PR24

NORTHUMBRIAN WATER living water | ESSEX&SUFFOLK WATER living water

A3-17 WINEP SEPTIC TANKS

NES31

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1. INTRODUCTION

Septic tanks provide primary treatment where settling and anaerobic digestion processes reduce solids and organics. Our asset design standards for septic tanks are to achieve primary treatment only. This enhanced business case describes our proposed approach for meeting the statutory requirement in the Urban Wastewater Treatment Regulations (1994) to provide secondary treatment for septic tanks where they discharge to surface water. This contributes towards the improved water quality in downstream surface waterbodies, supporting the move towards Good Ecological Status. This business case relates to 71 septic tanks, 68 of which are in the Northumbrian Water Region and 3 of which are in the Essex and Suffolk Region. Based on initial estimates provided in the WINEP Guidance we have 2 to 3 times more septic tanks than other companies have. We intend to invest a total of £45.340m on capital and £0.860m on opex over the AMP8 period.

2. NEED FOR ENHANCEMENT INVESTMENT

2.1. ALIGNMENT WITH STATUTORY PLANNING FRAMEWORKS

This business case is produced in accordance with the WINEP Statutory Planning Framework. The timing of investment is set out within the WINEP framework driver guidance[1] as shown in Table 1. We have a statutory requirement to provide secondary treatment to septic tanks which discharge to surface water to meet the requirements of the Urban Waste Water Treatment Regulations (UWWTR) 1994.

TABLE 1: WINEP FRAMEWORK DRIVER GUIDANCE AND LINK TO PR24 DATA TABLES

Driver code	Description	Legal obligation	Tier 1 outcome	PR24 data tables enhanced category
U_IMP7	Provide secondary treatment capable of achieving 40:60 BOD: suspended solids where a septic tank discharges to surface water. Deliver necessary improvements as soon as possible and by March 2030. Guidance on profiling was confirmed in an email from the Environment Agency's Price Review Team on 10 February 2023 which confirmed the as soon as possible (expected) date as being 31 March 2028. The backstop of 2030 would only apply if a scheme had some unavoidable factors that delayed delivery beyond March 2028.	Statutory	Water company actions to protect the environment from the effects of urban wastewater collection and discharges.	Septic tank replacements – treatment solution. Septic tank replacements – flow diversion.

Source: Environment Agency WINEP framework driver guidance

[1] Environment Agency, undated, PR24 WINEP driver guidance – Septic Tanks V0.3

2.2. SUMMARY OF COSTS

We will deliver our septic tanks programme through enhancement investment. We summarise the costs in Table 2 below.

TABLE 2: COSTS BY ENHANCEMENT LINE (TOTEX)

Enhancement lines	Capex (£M)	Opex (£M)	Total (£M)
Septic tank replacements – treatment solution	9.090	0.196	9.286
Septic tank flow diversions	36.390	0.664	37.054
TOTAL	45.340	0.860	46.340

We responded to a request from the Environment Agency in July 2023 suggesting changes to our environmental programme, including the delay of some septic tank investments and other elements. The Environment Agency has responded to some of our suggestions, but there is no agreed revised programme yet.

However, we expect that the updated guidance and requirements for septic tanks will mean changes to the phasing of septic tanks. We have provided some duplicate tables alongside our business plan to reflect the updated guidance (NES_BPT04) but these changes are not yet reflected in our business plan.

We expect the revised guidance to mean a reduction from £46.340m to **£24.2m** in our 2025-30 business plan, with the remainder of the investment being delivered in 2030-35 instead. We estimate that this would mean a **£0.80** per year reduction in wastewater bills in 2029/30 compared to our business plan.

This investment case, and our business plan, reflects **the full £46.340m** in 2025-30.

2.3. NEED FOR ENHANCEMENT EXPENDITURE IN AMP8

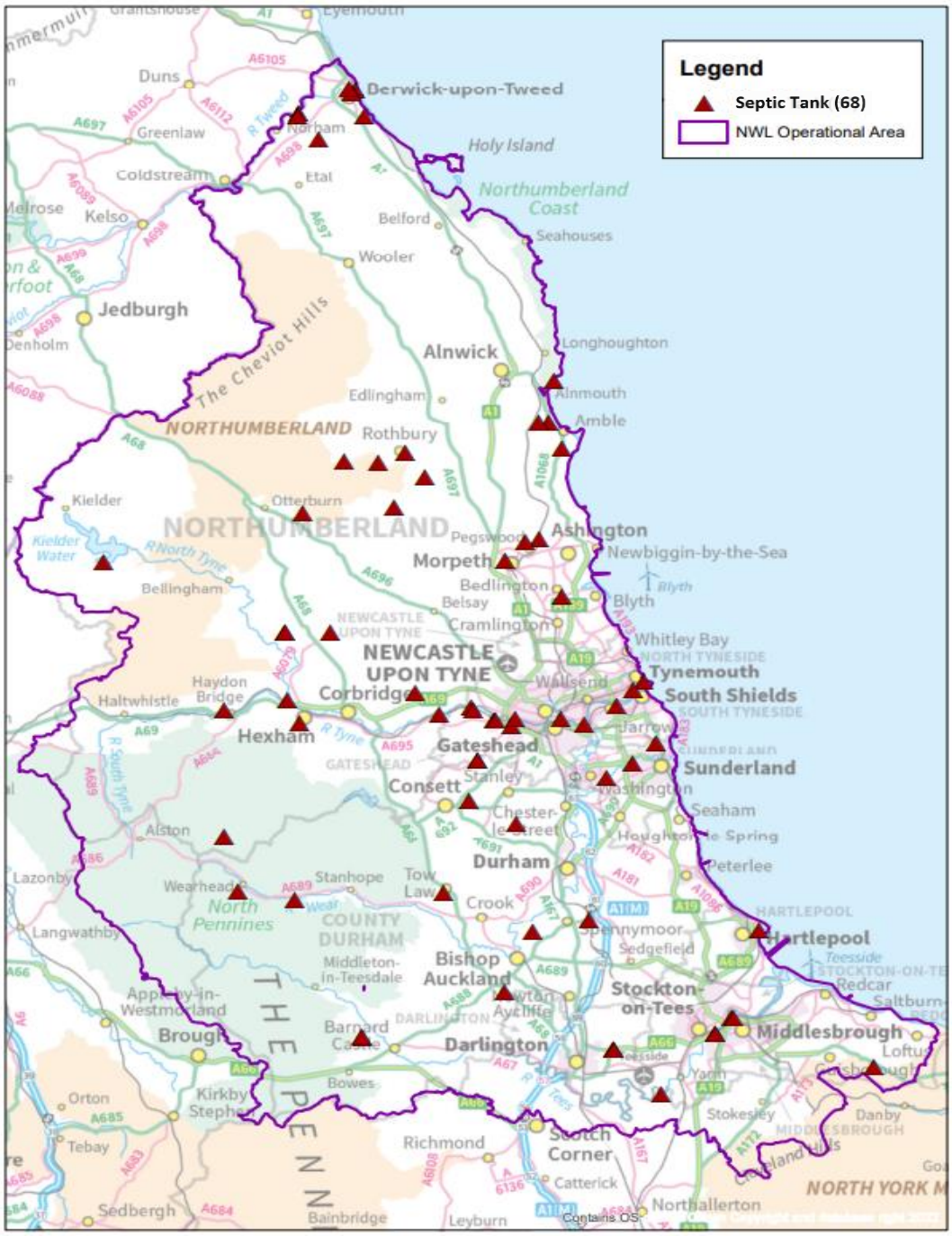
2.3.1 Process for identifying needs

We have followed the methodology set out in the WINEP driver guidance for septic tanks. Step 1 of the WINEP Options Development Guidance[2] requires us to confirm the environmental risks and issues to address. We have worked collaboratively with the Environment Agency to confirm the scale of investment required which is the number of septic tanks discharging to surface water. The Environment Agency provided an initial list of 50 septic tanks which we have compared against our asset records. Appendix A lists our 71 identified septic tanks; 68 of which are in the Northumbrian Water Region

[2] Environment Agency, July 2022, WINEP Options Development Guidance – Version 3

(**Error! Reference source not found.**) and three of which are in the Essex and Suffolk Region. This list was provided to t he Environment Agency in our WINEP submission in November 2022 and the final list was confirmed on 23 June 2023.

FIGURE 1: LOCATION OF SEPTIC TANKS DISCHARGING TO SURFACE WATER IN NORTHUMBRIAN WATER REGION



Source: Northumbrian Water

In accordance with the WINEP Options Development Guidance, we have also carried out an assessment of the environmental risks; including source protection zones and designated sites which can be found in our Outcomes Delivery Report. This has been used to assess the type of solution.

2.3.2 Overlaps with other investment programmes

We are not requesting enhancement investment for activities which were funded at previous price reviews. None of the proposed enhancement investment overlaps with activities funded through base expenditure. We are providing treatment to a higher standard (secondary treatment instead of primary) to protect surface water which is a statutory requirement. All the interventions relate to new assets.

There is one overlap with an S101A First Time Sewerage application which has been received for five properties (Railway Cottages) which could drain to the existing septic tank at Hagg Bank. Our optioneering has considered both separate and joint solutions, which is explained in section 3.3.2.

2.3.3 Link to long term strategy

This investment is needed as part of the 'protecting the local environment' investment area under our Long-Term Strategy (LTS) core pathway. We consider this as low/no regret investment because it is needed to meet statutory requirements in 2025-30. We have a legal obligation to deliver this investment by 2030 as this enhancement case includes only investment needed to meet statutory requirements for 2025-30 under the UWWTR in the WINEP. We therefore consider this investment necessary in 2025-30 to deliver our LTS.

As this enhancement case tackles septic tanks individually, there are unlikely to be further requirements in future investment periods. We include no further investigations on this topic. The timing of this investment is set by the Environment Agency and it reflects a no regrets approach. The programme is not likely to change in the future as part of an adaptive pathway.

2.3.4 Factors outside of our control

We responded to a request from the Environment Agency in July 2023[3] suggesting changes to our environmental programme, including the delay of some septic tank investments and other elements. The Environment Agency has responded to some of our suggestions, but there is no agreed revised programme yet.

However, we expect that the updated guidance and requirements for septic tanks will mean changes to the phasing of septic tanks. We have provided some duplicate tables alongside our business plan to reflect the updated guidance (NES_BPT04) but these changes are not yet reflected in our business plan.

[3]Environment Agency, July 2023, Information letter EA_16_2023 WINEP

We are not aware of any other factors outside of our control. There are no spend-to-save opportunities associated with this investment.

2.4. CUSTOMER SUPPORT FOR THE NEED

These projects are all a consequence of statutory requirements, and so we have not discussed the specific needs with customers. That is because our research shows that customers expect us to meet our statutory obligations, and it is not appropriate to discuss delaying or phasing investment where there are no alternatives to meet the statutory requirement to deliver our part of WINEP.

Our research shows that customers support investment in the environment, including wider environmental and social benefits – though they do not necessarily think they should always pay for this through their water and wastewater bills. In particular, our customers rank dealing with sewage effectively and improving the quality of rivers as two of their "medium" priorities (**prioritisation of common PCs**, NES44).

