes leaks on 44,000 miles of pipework – this includes nearly 21 million joints or potential points of weeps and seeps. Yorkshire Water has a target set by Ofwat to lose no more than 24% of the daily 1.2 billion litres of water it supplies through leaks and it's hitting this target. Yorkshire Water wants to reduce this by a further 40%.

Currently, Yorkshire Water spends £30 million finding and fixing leaks to meet the Ofwat target of 24% leakage.

To reduce leakage by another 40% and maintain this, it will need to spend another £325million

Benefits of this investment:

- **It would make Yorkshire Water's one of the best water companies in the country for leakage control.**
- **Yorkshire Water will take less from the environment, prevent wastage and ensure a continuous water supply**

SINGLECODE
I have read this description.

Q1e. Please read this and tick to confirm that you have.

Improving River Water Quality - Yorkshire Water follows rules and guidelines provided by its regulators, such as the Environment Agency (EA). The EA has stated that water companies must be better at removing Phosphorus from waste water at their sewage treatment works. Whilst Yorkshire Water meets current standards, the new standard poses a significant costs to the company.

Further removal of Phosphorous to the levels outlined by the EA would cost an additional £xm. This would improve 3km of river water to Moderate status from Poor. We are one ok the best in the UK for Phosphorous removal as 60% of our 6000km of rivers in Yorkshire, are classified as at good status.

Benefits of this investment:

- **Improved river water quality would mean improved biodiversity of rivers and the surrounding lands, plants and animals impacted by river water quality**

SINGLECODE
I have read this description.

Q1f. Please read this and tick to confirm that you have.

Infrastructure for New Towns - The population is growing, by 2045 we are expecting to have 1 million more people living in Yorkshire.

There are 3 new town developments planned over the next 20 years that will require new infrastructure to provide drinking water and waste water services. Whilst new water and waste water connections are part of Yorkshire Water's service, building the infrastructure for entire new towns is completely different and very expensive.

Therefore, Yorkshire Water would require £57million of additional investment to cope with the building of these new towns.

Benefits of this investment:

- **Provide a continuous high-quality water supply to new customers and to prevent water shortages for all**
- **Ensure they have enough capacity in the waste system to remove and treat additional waste water.**

SINGLECODE

I have read this description.

Q1g. Please read this and tick to confirm that you have.

New Customer Management System - Yorkshire Water manages customer service using its Customer Management System, but this is old and in need of replacement and isn't quite as clever as the company would like.

Currently, customers are happy with the service Yorkshire Water provides. However, a new Customer Management System will help it offer personalisation through a deeper understanding of customers' needs (e.g. it could identify customers who'd prefer a text to an email to let them know about works in their area, or automatically notify a customer of higher than normal water use in their home, potentially identifying leaks).

Purchasing a new smarter Customer Management System would cost £53million.

Benefits of this investment:

- **A personal service, so customers receive information when they want it, in the way they want it**
- **Costs will be reduced in the long run as automation will handle much of the calling the company has to do at the moment.**

SINGLECODE

I have read this description.

Q2. The following 7 screens show descriptions of the special factors in groups of 3.

From each group, please select the one you support most and the one you support least.

If you want to read the full description again, click on the relevant one at the bottom of the screen.

Please don't worry if you see the same description more than once.

FIRST MAXDIFF: BASED ON 7 FACTORS, EACH RESPONDENT WOULD SEE 7 SETS OF 3 ATTRIBUTES - THE 7 COST ADJUSTMENTS ARE;

- ***Maintaining Drinking Water Quality***
- ***Reducing Cellar Sewer Flooding***
- ***Reducing Flood Risk in Hull***
- ***Reducing Water Lost Through Leaks***
- ***Improving River Water Quality***
- ***Infrastructure for New Towns***
- ***New Customer Management System***