In our **qualitative affordability and acceptability testing** (NES49), customers supported our "preferred" plan which included these septic tanks improvements. Customers found this plan acceptable because it focused on the right things, is good for future generations, and is environmentally friendly. Customers who did not find this plan acceptable said that this was expensive, and water companies should pay out of their own profits. We did not ask specifically about septic tanks (as our individual items were limited only to the largest investments), but customers supported maintaining rivers and reducing pollution (NES49). In our **quantitative research** (NES50), 74% of customers supported our preferred plan, including this investment.

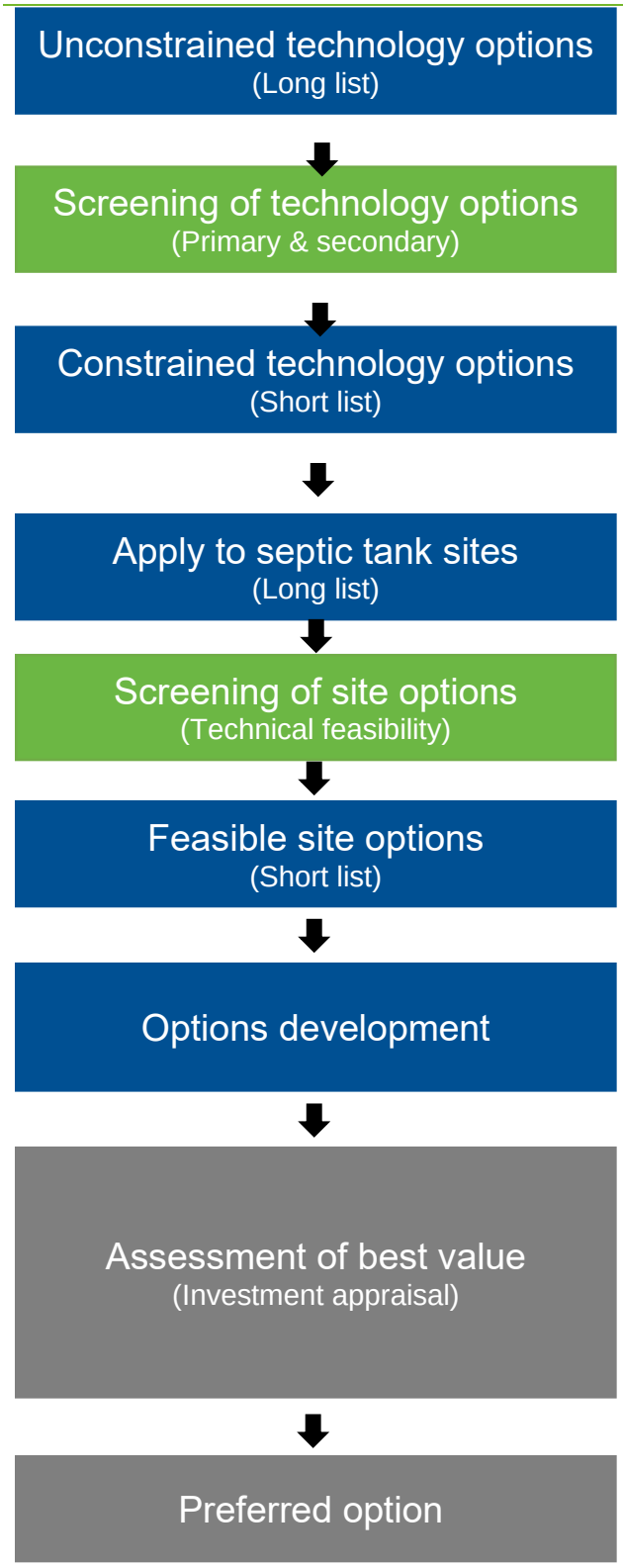
3. BEST OPTION FOR CUSTOMERS

Figure 2 shows our process for identifying the best option for customers which is based on the principles of the HM Treasury, The Green Book: Central Government Guidance on Appraisal and Evaluation[4] and the WINEP Options Development Guidance. A full description of each of the steps and the output from it is contained in the following sections.

Table 3 shows how we have met the WINEP Options Development Principles.

[4] HM Treasury, 2022, The Green Book, Central Government Guidance on Appraisal and Evaluation

FIGURE 2: PROCESS FOR DEVELOPING AND FILTERING OPTIONS



Unconstrained list of technology options (section 3.1)

We have developed a broad range of potential technology options in accordance with section 7.2.1 of the WINEP Options Development Guidance.

Constrained list of technology options (section 3.2.1)

We have screened the unconstrained list of technology option against:

1) expected to meet statutory obligation, and

2) technically feasible in accordance with section 7.2.2 of the WINEP Options Development Guidance.

Where we have multiple options of a similar type, we have used a proportional approach to screen out technology options which are obviously less natural capital benefits, higher costs, and higher carbon.

Unconstrained list of technology options for site options (section 3.2.2 and appendix A)

We have applied the constrained list of technology options to each of the septic tank sites and then screened this to make sure the technology is technically feasible to implement on a specific septic tank site (contributes towards the deliverability assessment).

For example, it is not possible to implement a gravity solution where the gradient does not allow it.

Options development (section 3.2.4)

We have developed scope to level 2 which contains a mixture of desktop assessments and an 11% sample of onsite surveys. We have used information from the surveys to extrapolate to the sites which have had a desktop assessment.

Assessment of best value (section 3.3 and Appendix B)

We have carried out an assessment of benefits and net present value for each of the options from the constrained list at each site using the guidance in section 7.3 of WINEP Options Development Guidance.

We have also assessed each option against the Wider Environmental Outcomes Metrics and a deliverability assessment as part of our benefits assessment in accordance with section 7.2 of WINEP Options Development Guidance.

Preferred option (section 3.3.2)

We have selected the preferred option and where we have not selected the least cost option we have explained why.

Source: Northumbrian Water

TABLE 3: WINEP OPTIONS PRINCIPLES

Expectation	How this has been met
Environmental net gain	We have carried out an assessment of environmental net gain options by assessing the potential environmental impacts including the natural environment, net zero, catchment resilience, access, amenity, and engagement of each option and monetised alongside the whole life cost, choosing the one that provides the greatest overall environmental benefit/cost ratio.
Natural capital	We have assessed each of our options against the full range of natural capital metrics and wider environmental objectives as part of our WINEP assessment to the Environment Agency. The measures that apply to our options are shown in Table 8. These have been quantified through our benefits assessment which is described in section 3.3.
Catchment and nature-based solutions	We have considered a range of nature-based solutions such as integrated constructed wetlands, reed beds, evaporation, facultative lagoons, and infiltration fields as shown in Figure 3.
Proportionality	We have taken a proportional approach to options development based on green book principles. Where there are more than three traditional treatment options, we have screened out those which have obviously less natural capital benefits, higher costs and higher carbon without undertaking a full benefits and cost assessment, which would require a level 2 optioneering scope. In the case of septic tanks, the monetary value of the water quality benefit is far more than the other natural capital benefits as the septic tanks tend to be very small. Further information is contained in the remainder of section 3.
Evidence	The evidence to our options is described within sections 3 and 4 of this document. We clearly record the reasons for discarding options. Further supporting evidence of our solutions development and our datasets are available in our Options Development Report and Options Assessment. Our WINEP submission has been independently audited by a third party (Jacobs) and there are no outstanding actions.
Collaboration	We have collaborated with the Environment Agency to define the list of sites. Collaboration with local stakeholders and planning authorities will occur as part of the delivery process.

Source: WINEP's options principles, Environment Agency

3.1. BROAD RANGE OF OPTIONS

3.1.1 Range of options to meet the need

We have developed a broad range of options as shown in Figure 3 which includes extra variants of the three options specified in the WINEP driver guidance for Septic Tanks and the government guidance[5] relating to small sewage discharges Rule 6 – that is:

- connect to a public sewer;
- replace your septic tank with a small sewage treatment plant; and
- install a drainage field (infiltration system) – a series of pipes with holes placed in trenches and arranged so that the wastewater can trickle through the ground for further treatment.

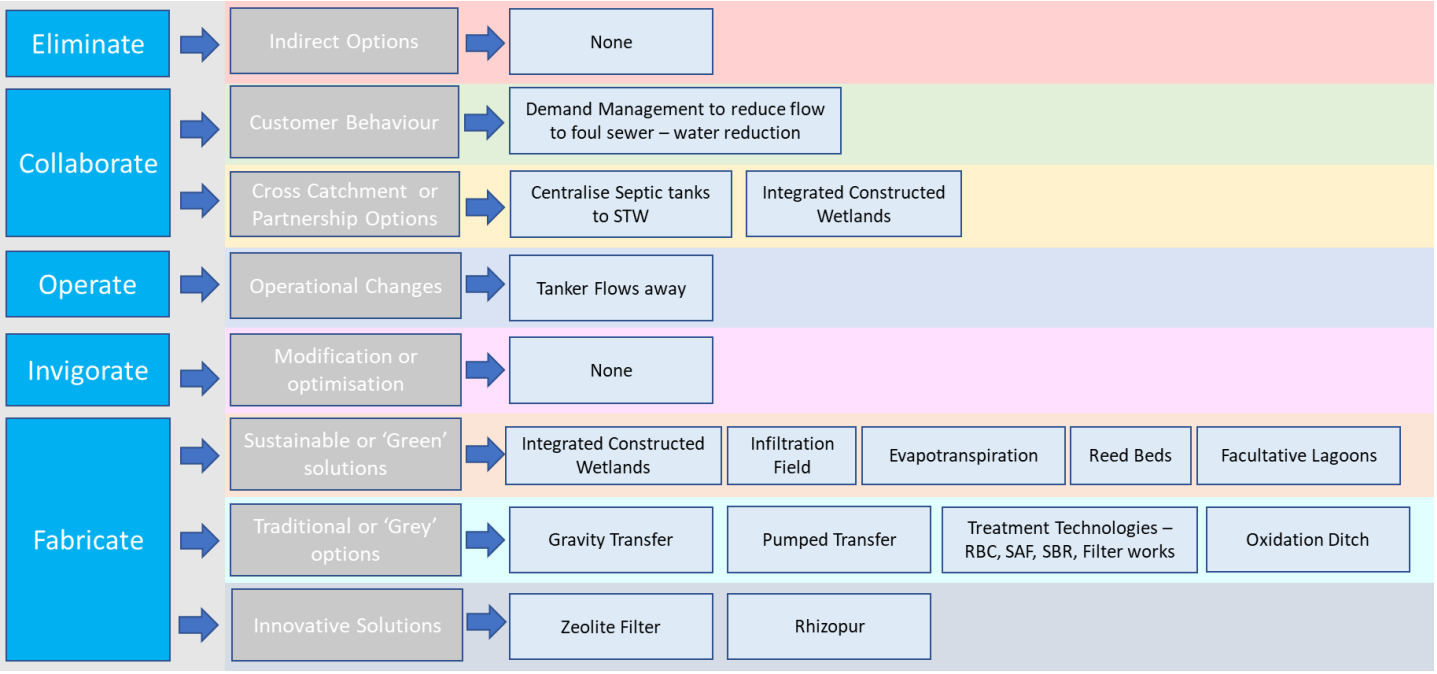
[5] GOV.UK, 2023, General binding rules: small sewage discharge to the ground

In accordance with the WINEP guidance, we have also considered sustainable low carbon solutions such as integrated wetlands, infiltration fields, reed beds (vertical and secondary/tertiary treatment), evapotranspiration and facultative lagoons. We have also considered changing the discharging of septic tanks from surface water to ground using an infiltration system.

Our broad range of options considers options with differing levels of costs and benefits categorised as follows:

- Eliminate - identification of processes and practices that can be stopped possibly by stakeholder management or other, and by challenging the need for existence. Eliminate options are likely to have the lowest costs to deliver the benefit. They may be used in combination with other options. For septic tanks, the provision of secondary treatment is a statutory requirement so it cannot be met through change in processes, practices or permits and eliminate options are not applicable.
- Collaborate - work with stakeholders to re-assign the issue or co-fund. Costs can be shared with third parties either to deliver the same or an extra level of social and environmental benefit.
- Operate - improved operational management practices to enhance existing capacity.
- Invigorate - invest in the existing infrastructure to improve performance. These options will provide an increased level of benefit and may be of a lower cost than fabricate options. In this case new infrastructure would be required to meet the standard for secondary treatment, so there are no options for invigorate.
- Fabricate - new assets to augment or replace existing. These options are likely to have the highest costs. Green options will have lower carbon and potentially higher biodiversity and amenity benefits. Traditional grey options are likely to have highest certainty that service-related benefits will be realised. Innovative options have the potential for greater benefits and lower costs but have a lower certainty that benefits will be realised. We have considered options such as zeolite filters, rhizopur and sequential bioreactors.

FIGURE 3: INTERVENTIONS FRAMEWORK CONSIDERING RANGE OF APPLICABLE INTERVENTIONS



Source: Northumbrian Water

3.2. PRIMARY AND SECONDARY SCREENING OF OPTIONS

3.2.1 Primary and secondary screening of technologies at a programme level

In accordance with the WINEP options assessment guidance[6] section 6, we have carried out screening of each of the technology options shown in Figure 3 to make sure the option is:

- expected to meet the statutory obligation; and
- technically feasible (to implement the option).

If the option does not meet these criteria, then the option is discarded. The results and reasons for discarding interventions are shown in Table 4.

We then undertook secondary screening to understand which of the technologies were higher in cost, carbon and those that delivered less benefit compared to other options. The results are shown in Table 4.

[6]Environment Agency, March 2022, WINEP Options Assessment Guidance

TABLE 4: PRIMARY SCREENING OF OPTIONS AGAINST NEED AND TECHNICAL FEASIBILITY

Option	Meets Statutory Obligation?	Technically Feasible?	Reason for discarding	PR24 data table line
Continue business as usual	No	Yes	**Discarded** – does not keep to statutory guidance to provide secondary treatment.	-
Demand management to reduce flow to foul sewer Water reduction.	Part	Yes	**Carried forward** - considered as part of the overall demand management strategy and in combination with other options. The level of flow reduction is likely to be negligible.	-
Tanker flows away Tanker flows to another STW.	No	Yes	**Discarded** – This option is deemed not feasible and does not keep to statutory guidance to provide secondary treatment. The creation of a cess pit to enable tankering would require planning permission and permitting[7].	-
Centralise septic tanks to STW Combine 2 or more septic tank sites into a new larger works to achieve efficiencies of scale.	Yes	Yes	**Carried forward**	Septic tank replacements – flow diversion
Integrated wetlands Tertiary wetland to achieve increased biological treatment.	Yes	Yes	**Carried forward**	Septic tank replacements – treatment solution
Infiltration field Discharge of the septic tank to ground rather than surface water using an infiltration system.	Yes	Yes	**Carried forward**	Septic tank replacements – treatment solution
Evapotranspiration Disposal of wastewater into the atmosphere through evaporation from transpiration from reed beds. Implemented in conjunction with reed beds.	No	No	**Discarded –** unproven technology in this configuration and it requires significant land (circa 91m^2 for every one population equivalent).	Septic tank replacements – treatment solution

[7]GOV.UK, 2023, Septic tanks and sewage treatment plants: what you need to do: Your property has a cesspool - GOV.UK (www.gov.uk)

Option	Meets Statutory Obligation?	Technically Feasible?	Reason for discarding	PR24 data table line
Vertical flow reed beds Septic Tank effluent is dosed via a network of pipes. The effluent percolates vertically down through the media and is collected by drainage pipes that discharge to the watercourse.	Yes	Yes	**Carried forward**	Septic tank replacements – treatment solution
Reed beds – secondary or tertiary This would be in addition to converting the existing septic tank to primary treatment process.	No	No	**Discarded -** no confidence that this will achieve the standard.	Septic tank replacements – treatment solution
Facultative lagoons Waste stabilisation pond for biological treatment of wastewater.	Part	Yes	**Carried forward** – can be used instead of an integrated constructed wetland as land take is similar.	Septic tank replacements – treatment solution
Gravity transfer Transfer flow to another STW using gravity.	Yes	Yes	**Carried forward**	Septic tank replacements – flow diversion
Pumped transfer Transfer flow to another STW using pumping.	Yes	Yes	**Carried forward**	Septic tank replacements – flow diversion
Treatment technologies – Package STW Using rotating biological filter or submerged aerated filter or biological filtration.	Yes	Yes	**Carried forward**	Septic tank replacements – treatment solution
Treatment technologies – Oxidation ditch Provide an oxidation ditch for secondary treatment.	Yes	Yes	**Carried forward** from primary screening and **Discarded** from secondary screening. Oxidation ditches in all cases cost more to construct (more concrete) and operate (higher energy costs) than other packaged treatment technologies. In terms of natural capital, they have more embedded carbon due to more concrete and more operational carbon due to high energy use aerators. Benefits to water quality and other natural capital measures are the same as other traditional treatment technologies.	Septic tank replacements – treatment solution

Option	Meets Statutory Obligation?	Technically Feasible?	Reason for discarding	PR24 data table line
Treatment technologies – Sequencing Batch Reactor (SBR) A type of activated sludge batching process that aerates a sewage/activated sludge mixture, settles and then refills sequentially.	Yes	Yes	**Carried forward** from primary screening. **Discarded** from secondary screening. SBRs cost more to construct and have a higher energy requirement (higher carbon and higher opex costs) than other packaged wastewater treatment technologies and would deliver the same benefit to water quality.	Septic tank replacements – treatment solution
Zeolite filter Previously offered by a supplier, Zeolite was an innovative trial product based on a filter media used more commonly in water treatment.	No	No	**Discarded** – this is new and innovative but as yet unproved technology. In addition, it is likely to be of a higher cost to implement than other secondary treatment technology which means it would have been screened out through secondary screening.	Septic tank replacements – treatment solution
Rhizopur A combination of a trickling filter with infiltration beds planted with reeds.	No	No	**Discarded** – this is new and innovative but as yet unproved technology. In addition, it is likely to be of a higher cost to implement than other secondary treatment technology which means it would have been screened out through secondary screening.	Septic tank replacements – treatment solution

Source: Northumbrian Water

3.2.2 Application of technology options to septic tank sites

Ten standalone and two combination technology options were taken forward from Table 4 and applied to the 71 septic tank sites. In accordance with the WINEP Options Development Guidance, we screened each site against the potential technology options to identify whether it was technically feasible to implement that technology on each site. For each septic tank site, we applied the following screening criteria:

- **Land availability**: Is there sufficient green space available in the locality in which to construct a biological filter, a package sewage treatment works (STW), a wetland or a vertical flow reed bed to replace the septic tank? If not, the option is not technically feasible and will not meet the need.
- **Gravity Transfer**: Is the nearest sewer on the network at a lower level than the septic tank? If not, a gravity sewer is not a feasible option, and a pumped option should be considered.
- **Infiltration systems**: Does the septic tank location meet the government general binding rules for discharging to groundwater which include:
    - is the discharge of 2 m^3/day or less;
    - is the location in a groundwater source protection zone?;
    - is the location within an ancient woodland?; and
    - is the location within 50m of a (1) special area of conservation, (2) special protection area, (3) Ramsar wetland site or (4) biological site of special scientific interest?

  If these rules are not met, then an infiltration system is not technically feasible to implement.
- **Combine with another septic tank solution**: Is there another septic tank within 1km for which a combined solution could be considered. Combining flows to be treated by a single package plant or transfer by a single pumping station will provide more efficient capex and opex costs. We used GIS processes to identify 26 sites in 12 groupings where there were multiple septic tanks within 1km of each other. We also identified that there was a private septic tank which has submitted a first-time sewerage application at Hagg Bank within 1km of one of our septic tanks.

The result of the screening is shown in Table 5 and there were 12 sites which only had one technically feasible option remaining after the initial screening. All technically feasible options were taken forward for options development.

TABLE 5: PRIMARY SCREENING FOR SEPTIC TANKS

Septic Tank Name	WINEP action ID	Centralise septic tanks	Biological Filter	Package RBC	Package SAF	Pumped Transfer	Gravity Transfer	Integrated Wetlands/ Facultative Lagoons	Vertical Flow Reed Beds	Infiltration Field
ALBANY RD./SALTMEADOWS RD.	08NW100016	No	No	No	No	Yes	Yes	No	No	No
ALBION INN ST	08NW100017	No	No	No	No	Yes	Yes	No	No	No
ATTWOOD TERRACE ST (Attwood Place)	08NW100075	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
BARMSTON RIVERSIDE	08NW100018	No	No	No	No	Yes	Yes	No	No	No
BEACON HILL No.1 ST	08NW100019	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BEACON HILL No.2 ST	08NW100020	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BEACON HILL No.3 ST	08NW100021	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BEDLINGTON BANK TANK	08NW100022	No	No	No	No	Yes	Yes	No	No	No
BILDERSHAW ST	08NW100123	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BLAYDON GLASS ST	08NW100024	Yes	No	No	No	Yes	Yes	No	No	No
BOTHAL COTTAGE	Agreed as a late addition	No	Yes	Yes	Yes	Yes	Yes	No	No	No
BOWLING GREEN & RIFLE RANGE (Berwick)	08NW100025	Yes	No	No	No	Yes	No	No	No	No
BRIDGE TERRACE ST (Berwick)	08NW100026	Yes	No	No	No	Yes	Yes	No	No	No
BRITANNIA TESTING STATION	08NW100027	Yes	No	No	No	Yes	No	No	No	No
BROTHERLEE ST	08NW100076	No	No	No	No	Yes	No	No	No	No
E.W.S. OFFICES	08NW100028	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No