EXERCISE 1 - THE FOLLOWING TABLE SHOWS HOW EACH FACTOR SHOULD BE PRESENTED ON SCREEN

Special Factor	Maintaining Drinking Water Quality	Reducing Cellar Sewer Flooding	Reducing Flood Risk in Hull	Reducing Water Lost Through Leaks	Improving River Water Quality	Infrastructure for New Towns	New Customer Management System
Benefit	Improved water treatment at 5 sites	Cellar flooding reduced by 70%	Increased flood protection in Hull	Leakage reduced by 40%	Improved water in 3km of rivers	Infrastructure to cope with building 3 new town	New, smarter system purchased
Required total investment	£93 million	£163 million	£30 million	£325 million	£xm	£57million	£52million
Support most							
Support least							

ON EACH SCREEN, INCLUDE A LINK TO THE FULL TEXT SHOWN IN Q1 AS A DROP-DOWN SO RESPONDENTS CAN RE-READ IT IF THEY WISH TO.

Q3. We're now going to ask you to do the same exercise again, but this time in each description we've included how much it could potentially cost an average household customer if this investment was made.

From each group, please select the one you support most and the one you support least.

Of course this time you need to think about how much customers will be asked to pay when deciding which one to choose

SECOND PAIRWISE: BASED ON 7 FACTORS WITH BILL COST, EACH RESPONDENT WOULD SEE 11 SETS OF 2 ATTRIBUTES

- ***Maintaining Drinking Water Quality***
- ***Reducing Cellar Sewer Flooding***
- ***Reducing Flood Risk in Hull***
- ***Reducing Water Lost Through Leaks***
- ***Improving River Water Quality***
- ***Infrastructure for New Towns***
- ***New Customer Management System***

EXERCISE 2 - THE FOLLOWING TABLE SHOWS HOW EACH FACTOR SHOULD BE PRESENTED ON SCREEN

pecial Factor	Maintaining Drinking Water Quality	Reducing Cellar Sewer Flooding	Reducing Flood Risk in Hull	Reducing Water Lost Through Leaks	Improving River Water Quality	Infrastructure for New Towns	New Customer Management System
Benefit	Improved water treatment at 5 sites	Cellar flooding reduced by 70%	Increased flood protection in Hull	Leakage reduced by 40%	Improved water in 3km of rivers	Infrastructure to cope with building 3 new town	New, smarter system purchased
Required total investment	£93 million	£163 million	£30 million	£325 million	£xm	£57million	£52million

Change to an average household bill per year	0.3% increase, which is £1.20 per year (or 10p per month)	3.2% increase, which is £12.20 per year (or £1.02 per month)	0.1% increase, which is 40p per year (or 3p per month)	6.3% increase, which is £24.40 per year (or £2.03 per month)	£x per month	0.2% increase, which is 80p per year (or 7p per month)	0.3% increase, which is £1.20 per year (or 10p per month)
Support most							
Support least							

ON EACH SCREEN, INCLUDE A LINK TO THE FULL TEXT SHOWN IN Q1 AS A DROP-DOWN SO RESPONDENTS CAN RE-READ IT IF THEY WISH TO.

ADD THE FOLLOWING BILL IMPACT TO THE RELEVANT COST ADJUSTMENT CLAIM.

Maintaining Drinking Water Quality:
- ***This investment would mean an increase to the average household bill of 0.3% per year, which means it would cost £1.20 per household per year or 10p per month.***

Reducing Cellar Sewer Flooding
- ***This investment would mean an increase to the average household bill of 3.2% per year, which means it would cost £12.20 per household per year or £1.02 per month.***

Reducing Flood Risk in Hull
- ***This investment would mean an increase to the average household bill of 0.1% per year, which means it would cost 40p per household per year or 3p per month.***

Reducing Water Lost Through Leaks
- ***This investment would mean an increase to the average household bill of 6.3% per year, which means it would cost £24.40 per household per year or £2.03 per month.***

Improving River Water Quality
- ***This investment would mean an increase to the average household bill of x% per year, which means it would cost £x per household per year or xp per month.***

Infrastructure for New Towns
- ***This investment would mean an increase to the average household bill of 0.2% per year, which means it would cost 80p per household per year or 7p per month.***

New Customer Management System
- ***This investment would mean an increase to the average household bill of 0.3% per year, which means it would cost £1.20 per household per year or 10p per month.***

Q4. Thinking about these investments, would you be happy to pay....
SINGLECODE
Yes
No
Don't know

LOOP – RANDOMISE ORDER
- **£1.20 a year (10p a month) to Maintain Drinking Water Quality by improving 5 Pennine water treatment works?**
- **£12.20 a year (£1.02 a month) to Reduce Cellar Sewer Flooding**
- **40p a year (3p a month) to Reduce Flood Risk in Hull?**
- **£24.40 a year (£2.03 a month) to Reduce Water Lost Through Leaks by a further 40%?**
- **£x a year (xp a month) to Improve River Water Quality in 3km of river?**
- **80p a year (7p a month) to provide drinking and waste water Infrastructure for New Towns?**
- **£1.20 a year 10p a month so Yorkshire Water can purchase a New Customer management System?**

Section 2: About You

Finally, we'd like to find out a little more about you to help us understand the views of different types of customers.

D1. Including yourself, how many people aged 16 years old or older live in your household?
ENTER NUMBER
Prefer not to say

D2. How many people aged under 16 live in your household?
ENTER NUMBER
Prefer not to say

D3. Are you currently working?
SINGLECODE
Yes
No
Don't know
Refused

ASK D4 IF 'No' AT D3, OTHERS GOTO D5.
D4. Which of the following best describes your status? TICK ONE ONLY
SINGLECODE
Retired
At home raising family/housewife/house husband
Registered unemployed
Student in full time education
Other
Refused
Don't know

ASK ALL
D5. Please tick any of the following circumstances that you feel apply to your household, including yourself.
MULTICODE
Someone in my household has a long-term physical health condition
Someone in my household has a long-term mental health condition
In my household, English is not our first language

None of the above
Prefer not to say
Don't know

D6. Which of the following do you agree with most? TICK ONE ONLY
SINGLECODE
I don't really think about my water bill it's just something I have to pay
I worry about not being able to afford my water bill
I struggle to afford my water bill
I receive help to pay my water bill
Prefer not to say
Don't know

D7. Does your household currently receive any of the following benefits?
MULTICODE
Housing benefit
Jobseekers allowance
Working family tax credits
Child tax credits
Incapacity benefit
Pension Credit
Universal Credit
Disability Living Allowance
None
Prefer not to say
Don't know

THANK AND CLOSE

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6.2 Appendix 2 – Qualitative Materials

6.2.1 Services provided by Yorkshire Water (SHOWCARD)

- Providing clean and safe water to drink
- Ensuring there is always enough water supply
- Safe removal of waste water and sewerage
- Protecting you and the environment from sewer flooding
- Protecting and improving the water environment (rivers, sea)
- Customer services (call centre, engineers responding to incidents etc)

6.2.2 Cost Adjustment Claims with no bill impact (SHOWCARD)

Claim I

Maintaining Drinking Water Quality

There is more colour in the water Yorkshire Water collects in its reservoirs and rivers now than ever before. It's caused by rain water running off the peatlands, which are deteriorating in quality.

Highly coloured water is more difficult and costly to treat and increases the risk of failing water quality standards. Action is needed now to prevent water quality failures in the near future.

Yorkshire Water will need to invest in new treatment processes at 5 of its Pennine water treatment works to tackle highly discoloured water to ensure a secure supply of water from these sites in future.

An additional £93 million in funding would be needed to improve water treatment at these 5 sites.

Benefits of making this investment:

- Yorkshire Water's high standard for delivery of high quality drinking water will be maintained
- Reduced need to pump water from rivers.

Claim2

Reducing Cellar Sewer Flooding

This happens when sewers over flow and flood cellars. Ofwat wants all water companies to improve and to have a similar number of cellar sewer flooding incidents, but the Yorkshire region has more properties with cellars than the rest of the UK, making it a more costlier problem to fix.

To meet Ofwats requirements, Yorkshire Water would have to reduce sewer flooding in properties with cellars by 70%, this would cost an additional £163m.

Benefits of this investment:

- Sewer flooding in cellars will be reduced by 70%, benefitting customers
- Less emotional and financial stress for customers experiencing cellar flooding.