Septic Tank Name	WINEP action ID	Centralise septic tanks	Biological Filter	Package RBC	Package SAF	Pumped Transfer	Gravity Transfer	Integrated Wetlands/ Facultative Lagoons	Vertical Flow Reed Beds	Infiltration Field
EAST CASTLE NORTH ST	08NW100080	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
ELSDON TANK (Town Foot)	08NW100029	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
ETAL	08NW100030	No	No	No	No	Yes	No	No	No	No
FONTBURN 2 RESERVOIR HOUSE	08NW100031	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
FOXTON HALL ST	08NW100032	No	No	No	No	Yes	No	No	No	No
FRIARSIDE CRESCENT STW	08NW100033	No	No	No	No	Yes	No	No	No	No
GAS LANE, BLAYDON ST	08NW100034	Yes	No	No	No	Yes	Yes	No	No	No
GUNNERTON WTW (new mess rm)	08NW100035	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
GUNNERTON WTW (The Cottage and old mess rm)	08NW100036	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
HAGG BANK	08NW100037	Yes	No	No	No	Yes	No	No	No	No
HALLINGTON RES ST (Crawley Cottages)	08NW100081	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
HEPPLE	08NW100038	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
HERBERT TERRACE	08NW100083	No	No	No	No	Yes	No	No	No	No
HETTON LYONS ST	08NW100039	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
HEUGH HOUSES	08NW100040	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
HORNCLIFFE 1, 2 & 3 (NORTH)	08NW100041	Yes	No	No	No	Yes	No	No	No	No
HORNCLIFFE SOUTH	08NW100042	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No

Septic Tank Name	WINEP action ID	Centralise septic tanks	Biological Filter	Package RBC	Package SAF	Pumped Transfer	Gravity Transfer	Integrated Wetlands/ Facultative Lagoons	Vertical Flow Reed Beds	Infiltration Field
JARROW BRIDGE (Bedes World)	08NW100043	No	No	No	No	Yes	Yes	No	No	No
LANGHAM HIGH LIFT PS*	08ES100210	Yes	No	No	No	Yes	No	No	No	No
LANGHAM LOW LIFT PS*	08ES100211	Yes	No	No	No	Yes	No	No	No	No
LARTINGTON No.1 ST	08NW100085	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
LARTINGTON No.2 ST (Cotherstone ST)	08NW100086	Yes	No	No	No	Yes	No	No	No	No
LOCKWOOD RES RECREATION ST (Lockwood Beck)	08NW100044	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
LONGHIRST COLLIERY 1	08NW100045	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
LONGHIRST COLLIERY 2	08NW100046	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
LONGRIGG (Swallwell) ST	08NW100047	Yes	No	No	No	Yes	Yes	No	No	No
LOW WORSALL ST	08NW100048	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
MARSKE MACHINE COMPANY	08NW100049	Yes	No	No	No	Yes	No	No	No	No
MIDDLETON BEACH HARTLEPOOL	08NW100051	No	No	No	No	Yes	No	No	No	No
MOOR COURT	08NW100052	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
NEWMINSTER TERRACE ST (Morpeth)	08NW100087	No	No	No	No	Yes	No	No	No	No
OLD PARK TERRACE ST (Byers Green)	08NW100088	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
PEAR TREE	08NW100053	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
PIER COTTAGES (Spanish Battery)	08NW100054	No	No	No	No	Yes	Yes	No	No	No

Septic Tank Name	WINEP action ID	Centralise septic tanks	Biological Filter	Package RBC	Package SAF	Pumped Transfer	Gravity Transfer	Integrated Wetlands/ Facultative Lagoons	Vertical Flow Reed Beds	Infiltration Field
RADCLIFFE ROAD	08NW100055	No	No	No	No	Yes	No	No	No	No
RAILTRACK SIGNALLING BOX	08NW100056	Yes	No	No	No	Yes	No	No	No	No
ROTHBURY ST CARAVAN PARK	08NW100057	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
RYTON WILLOWS ST	08NW100058	Yes	No	No	No	Yes	No	No	No	No
SCREMERSTON	08NW100059	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
SHORES DEAN	08NW100060	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
SOUTH HYLTON ST	08NW100061	No	No	No	No	Yes	Yes	No	No	No
THE LEE, (Embleton Terrace)	08NW100062	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
TOMMY THE MILLERS FIELD (Castlegate)	08NW100063	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
TOSSON TANK	08NW100089	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
TURSDALE ST (Old Mill/Metal Bridge)	08NW100065	No	No	No	No	Yes	No	No	No	No
WALPOLE*	08ES100214	No	No	No	No	Yes	No	No	No	No
WAPPING STREET ST (Comical Corner)	08NW100066	No	No	No	No	Yes	Yes	No	No	No
WARDEN VILLAGE	08NW100067	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
WARKWORTH HELSAY FARM ST	08NW100068	No	No	No	No	Yes	No	No	No	No
WARKWORTH WTW ST (bungalows 1&2)	08NW100069	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
WEARHEAD WTW ST (Site Klargester)	08NW100070	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No

Septic Tank Name	WINEP action ID	Centralise septic tanks	Biological Filter	Package RBC	Package SAF	Pumped Transfer	Gravity Transfer	Integrated Wetlands/ Facultative Lagoons	Vertical Flow Reed Beds	Infiltration Field
WHICKHOPE (Kielder)	08NW100071	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
WHITTLE DENE WTW	08NW100090	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
WYNDON BURN ST (Wyndon burn house)	08NW100073	No	No	No	No	Yes	No	No	No	No
ZENITH PLUMBPOINT (Vickers)	08NW100072	Yes	No	No	No	Yes	Yes	No	No	No

Note: Sites marked with an "*" are Essex & Suffolk Water sites
Source: Northumbrian Water

3.2.3 Synergies or overlaps covering more than one need

A number of sites only had one option. We used GIS processes to identify septic tanks which are located within 1km of each other, to identify whether it is feasible to identify solutions which would address more than one need and provide a more cost-effective way than delivering them separately. Table 6 sets out where we were able to identify extra interventions to combine more than one septic tank need. Where physical limitations are given as a reason, we discarded the centralising of options based on the difficulty of routing pipelines around properties or features, multiple pumping stations and so on.

TABLE 6: SOLUTIONS ADDRESSING MORE THAN ONE NEED

Grouped septic tank sites	Tanks within 1 km	Solution 1	Solution 2	Solution 3	Rejection rationale
Beacon Hill No.1 St Beacon Hill No.2 St Beacon Hill No.3 St	3	Combined Septic Tank Influent into Biological treatment using the existing outfall.	Combined Septic Tank Influent to common transfer PS to existing sewer network.	Combined Septic Tank Influent to common transfer PS to existing STW.	**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.
Bowling Green & Rifle Range (Berwick) Bridge Terrace St (Berwick) Tommy The Millers Field (Castlegate)	3	No technically feasible options combining all three site where identified			**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.
Britannia Testing Station Marske Machine Company	2	No technically feasible options combining all three site where identified			**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.
E.W.S. Offices Railtrack Signalling Box	2	Transfer via influent pumped rising main to combine flows to a new Biological Treatment STW.	Transfer via influent pumped rising main, combine flows into a new transfer PS to transfer flows to existing sewer network.		**Carried forward** – solution 1
Longhirst Colliery 1 Longhirst Colliery 2	2	No technically feasible options combining all three site where identified			**Discarded** - physical limitations in location.
Longrigg (Swallwell) St Zenith Plumbpoint (Vickers)	2	No technically feasible options combining all three site where identified			**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.

Grouped septic tank sites	Tanks within 1 km	Solution 1	Solution 2	Solution 3	Rejection rationale
Blaydon Glass St Gas Lane, Blaydon St	2	No technically feasible options combining all three site where identified			**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.
Moor Court Ryton Willows St	2	No technically feasible options combining all three site where identified			**Discarded** – secondary screening. The difficulty of routing pipelines around properties or features, multiple pumping stations etc. would add significant costs compared with separate options.
Lartington No.1 St Lartington No.2 St (Cotherstone St)	2	Transfer via. separate pumped mains to a new Infiltration Field to east of WTW boundary.	Transfer via. separate pumped mains to a new STW to east of WTW boundary.		**Carried forward** – solution 1
Horncliffe 1, 2 & 3 (North) Horncliffe South	2	Transfer Horncliff North FE pumped main to new site and transfer Horncliffe South FE pumped main (250m) to new site, combined FE to Vertical Flow Reed Beds site on agricultural land to east Horncliffe South with new outfall.	Transfer Horncliff North FE pumped main to new site and transfer Horncliffe South FE pumped main (250m) to new site, combined FE to Biological treatment site on agricultural land to east Horncliffe South with new outfall.		**Carried forward** – solution 1
Gunnerton WTW (New Mess Rm) Gunnerton WTW (The Cottage and Old Mess Rm)	2	Transfer Gunnerton (The Cottage & Old Mess RM) to Gunnerton WTW (New Mess Rm) FE via gravity (based on Google Earth profile), transfer combined FE flows pumped main to new Constructed Wetland site to east of WTW site boundary on NWG owned land or acquire land with new outfall to watercourse.	Transfer Gunnerton (The Cottage & Old Mess RM) to Gunnerton WTW (New Mess Rm) Influent via gravity (based on Google Earth profile), transfer combined influent flows pumped main to new biological treatment STW site to east of WTW site boundary on NWG owned land or acquire land.		**Discarded** – high level costings showed solution to be higher cost than preferred option in WINEP, site already has alternative options for consideration.

Grouped septic tank sites	Tanks within 1 km	Solution 1	Solution 2	Solution 3	Rejection rationale
Langham High Lift PS Langham Low Lift PS	2	Transfer via. separate rising mains to new Biological treatment site to east of WTW boundary with new outfall.	Transfer via. separate rising mains to new Infiltration Field site to east of WTW boundary.		**Carried forward** – solution 1
Hagg Bank (NWL septic tank) and s101A Hagg Bank (private septic tank)	2	Provide a separate solution for Hagg Bank	Pumping flows from both the private septic tank and the NWG septic tank, to a local gravity sewer approximately 200 metres to the west of Hagg Bank, which flows to Howdon STW.		**Carried forward**

Source: Northumbrian Water

3.2.4 Options Development process/deliverability assessment

For each of the options, we developed a list of scopes from our desktop assessments. We also carried out a deliverability assessment in accordance with the WINEP. We visited 11% of the sites to check our assumptions on land availability from the desktop assessment.

In the optioneering process we have made the following assumptions:

- The existing septic tank asset condition is suitable for continued use where tertiary nature-based solutions are proposed; any remedial work to existing assets will be covered under base expenditure.
- Where a transfer solution is preferred, we assume that the site can be accessed easily, and the transfer solution can be designed from the existing septic tank.
- Where the site reviewed was determined urban, we assume that treatment options are not feasible due to construction, access/covers, kiosk/controls.
- Where a green space exists and a treatment option is determined feasible, we assume that a manhole can be constructed over the incoming sewer, a nominal pipework length allowed to and from the treatment process and a nominal pipework length allowed back to a manhole built over the outgoing sewer. We assume that the outgoing sewer/outfalls are in adequate condition.
- Where PE or flow information is not available, we make an allowance based on the average (PE 10).
- If the site is in a green space and it meets the 'General binding rules: small sewage discharge to the ground' government guidance, then a drainage field is determined as feasible. If not, the infiltration system / drainage field solution is determined unfeasible.
- If the site is in a green space, we assume that biological filters, Package STW RBC and SAF, Transfer by gravity or pumped, constructed wetlands and vertical flow reed beds are feasible options.
- If the site is in an urban space, we assume that transfer by gravity or pumped are the only feasible solutions.

3.3. BEST VALUE

3.3.1 Benefit scoring

For each of the technology options carried forward to this stage we conducted a benefits assessment using our value framework which contains performance commitments, wider environmental outcomes[8] and other metrics. In this assessment we have applied the remaining two WINEP assessment criteria:

- how they contribute to the WINEP Wider Environmental Outcomes; and
- the likelihood that the benefits will be realised (deliverability).

[8]Environment Agency, March 2022, WINEP Options Assessment Guidance

We have incorporated the Wider Environmental Outcomes Metrics[9] into our Value framework, which is embedded into our portfolio optimisation tool, Copperleaf, used to carry out the appraisal of options. Table 7 shows the range of benefits, the quantification and monetisation values we have used for the assessment of septic tanks. These include carbon impact (operational and embedded), natural capital and other benefits. All values in our value framework reflect PR19 values, but as they have been used consistently across options, they do not affect the choice of option.

TABLE 7: RANGE OF BENEFITS IDENTIFIED FOR SEPTIC TANKS

Value measures	Description	Unit	Value	WEO	Performance Commitment
Improved water environment	Length of water environment improved.	Km	Not monetised in VM**	Yes	No
Biodiversity net gain	Change in biodiversity units (BU).	BU	Not monetised in VM	Yes	Yes
Pollution Category 3	Number of pollution incidents.	Num	£1,738 £224,187	No	Yes - Avoided benefit
Treatment Works Performance	Descriptive treatment works failure.	Num	£918	No	Yes - Avoided benefit
Amenity (negligible)	Amenity	Ha	-	Yes	No
Operational Carbon	t/CO2e /year	tCO2e	£256.2*	Net zero	Yes – GHG
Embedded Carbon	t/CO2e /year	tCO2e	£256.2*	Net zero	No

Notes: *£ value per tonne of CO2e in 2025/26, annual increase (varying rate) reaching £378.6/t CO2e in 2024/55

** An annual value of £16,869 per km (£22,493 multiplied by a assumed confidence in level of 0.75) can be included in Copperleaf using a dummy model if externally calculated using the 'Benefits Assessment Tool'

Source: Northumbrian Water

In Table 8, we show that first we score the impact of continuing business as usual and then we score each of the relevant options. Benefits are scored over time for a 30-year time horizon. This scoring takes into account the certainty of benefits being realised for different types of options. Each of the technology options for an individual site are designed to deliver the same length of water environment improved (1km), because the requirement is to deliver a treatment standard of 40 BOD or 60 suspended solids. The area required for a wetland or reed bed is very small, circa 0.0004 hectares, therefore the biodiversity and amenity benefits are negligible when compared to water quality and carbon benefits. The differentiators for this business case are carbon and cost.

[9]Environment Agency, 07.04.2022, WINEP Wider Environmental Outcome Metrics V2.1

TABLE 8: BENEFITS FOR EACH OPTION

Options carried forward	NWG value framework measures	WINEP wider environmental outcomes
Continue business as usual As is position	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution	For each of the options we score the as is position and the to be position against the benefits.
Centralise septic tanks to STW	Water quality (Improved Water Environment) Embedded carbon emissions. Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero
Integrated wetlands	Water quality (Improved Water Environment) Biodiversity Embedded carbon emissions Operational carbon emissions Amenity (recreation) - negligible Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero Amenity access and engagement
Infiltration field	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero
Vertical flow reed beds	Water quality (Improved Water Environment) Biodiversity Embedded carbon emissions Operational carbon emissions Amenity (recreation) - negligible Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero Amenity access and engagement
Gravity transfer	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance Amenity (less disruption from tankering) – negligible	Natural environment Catchment resilience Net zero
Pumped transfer	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance Amenity (less disruption from tankering) – negligible	Natural environment Catchment resilience Net zero

Options carried forward	NWG value framework measures	WINEP wider environmental outcomes
Treatment technologies – Rotating biological contactor	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero
Treatment technologies – Submerged aerated filter	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero
Treatment technologies – biological filter	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero
Treatment technologies – SBR	Water quality (Improved Water Environment) Embedded carbon emissions Operational carbon emissions Pollution Treatment Works Performance	Natural environment Catchment resilience Net zero

Source: Northumbrian Water

3.3.2 Cost benefit appraisal to select preferred option

For each of the technically feasible options we have conducted a robust cost benefit appraisal within our portfolio optimisation tool to select the preferred option. This calculates a net present value (NPV) over 30 years in accordance with the PR24 Guidance and a cost to benefit ratio for each option. The ratio is calculated by dividing the present value of the profile of benefits by the present value of the profile of costs over the appraisal period of 30 years.

Costs and benefits have been adjusted to 2022-23 prices using the CPIH Index financial year average. The impact of financing is included in the benefit to cost ratio calculation. Capital expenditure has been converted to a stream of annual costs, where the annual cost is made up of depreciation/RCV run-off costs and allowed returns over the life of the assets. Depreciation (or run-off) costs are calculated using the straight-line depreciation over the appraisal period. To discount the benefits and costs over time, we have used the social time preference rate as set out in 'The Green Book'.

We have run optimisations to select the least cost based on private values only and the best value using private and societal values. The output of this assessment and the cost benefit ratios are included in Appendix B. For 66 sites, the least cost and best value alternatives were the same. Table 9 shows our least cost and the best value option we are now proposing. The vertical reed beds produce a higher carbon benefit. For Longhirst Colliery 1 over a 30-year period it costs £0.009m extra to invest in vertical flow reed beds than a biological filter. The extra carbon reduction generated by the vertical reed

bed is 933.27 t/CO2e and in monetary terms customers value this as worth £0.224m. Therefore, it represents best value to invest an extra £0.009m to get £0.224m of carbon reduction benefit of 933.27 t/CO2/e.

TABLE 9: SITES WITH DIFFERENT LEAST COST AND BEST VALUE OPTIONS

Site	Least cost option	Best value option	30 Year totex variance £m	Carbon societal value variance £M	Carbon variance t/CO2e
Longhirst Colliery 1	Biological filter	Vertical flow reed bed	0.009	0.224	933.27
Old Park Terrace	Biological filter	Vertical flow reed bed	0.090	0.099	411.57
Shores Dean	Biological filter	Vertical flow reed bed	0.058	0.235	978.07
The Lee	Biological filter	Vertical flow reed bed	0.072	0.189	786.05
Warden Village	Biological filter	Vertical flow reed bed	0.080	0.114	472.70
Total			0.309	0.861	3,581.66

Source: Northumbrian Water

Table 10 shows that by investing an extra £357k in capex in AMP8 which would give us a carbon benefit of £861k. Therefore, our preferred option is to choose the best value option which would give us 3,581.66 t/CO2e of carbon for an extra £357k.

TABLE 10: EVALUATION OF PREFERRED OPTION

Totals for 5 sites	Least cost option	Best value option	Variance £m
Capex in AMP8	2.158	2.515	-0.357
Opex in AMP8	0.028	0.000	0.028
Totex (30 yr NPV)	2.124	2.434	-0.309
Private value	-0.524	-0.834	0.31
Private and societal value	17.065	17.615	-0.55
Societal carbon cost	0.864	0.003	0.861

Source: Northumbrian Water

For Hagg Bank we have selected the joint solution, which pumps flows from both the private septic tank and the NWG septic tank, to a local gravity sewer approximately 200 metres to the west of Hagg Bank, as this is the lowest cost option. We have proportionally allocated the investment between the WINEP septic tanks and the S101A driver based on the number of properties.

The benefits and investment for our preferred option for septic tanks are included in Table 11 and Table 12. We will continue to refine the profiling of benefits and expenditure as we continue to work with our strategic delivery partner to carry out further design work and optimisation of the programme for delivery.

TABLE 11: INPUTS FOR TABLE CWW15 – BENEFITS BEST VALUE OPTION

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Septic tank replacements – treatment solution	Operational carbon	t/CO2e		22.65	63.873	53.505	39.448	30.813
	Embedded carbon	t/CO2e		704.91	704.91			
Septic tank flow diversions	Operational carbon	t/CO2e		602.89	602.89			
	Embedded carbon	t/CO2e		0	0			

Source: Northumbrian Water

As the septic tanks are very small, the benefit to the water environment is negligible and less than 1km for each of the sites.

TABLE 12: INPUTS FOR TABLE CWW3 - ENHANCED EXPENDITURE

EA/NRW environmental programme		2023-2024	2024-2025	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Septic tank replacements – treatment solution	Capex		1.750	3.030	3.030	1.280			9.090
	Opex				0.049	0.049	0.049	0.049	0.196
	Totex								9.286
Septic tank flow diversions	Capex		1.750	12.130	12.130	10.380			36.390
	Opex				0.166	0.166	0.166	0.166	0.664
	Totex								37.054
Totals	Capex		3.500	15.160	15.160	11.660			45.480
	Opex				0.215	0.215	0.215	0.215	0.860
	Totex								**46.340**

Source: Northumbrian Water

3.4. THIRD PARTY FUNDING

We have not identified any opportunities for third party funding for the chosen interventions because the nature-based solutions such as wetlands are very small and have been assessed as having a very minor environmental benefit. Therefore, they are unlikely to attract funding from third parties. We will continue to explore opportunities for third party funding in the delivery of the projects.

3.5. DIRECT PROCUREMENT FOR CUSTOMERS

We assessed the septic tanks programme against the DPC guidance (see our **assessment report**, NES38). This report concludes there are no opportunities for direct procurement for customers relevant to septic tanks because the projects are small value and less than <£200m of whole life totex.

3.6. CUSTOMERS VIEWS INFORMING OPTION SELECTION

The best value option is only marginally more expensive than the least cost option (£161k more). We did not discuss this specifically with our customers, as this is a very small difference. However, we tested whether or not this was in line with customer views:

- We compared this to customer views about embedded carbon from our storm overflows research (see our **line-of-sight report**, NES45). Here, customers supported nature-based and hybrid solutions for individual storm overflows where this was not much more expensive and asked us to explore better value green solutions where we could. Customers supported an increase of £31m in the storm overflows programme to switch to green solutions which were better value because they have lower embedded carbon. We can apply a similar approach here by switching to vertical flow reed beds.
- We discussed this with the Water Forum as part of their deep dives into our enhancement investments. They suggested that this did not need further customer research.