Claim3

Reducing Flood Risk in Hull

Hull and its immediate surroundings are at risk from river and tidal flooding and it also has a more complex system of watercourses and sewers than elsewhere in the region.

In this area, there are roughly 5,000 properties that are at risk of internal sewer flooding once in a 5-year period (in other words, they have a 20% chance of being flooded each year). Yorkshire Water would like to reduce the risk of 400 of these properties flooding to a once in 75 year period

To help achieve this, it wants to use less traditional ways of reducing the amount of rainwater it must deal with (e.g. permeable paving, green roofs etc.). It also plans to work in partnership with other organisations who manage flood risk to combine expertise.

The cost of providing this increased level of protection is an additional £30 million.

Benefits of this investment:

- Reduced chance of sewer flooding for approximately 400 properties during severe rain that might occur once every 5 years and 550 properties during severe rain that might only occur once every 30 years

- Contribute to the health and wellbeing of the community using sustainable methods of managing flood risk.

Claim4

Reducing Water Lost Through Leaks

Yorkshire Water has a target set by Ofwat to lose no more than 23% of the daily 1.2 billion litres of water it supplies through leaks and it's hitting this target. Yorkshire Water wants to reduce this by a further 40%.

Currently, Yorkshire Water spends £30 million finding and fixing leaks to meet the Ofwat target of 23% leakage.

To reduce leakage by another 40% and maintain this, it will need to spend another £325million

Benefits of this investment:

- It would make Yorkshire Water's one of the best water companies in the country for leakage control.

- Yorkshire Water will take less from the environment, prevent wastage and ensure a continuous water supply

Claim 5

Improving River Water Quality

Removed from Report

Claim 6

Infrastructure for New Towns

The population is growing, by 2045 we are expecting to have 1 million more people living in Yorkshire.

There are 3 new town developments planned over the next 20 years that will require new infrastructure to provide drinking water and waste water services. Whilst new water and waste water connections are part of Yorkshire Water's service, building the infrastructure for entire new towns is completely different and very expensive.

Therefore, Yorkshire Water would require £57million of additional investment to cope with the building of these new towns.

Benefits of this investment:

- Provide a continuous high-quality water supply to new customers and to prevent water shortages for all

- Ensure they have enough capacity in the waste system to remove and treat additional waste water.

Claim 7

New Customer Management System

Yorkshire Water manages customer service using its Customer Management System, but this is old and in need of replacement and isn't quite as clever as the company would like.

Currently, customers are happy with the service Yorkshire Water provides. However, a new Customer Management System will help it offer personalisation through a deeper understanding of customers' needs (e.g. it could identify customers who'd prefer a text to an email to let them know about works in their area, or automatically notify a customer of higher than normal water use in their home, potentially identifying leaks).

Purchasing a new smarter Customer Management System would cost £53million.

Benefits of this investment:

- A personal service, so customers receive information when they want it, in the way they want it

- Costs will be reduced in the long run as automation will handle much of the calling the company has to do at the moment.

6.2.3 Cost Adjustment Claims with bill impact revealed (SHOWCARD)

Claim 1 with bill impact

Maintaining Drinking Water Quality

There is more colour in the water Yorkshire Water collects in its reservoirs and rivers now than ever before. It's caused by rain water running off the peatlands, which are deteriorating in quality.

Highly coloured water is more difficult and costly to treat and increases the risk of failing water quality standards. Action is needed now to prevent water quality failures in the near future.

Yorkshire Water will need to invest in new treatment processes at 5 of its Pennine water treatment works to tackle highly discoloured water to ensure a secure supply of water from these sites in future.

An additional £93 million in funding would be needed to improve water treatment at these 5 sites.

Benefits of making this investment:

- Yorkshire Water's high standard for delivery of high quality drinking water will be maintained

- Reduced need to pump water from rivers.

This investment would mean an increase to the average household bill of 0.3% per year, which means it would cost £1.20 per household per year or 10p per month.

Claim 2 with bill impact

Reducing Cellar Sewer Flooding

This happens when sewers over flow and flood cellars. Ofwat wants all water companies to improve and to have a similar number of cellar sewer flooding incidents, but the Yorkshire region has more properties with cellars than the rest of the UK, making it a more costlier problem to fix.