3.7. DELIVERABILITY ASSESSMENT

In accordance with the WINEP options development guidance we have conducted a deliverability assessment. This has considered:

- The technical feasibility of implementing an intervention (Table 4 and Table 5). In practice, all of the preferred options are technically feasible to implement.
- The certainty that benefits for each option will be realised. We have assessed this as part of the likelihood scoring in our benefits assessment (section 3.3.1).
- We are confident that we can deliver the 71 sites by 2028. We plan to start the delivery of 5 sites in 2024/5. These are Beacon Hill 1, 2 and 3 and Thursdale where there have been historical pollution incidents, and Hagg Bank where there is a first-time sewerage application, and it is lower cost to deliver these as a single solution. We will continue to discuss the profiling of the remaining sites with the Environment Agency.
- We appointed our Strategic Solutions Identification Partner for AMP8 and have been working with them to identify opportunities for grouping work for delivery such as at Hagg Bank and where sites are in a similar geographical location.

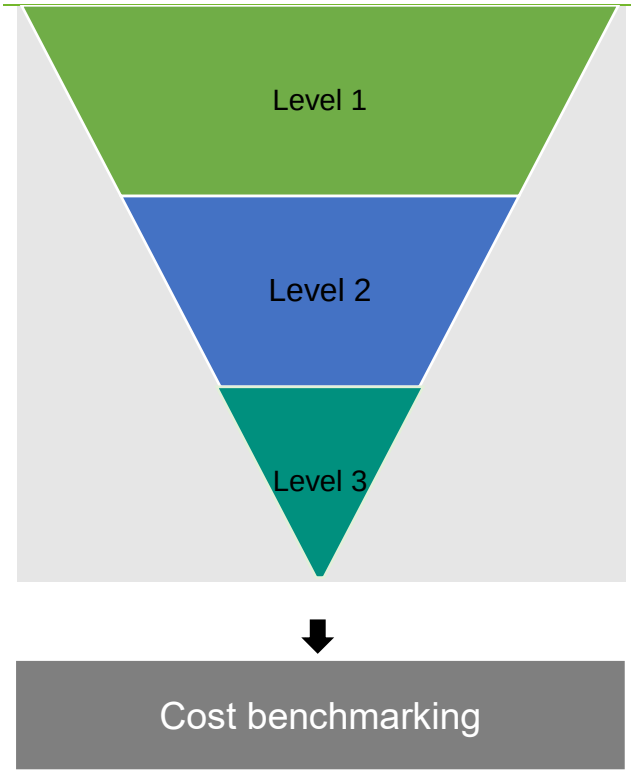
4. COST EFFICIENCY

4.1. APPROACH TO COSTING

4.1.1 Cost methodology

A full description of our costing methodology is contained in Appendix A3 - Costs (NES04). In Figure 4, our plans for accommodating new development have been costed to Level 2. This level is appropriate for a Price Review submission as it is sufficient to understand that the interventions can be delivered within the cost at a programme level. A level 3 estimate would require a level of detailed design to be carried out which would incur significantly more cost which is not appropriate until delivery is confirmed.

FIGURE 4: PROCESS COST ESTIMATION



Level – 1 (confidence: – 50% to +100%)
Costing is carried out using our costing curves. Costing occurs at an overall asset level. For example, package plant or a pumping or a certain population.

Level – 2 (confidence: - 50% to + 50%) – Chosen approach
Costing is carried out using our costing curves. Costing occurs for each of the main items of scope. For example, the length of rising main and the size of the pumps.

Level – 3 (confidence: - 20% to +30%)
Detailed bottom-up cost of all items taking into consideration factors such as ground conditions.

Cost benchmarking
We have benchmarked 9% of the preferred options against the available cost curves from other companies. Further detail is provided in section 4.1.3.

Source: Northumbrian Water

Our costing has been carried out by our costing partners (Mott MacDonald) using our cost models. They have then been benchmarked against our costing partner's cost database and independently assured by PwC and internal audit as they have been loaded into data tables.

4.1.2 Options providing cost efficiencies

We have identified three types of delivery efficiencies:

- Delivering of monitors for all sites as a single project.
- The opportunity to deliver one intervention to address a WINEP and a growth driver – we have developed joint solutions and allocated investment between the relevant drivers.

4.1.3 Cost benchmarking

We have benchmarked direct costs for each of the key asset types and indirect costs against the cost curves for other companies in our costing partner's database. As there is no standard asset hierarchy used for costing across all companies, there are differences in what each company includes and excludes. For septic tanks our costing partner has benchmarked where it is possible to carry out an equitable comparison and this ranges between four and two other companies depending on the asset type, as shown in Table 13. A mean average of these companies has been used as the benchmark with a 25% percentile and 75% percentile provided as a suitable range. There is insufficient data to be able to benchmark the costs for delivering integrated constructed wetlands.

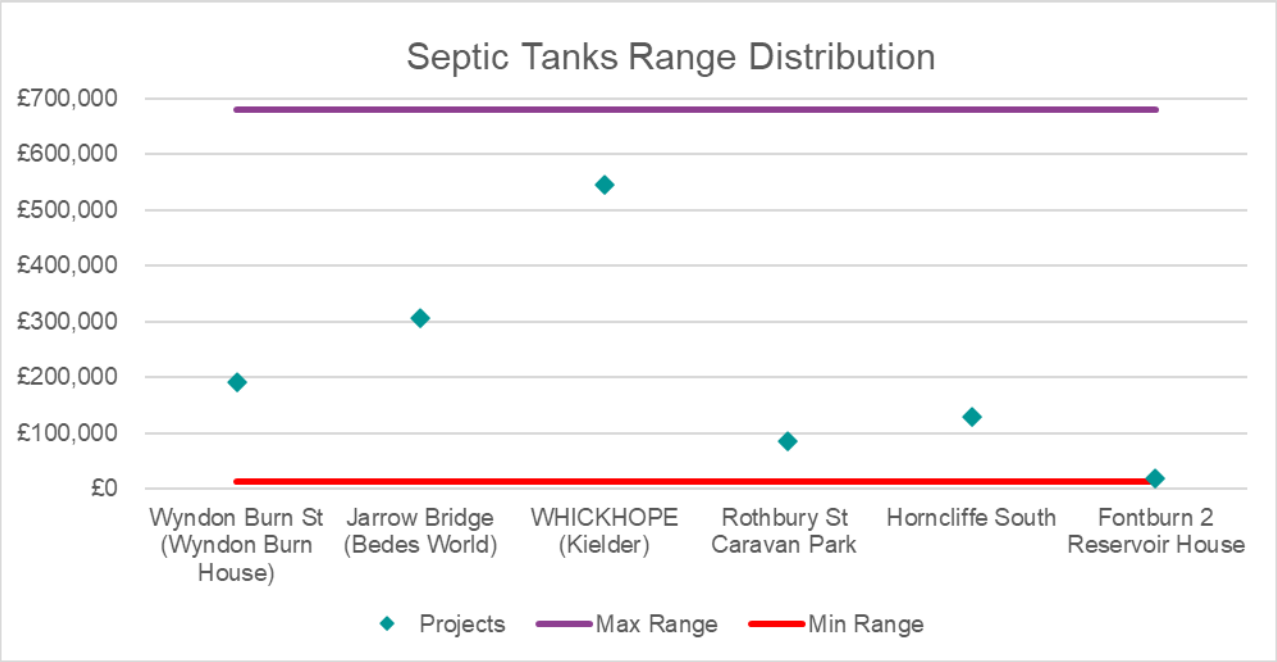
TABLE 13: NUMBER OF COMPARATORS USED FOR BENCHMARK

Scope item analysed	Comparators used for benchmark	Data points per curve	Total data points per benchmarked item
Wet Well Sewage PS	3	181	543
Sewer - Rising Main	3	1,600	4,799
Sewer - Manhole	2	1,600	3,199
Power supply	2	1	2
Primary Tanks Desludging and Scrapers, Circular	4	184	734
Biofilter Tanks - (combined)	2	179	358
Humus Tanks Desludging and Scrapers, Circular	4	50	200
Sewer - Gravity	3	642	1,926
Vertical Flow Reed Beds	3	1	3
Soakaway	3	1	3
Total			**11,767**

Source: Northumbrian Water

We have selected six projects within the Septic Tank business case (9% of preferred options) at varying costs across the identified range of solution costs to compare against the industry position, as seen in Figure 5. Reviewing projects at varying ranges of value allows for interrogation of the costs produced at individual ranges of the curves and price data utilised in costing.

FIGURE 5: SEPTIC TANKS COST RANGE DISTRIBUTION



Source: Northumbrian Water

We have benchmarked on direct costs which are directly attributable to the project such as plant, labour material and equipment and on indirect costs which are related to design, site setup, professional support and other costs not directly related to the construction aspect of a project. Our indirect costs have been bench marked as 63.4% of direct costs 10.46% below the industry average as we describe in our A3 Cost Appendix (NES04).

TABLE 14: BENCHMARK OF DIRECT COSTS

Investment Name	Option Type	Northumbrian £	Benchmark £	25%ile £	75%ile £	Delta[10] £	Delta %[11]
Wyndon Burn St (Wyndon Burn House)	Pumped Transfer	£192,092	£196,825	£203,234	£265,556	-£4,733	-2%
Jarrow Bridge (Bedes World)	Pumped Transfer	£305,703	£302,017	£379,284	£505,948	£3,687	1%
Whickhope (Kielder)	Packaged Biological Filter	£545,465	£818,517	£764,778	£895,369	-£273,052	-33%
Rothbury St Caravan Park	Gravity Transfer	£85,141	£99,359	£88,283	£111,416	-£14,218	-14%

[10] Delta = Northumbrian – Benchmark
[11] Delta % = Delta ÷ Benchmark

Investment Name	Option Type	Northumbrian £	Benchmark £	25%ile £	75%ile £	Delta[10] £	Delta %[11]
Horncliffe South	Vertical Flow Reed Beds	£129,917	£110,487	£102,432	£122,916	£19,430	18%
Fontburn 2 Reservoir House	Infiltration systems	£18,171	£14,186	£24,429	£30,907	£3,985	28%
Total		**£1,276,488**	**£1,541,390**	**£1,562,441**	**£1,932,113**	**-£264,902**	**-17%**

Source: Northumbrian Water

When taking into account both direct and indirect costs for the selected projects, Table 15 shows we are 22% more efficient overall than our comparators. Our vertical flow reed beds and infiltration systems were slightly above the benchmark but are within the 25%ile banding that we would expect. We have implemented less of these types of solutions in the past, so we would expect our cost benchmarking to be slightly higher for these types of assets.

TABLE 15: SUMMARY FOR SEPTIC TANKS INCLUDING INDIRECT COSTS

Investment Name	Option Type	Northumbrian	Benchmark	Delta*	Delta %**
Wyndon Burn St (Wyndon Burn House)	Pumped Transfer	£313,878	£342,199	-£28,322	-8%
Jarrow Bridge (Bedes World)	Pumped Transfer	£499,519	£525,086	-£25,567	-5%
Whickhope (Kielder)	Biological Filter	£891,290	£1,423,073	-£531,783	-37%
Rothbury St Caravan Park	Gravity Transfer	£139,120	£172,745	-£33,625	-19%
Horncliffe South	Vertical Flow Reed Beds	£212,284	£192,093	£20,191	11%
Fontburn 2 Reservoir House	Infiltration systems	£29,691	£24,664	£5,027	20%
Total		**£2,085,782**	**£2,679,861**	**-£594,079**	**-22%**

Notes: * Delta = Northumbrian – Benchmark

** Delta % = Delta ÷ Benchmark

Source: Northumbrian Water

4.1.4 Factors affecting cost allowances

We do have a larger number of septic tanks than other companies, but we are not currently submitting any evidence to support that our costs for individual septic tanks would be different than other companies and we are not currently aware of what Ofwat is including and excluding in its enhancement model for this cost driver.

5. CUSTOMER PROTECTION

5.1. PERFORMANCE COMMITMENT

This enhanced investment does not deliver a specific improvement in pollution or treatment works compliance as this is a new statutory requirement. However, should we fail to deliver secondary treatment by 2028, the Environment Agency may consider this as a pollution incident or as a permit breach and this would increase the number of pollution incidents and discharge compliance we would have to address under base expenditure.

5.2. PRICE CONTROL DELIVERABLE

Our approach to determining Price Control Deliverables (PCD) is outlined in Section 12.3 of **A3 – Costs** (NES04). In Table 16 below, we assess our septic tank related enhancements to test if the benefits are linked to PCs, against Ofwat's materiality of 1%, and to understand if there are outcome measures that can be used. Our assessment has highlighted that the benefits we expect to deliver through our AMP8 WINEP programme will not be measured through PCs. Therefore, we propose a PCD to make sure customers are protected through delivery of our WINEP programme.

TABLE 16: ASSESSMENT OF BENEFITS AGAINST THE PCD CRITERIA

Enhancement scheme	Benefits linked to PC?	Materiality	Possible outcomes?
Wastewater WINEP – septic tanks Water Framework Directive (NES31)	Pass – benefits are environmental or investigations	Pass – 1.7%	Outcome difficult to measure effectively and vary between schemes (particularly investigations). Customers could be protected through an output measure based on delivery of schemes.

Source: Northumbrian Water

Our WINEP programme is set by the Environment Agency, which determines the statutory and non-statutory investments we should make. The Environment Agency assures that WINEP actions are delivered to the agreed timeframe, and environmental obligations are met. We therefore propose a PCD that makes sure that costs are returned to customers either where the Environment Agency has decided that a project is no longer required, or where we have not delivered to the agreed timeframe and/or environmental obligations have not been met (according to the Environment Agency). A summary of our PCD for WINEP programme delivery is outlined in Table 17.

TABLE 17: SUMMARY OF THE PRICE CONTROL DELIVERABLE FOR OUR WINEP PROGRAMME DELIVERY TO PROTECT CUSTOMERS

Description of price control deliverable	**Delivery of WINEP projects as specified in our WINEP enhancement cases** (NES17, NES18, NES19, NES28, NES29, NES30, NES31, NES34).
Measurement and reporting	We will report on the delivery of WINEP projects at the next price review (PR29), including specifying the individual projects that have been delivered, not delivered, or that the Environment Agency has decided are no longer required (under the Environment Agency's WINEP alterations process). This is in addition to the WINEP guidance which specifies how we will need to report progress against delivery of the WINEP actions and tracking and reporting WINEP delivery in a transparent and auditable manner.
Conditions on allowance	Projects must be delivered to the specification agreed with the Environment Agency under WINEP.
Assurances	The Environment Agency will confirm that WINEP actions have been delivered to the agreed timeframe, and that environmental obligations have been met. As set out in the WINEP Guidance[12], there will be regular liaison between water companies and the Environment Agency to discuss progress, risks and issues associated with delivery of the WINEP programme and to identify any alterations. The Environment Agency uses the WINEP measures sign-off, technical review and audit guidance for assurance that the environmental obligations as set out in the WINEP are completed as planned.
Price control deliverable payment rate	We will return funds back to customers for individual projects, as specified in Tables 10 and 11 above (for NES31) – 71 individual schemes to be delivered by the dates specified.
Impact on performance in relation to performance commitments	There are some benefits to greenhouse gas emissions in NES31.

Source: Northumbrian Water

We propose a single PCD for most of our WINEP programme delivery (with the exception of storm overflows). This should:

- Be set according to individual project costs, rather than a "per project" unit cost. This is because these costs vary considerably, and a single rate would create an incentive to deliver more of the cheapest projects (at the expense of more expensive projects). Ofwat's guidance in IN23/05 identifies this incentive and expects us to set out scheme level deliverables where costs vary significantly across schemes (so our approach here is consistent with the guidance).
- Not include an automatic penalty for non-delivery (beyond returning the costs to customers). This is because this PCD includes projects where the Environment Agency has decided these are no longer required, which should not lead to a penalty. If we did not deliver a project that is required (and where we had not agreed a change with the Environment Agency), we would not meet our statutory obligations and so this does not require an extra incentive to deliver.
- Change according to the Environment Agency's WINEP alterations process. In 2020-25, our ODI for WINEP delivery does not automatically take into account projects that are removed from WINEP by the Environment Agency – but this should be for the Environment Agency to determine. Costs should be returned to customers for projects that are not required, without further interventions needed from Ofwat.

[12]GOV.UK, 2023, Water industry national environment programme (WINEP) methodology - GOV.UK (www.gov.uk)

This is an aggregated PCD across all our WINEP schemes except for storm overflows. We chose to aggregate these PCDs because most of our WINEP enhancement cases or projects would not be individually material, and these share the same reporting, assurance, and conditions.

6. APPENDIX A – LIST OF SITES

TABLE 18: LIST OF SITES

No.	Site Name	No.	Site Name (continued)	No.	Site Name(continued)
1	Albany Rd/Saltmeadows Rd	25	Hagg Bank	49	Pier Cottages (Spanish Battery)
2	Albion Inn St	26	Hallington Res St (Crawley Cottages)	50	Radcliffe Road
3	Attwood Terrace St (Attwood Place)	27	Hepple	51	Railtrack Signalling Box
4	Barmston Riverside	28	Herbert Terrace	52	Rothbury St Caravan Park
5	Beacon Hill No.1 St	29	Hetton Lyons St	53	Ryton Willows St
6	Beacon Hill No.2 St	30	Heugh Houses	54	Scremerston
7	Beacon Hill No.3 St	31	Horncliffe 1, 2 & 3 (North)	55	Shores Dean
8	Bedlington Bank Tank	32	Horncliffe South	56	South Hylton St
9	Bildershaw St	33	Jarrow Bridge (Bedes World)	57	The Lee (Embleton Terrace)
10	Blaydon Glass St	34	Langham High Lift PS*	58	Tommy The Millers Field (Castlegate)
11	Bowling Green & Rifle Range (Berwick)	35	Langham Low Lift PS*	59	Tosson Tank
12	Bridge Terrace St (Berwick)	36	Lartington No.1 St	60	Tursdale St (Old Mill/Metal Bridge)
13	Britannia Testing Station	37	Lartington No.2 St (Cotherstone St)	61	Walpole*
14	Brotherlee St	38	Lockwood Res Recreation St (Lockwood Beck)	62	Wapping Street St (Comical Corner)
15	E.W.S. Offices	39	Longhirst Colliery 1	63	Warden Village
16	East Castle North St	40	Longhirst Colliery 2	64	Warkworth Helsay Farm St
17	Elsdon Tank (Town Foot)	41	Longrigg (Swallwell) St	65	Warkworth WTW St (Bungalows 1&2)
18	Etal	42	Low Worsall St	66	Wearhead WTW St (Site Klargester)
19	Fontburn 2 Reservoir House	43	Marske Machine Company	67	Whickhope (Kielder)
20	Foxton Hall St	44	Middleton Beach Hartlepool	68	Whittle Dene WTW
21	Friarside Crescent STW	45	Moor Court	69	Wyndon Burn St (Wyndon Burn House)
22	Gas Lane, Blaydon St	46	Newminster Terrace St (Morpeth)	70	Zenith Plumbpoint (Vickers)
23	Gunnerton WTW (New Mess Rm)	47	Old Park Terrace St (Byers Green)	71	Bothal Cottage
24	Gunnerton WTW (The Cottage and Old Mess Rm)	48	Pear Tree		