To meet Ofwat's requirements, Yorkshire Water would have to reduce sewer flooding in properties with cellars by 70%, this would cost an additional £163m.

Benefits of this investment:

- Sewer flooding in cellars will be reduced by 70%, benefitting customers
- Less emotional and financial stress for customers experiencing cellar flooding.

This investment would mean an increase to the average household bill of 3.2% per year, which means it would cost £12.20 per household per year or £1.02 per month.

Claim 3 with bill impact

Reducing Flood Risk in Hull

Hull and its immediate surroundings are at risk from river and tidal flooding and it also has a more complex system of watercourses and sewers than elsewhere in the region.

In this area, there are roughly 5,000 properties that are at risk of internal sewer flooding once in a 5-year period (in other words, they have a 20% chance of being flooded each year). Yorkshire Water would like to reduce the risk of 400 of these properties flooding to a once in 75-year period

To help achieve this, it wants to use less traditional ways of reducing the amount of rainwater it must deal with (e.g. permeable paving, green roofs etc.). It also plans to work in partnership with other organisations who manage flood risk to combine expertise.

The cost of providing this increased level of protection is an additional £30 million.

Benefits of this investment:

- Reduced chance of sewer flooding for approximately 400 properties during severe rain that might occur once every 5 years and 550 properties during severe rain that might only occur once every 30 years

- Contribute to the health and wellbeing of the community using sustainable methods of managing flood risk.

This investment would mean an increase to the average household bill of 0.1% per year, which means it would cost 40p per household per year or 3p per month.

Claim 4 with bill impact

Reducing Water Lost Through Leaks

Yorkshire Water has a target set by Ofwat to lose no more than 23% of the daily 1.2 billion litres of water it supplies through leaks and it's hitting this target. Yorkshire Water wants to reduce this by a further 40%.

Currently, Yorkshire Water spends £30 million finding and fixing leaks to meet the Ofwat target of 23% leakage.

To reduce leakage by another 40% and maintain this, it will need to spend another £325million

Benefits of this investment:

- It would make Yorkshire Water's one of the best water companies in the country for leakage control.

- Yorkshire Water will take less from the environment, prevent wastage and ensure a continuous water supply

This investment would mean an increase to the average household bill of 6.3% per year, which means it would cost £24.40 per household per year or £2.03 per month.

Claim 5

Improving River Water Quality

Removed from Report

Claim 6 with bill impact

Infrastructure for New Towns

The population is growing, by 2045 we are expecting to have 1 million more people living in Yorkshire.

There are 3 new town developments planned over the next 20 years that will require new infrastructure to provide drinking water and waste water services. Whilst new water and waste water connections are part of Yorkshire Water's service, building the infrastructure for entire new towns is completely different and very expensive.

Therefore, Yorkshire Water would require £57million of additional investment to cope with the building of these new towns.

Benefits of this investment:

- Provide a continuous high-quality water supply to new customers and to prevent water shortages for all
- Ensure they have enough capacity in the waste system to remove and treat additional waste water.

This investment would mean an increase to the average household bill of 0.2% per year, which means it would cost 80p per household per year or 7p per month.

Claim 7 with bill impact

New Customer Management System

Yorkshire Water manages customer service using its Customer Management System, but this is old and in need of replacement and isn't quite as clever as the company would like.

Currently, customers are happy with the service Yorkshire Water provides. However, a new Customer Management System will help it offer personalisation through a deeper understanding of customers' needs (e.g. it could identify customers who'd prefer a text to an email to let them know about works in their area, or automatically notify a customer of higher than normal water use in their home, potentially identifying leaks).

Purchasing a new smarter Customer Management System would cost £52million.

Benefits of this investment:

- A personal service, so customers receive information when they want it, in the way they want it

- Costs will be reduced in the long run as automation will handle much of the calling the company has to do at the moment.

This investment would mean an increase to the average household bill of 0.3% per year, which means it would cost £1.20 per household per year or 10p per month.