Note: Site marked with an "*" are Essex & Suffolk Water sites

Source: Northumbrian Water

7. APPENDIX B – COST BENEFIT RATIOS AND PREFERRED OPTION

TABLE 19: COST BENEFIT RATIOS AND PREFERRED OPTIONS FOR SEPTIC TANKS

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Albany Rd./Saltmeadows Rd.	Pumped Transfer	3.248	Y	Preferred option
Albany Rd./Saltmeadows Rd.	Gravity Transfer	2.213	N	Alternative option
Albion Inn St	Pumped Transfer	3.116	Y	Preferred option
Albion Inn St	Gravity Transfer	2.422	N	Alternative option
Attwood Terrace St (Attwood Place)	Biological Filter	2.630	N	Alternative option
Attwood Terrace St (Attwood Place)	Constructed Wetlands	3.654	Y	Preferred option
Attwood Terrace St (Attwood Place)	Package STW option RBC	2.825	N	Alternative option
Attwood Terrace St (Attwood Place)	Package STW option SAF	3.058	N	Alternative option
Attwood Terrace St (Attwood Place)	Pumped Transfer	3.570	N	Alternative option
Attwood Terrace St (Attwood Place)	Vertical Flow Reed Beds	3.627	N	Alternative option
Barmston Riverside	Pumped Transfer	2.995	N	Alternative option
Barmston Riverside	Gravity Transfer	3.250	Y	Preferred option
Beacon Hill No.1 St	Biological Filter	3.674	N	Alternative option
Beacon Hill No.1 St	Constructed Wetlands	3.683	N	Alternative option
Beacon Hill No.1 St	Package STW option RBC	2.848	N	Alternative option
Beacon Hill No.1 St	Package STW option SAF	3.074	N	Alternative option
Beacon Hill No.1 St	Pumped Transfer	3.145	N	Alternative option
Beacon Hill No.1 St	Vertical Flow Reed Beds	3.627	N	Alternative option
Beacon Hill No.1 St	Infiltration Systems	3.917	Y	Preferred option
Beacon Hill No.2 St	Biological Filter	3.674	N	Alternative option
Beacon Hill No.2 St	Constructed Wetlands	3.683	N	Alternative option
Beacon Hill No.2 St	Infiltration Systems	3.866	Y	Preferred option
Beacon Hill No.2 St	Package STW option RBC	2.848	N	Alternative option
Beacon Hill No.2 St	Package STW option SAF	3.074	N	Alternative option
Beacon Hill No.2 St	Pumped Transfer	3.145	N	Alternative option
Beacon Hill No.2 St	Vertical Flow Reed Beds	3.627	N	Alternative option
Beacon Hill No.3 St	Biological Filter	3.674	N	Alternative option
Beacon Hill No.3 St	Constructed Wetlands	3.683	N	Alternative option
Beacon Hill No.3 St	Infiltration Systems	3.866	Y	Preferred option
Beacon Hill No.3 St	Package STW option RBC	2.848	N	Alternative option
Beacon Hill No.3 St	Package STW option SAF	3.074	N	Alternative option
Beacon Hill No.3 St	Pumped Transfer	3.145	N	Alternative option
Beacon Hill No.3 St	Vertical Flow Reed Beds	3.627	N	Alternative option
Bedlington Bank Tank	Pumped Transfer	2.993	N	Alternative option
Bedlington Bank Tank	Gravity Transfer	3.082	Y	Preferred option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Bildershaw St	Biological Filter	3,696	N	Alternative option
Bildershaw St	Constructed Wetlands	3.725	N	Alternative option
Bildershaw St	Infiltration Systems	3.911	Y	Preferred option
Bildershaw St	Package STW option RBC	2.827	N	Alternative option
Bildershaw St	Package STW option SAF	3.050	N	Alternative option
Bildershaw St	Pumped Transfer	3.080	N	Alternative option
Bildershaw St	Vertical Flow Reed Beds	3.627	N	Alternative option
Blaydon Glass St	Pumped Transfer	3.286	Y	Preferred option
Blaydon Glass St	Gravity Transfer	2.836	N	Alternative option
Bothal Cottage	Gravity Transfer	3.893	Y	Preferred option
Bothal Cottage	Pumped Transfer	3.287	N	Alternative option
Bothal Cottage	Package STW either SAF or RBC	3.033	N	Alternative option
Bothal Cottage	Biological filter	2.141	N	Alternative option
Bowling Green & Rifle Range (Berwick)	Pumped Transfer	3.216	Y	Preferred option
Bridge Terrace St (Berwick)	Pumped Transfer	3.256	Y	Preferred option
Bridge Terrace St (Berwick)	Gravity Transfer	1.564	N	Alternative option
Britannia Testing Station	Pumped Transfer	3.091	Y	Preferred option
Brotherlee St	Pumped Transfer	3.160	Y	Preferred option
E.W.S. Offices	Biological Filter	2.607	N	Alternative option
E.W.S. Offices	Constructed Wetlands	3.532	N	Alternative option
E.W.S. Offices	Package STW option RBC	3.070	N	Alternative option
E.W.S. Offices	Package STW option SAF	3.146	N	Alternative option
E.W.S. Offices	Pumped Transfer	3.621	N	Alternative option
E.W.S. Offices	Vertical Flow Reed Beds	3.891	Y	Preferred option
East Castle North St	Biological Filter	3.701	N	Alternative option
East Castle North St	Constructed Wetlands	3.734	N	Alternative option
East Castle North St	Infiltration Systems	3.919	Y	Preferred option
East Castle North St	Package STW option RBC	2.829	N	Alternative option
East Castle North St	Package STW option SAF	3.051	N	Alternative option
East Castle North St	Pumped Transfer	2.920	N	Alternative option
East Castle North St	Vertical Flow Reed Beds	3.627	N	Alternative option
Elsdon Tank (Town Foot)	Biological Filter	3.676	N	Alternative option
Elsdon Tank (Town Foot)	Constructed Wetlands	3.687	N	Alternative option
Elsdon Tank (Town Foot)	Infiltration Systems	3.918	Y	Preferred option
Elsdon Tank (Town Foot)	Package STW option RBC	2.817	N	Alternative option
Elsdon Tank (Town Foot)	Package STW option SAF	3.047	N	Alternative option
Elsdon Tank (Town Foot)	Pumped Transfer	3.522	N	Alternative option
Elsdon Tank (Town Foot)	Vertical Flow Reed Beds	3.508	N	Alternative option
Etal	Pumped Transfer	3.183	Y	Preferred option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Fontburn 2 Reservoir House	Biological Filter	3.699	N	Alternative option
Fontburn 2 Reservoir House	Constructed Wetlands	3.731	N	Alternative option
Fontburn 2 Reservoir House	Pumped Transfer	2.397	N	Alternative option
Fontburn 2 Reservoir House	Infiltration Systems	3.919	Y	Preferred option
Fontburn 2 Reservoir House	Package STW option RBC	2.797	N	Alternative option
Fontburn 2 Reservoir House	Package STW option SAF	3.023	N	Alternative option
Fontburn 2 Reservoir House	Vertical Flow Reed Beds	2.397	N	Alternative option
Foxton Hall St	Pumped Transfer	2.209	Y	Preferred option
Friarside Crescent STW	Pumped Transfer	3.198	Y	Preferred option
Gas Lane, Blaydon St	Pumped Transfer	3.248	Y	Preferred option
Gas Lane, Blaydon St	Gravity Transfer	2.668	N	Alternative option
Gunnerton WTW (New Mess Rm)	Biological Filter	3.660	N	Alternative option
Gunnerton WTW (New Mess Rm)	Constructed Wetlands	3.696	Y	Preferred option
Gunnerton WTW (New Mess Rm)	Package STW option RBC	2.809	N	Alternative option
Gunnerton WTW (New Mess Rm)	Package STW option SAF	3.044	N	Alternative option
Gunnerton WTW (New Mess Rm)	Pumped Transfer	1.531	N	Alternative option
Gunnerton WTW (New Mess Rm)	Vertical Flow Reed Beds	3.625	N	Alternative option
Gunnerton WTW (The Cottage and Old Mess Rm)	Biological Filter	3.031	N	Alternative option
Gunnerton WTW (The Cottage and Old Mess Rm)	Constructed Wetlands	3.696	Y	Preferred option
Gunnerton WTW (The Cottage and Old Mess Rm)	Package STW option RBC	2.820	N	Alternative option
Gunnerton WTW (The Cottage and Old Mess Rm)	Package STW option SAF	3.048	N	Alternative option
Gunnerton WTW (The Cottage and Old Mess Rm)	Pumped Transfer	1.601	N	Alternative option
Gunnerton WTW (The Cottage and Old Mess Rm)	Vertical Flow Reed Beds	3.508	N	Alternative option
Hagg Bank	Pumped Transfer	3.008	Y	Preferred option
Hallington Res St (Crawley Cottages)	Biological Filter	2.574	N	Alternative option
Hallington Res St (Crawley Cottages)	Constructed Wetlands	3.857	Y	Preferred option
Hallington Res St (Crawley Cottages)	Pumped Transfer	2.619	N	Alternative option
Hallington Res St (Crawley Cottages)	Package STW option RBC	3.262	N	Alternative option
Hallington Res St (Crawley Cottages)	Package STW option SAF	3.388	N	Alternative option
Hallington Res St (Crawley Cottages)	Vertical Flow Reed Beds	3.851	N	Alternative option
Hepple	Biological Filter	3.517	Y	Preferred option
Hepple	Constructed Wetlands	3.344	N	Alternative option
Hepple	Package STW option RBC	2.697	N	Alternative option
Hepple	Package STW option SAF	2.990	N	Alternative option
Hepple	Pumped Transfer	0.540	N	Alternative option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Hepple	Vertical Flow Reed Beds	3.497	N	Alternative option
Herbert Terrace	Pumped Transfer	3.176	Y	Preferred option
Hetton Lyons St	Biological Filter	2.630	N	Alternative option
Hetton Lyons St	Constructed Wetlands	3.654	Y	Preferred option
Hetton Lyons St	Pumped Transfer	2.370	N	Alternative option
Hetton Lyons St	Package STW option RBC	2.809	N	Alternative option
Hetton Lyons St	Package STW option SAF	3.044	N	Alternative option
Hetton Lyons St	Vertical Flow Reed Beds	3.627	N	Alternative option
Heugh Houses	Biological Filter	2.627	N	Alternative option
Heugh Houses	Constructed Wetlands	3.642	Y	Preferred option
Heugh Houses	Package STW option RBC	2.806	N	Alternative option
Heugh Houses	Package STW option SAF	3.043	N	Alternative option
Heugh Houses	Pumped Transfer	3.437	N	Alternative option
Heugh Houses	Vertical Flow Reed Beds	3.627	N	Alternative option
Horncliffe 1, 2 & 3 (North)	Pumped Transfer	1.291	Y	Preferred option
Horncliffe South	Biological Filter	2.961	N	Alternative option
Horncliffe South	Constructed Wetlands	2.776	N	Alternative option
Horncliffe South	Package STW option RBC	2.663	N	Alternative option
Horncliffe South	Package STW option SAF	3.112	N	Alternative option
Horncliffe South	Pumped Transfer	3.280	N	Alternative option
Horncliffe South	Vertical Flow Reed Beds	3.485	Y	Preferred option
Jarrow Bridge (Bedes World)	Pumped Transfer	2.846	N	Alternative option
Jarrow Bridge (Bedes World)	Gravity Transfer	2.921	Y	Preferred option
Langham High Lift PS	Pumped Transfer	3.204	Y	Preferred option
Langham Low Lift PS	Pumped Transfer	3.256	Y	Preferred option
Lartington No.1 St	Biological Filter	3.473	N	Alternative option
Lartington No.1 St	Constructed Wetlands	3.765	N	Alternative option
Lartington No.1 St	Infiltration Systems	3.920	Y	Preferred option
Lartington No.1 St	Package STW option RBC	3.145	N	Alternative option
Lartington No.1 St	Package STW option SAF	3.199	N	Alternative option
Lartington No.1 St	Pumped Transfer	3.112	N	Alternative option
Lartington No.1 St	Vertical Flow Reed Beds	3.915	N	Alternative option
Lartington No.2 St (Cotherstone St)	Pumped Transfer	2.525	Y	Preferred option
Lockwood Res Recreation St (Lockwood Beck)	Biological Filter	3.706	N	Alternative option
Lockwood Res Recreation St (Lockwood Beck)	Constructed Wetlands	3.742	N	Alternative option
Lockwood Res Recreation St (Lockwood Beck)	Infiltration Systems	3.919	Y	Preferred option
Lockwood Res Recreation St (Lockwood Beck)	Package STW option RBC	2.831	N	Alternative option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Lockwood Res Recreation St (Lockwood Beck)	Package STW option SAF	3.051	N	Alternative option
Lockwood Res Recreation St (Lockwood Beck)	Pumped Transfer	2.322	N	Alternative option
Lockwood Res Recreation St (Lockwood Beck)	Vertical Flow Reed Beds	3.627	N	Alternative option
Longhirst Colliery 1	Biological Filter	3.328	Y	Alternative option
Longhirst Colliery 1	Constructed Wetlands	2.910	N	Alternative option
Longhirst Colliery 1	Package STW option RBC	2.613	N	Alternative option
Longhirst Colliery 1	Package STW option SAF	2.979	N	Alternative option
Longhirst Colliery 1	Pumped Transfer	2.271	N	Alternative option
Longhirst Colliery 1	Vertical Flow Reed Beds	3.543	N	Preferred option
Longhirst Colliery 2	Biological Filter	3.671	N	Alternative option
Longhirst Colliery 2	Constructed Wetlands	3.678	N	Alternative option
Longhirst Colliery 2	Infiltration Systems	3.917	Y	Preferred option
Longhirst Colliery 2	Package STW option RBC	2.815	N	Alternative option
Longhirst Colliery 2	Package STW option SAF	3.046	N	Alternative option
Longhirst Colliery 2	Pumped Transfer	3.375	N	Alternative option
Longhirst Colliery 2	Vertical Flow Reed Beds	3.627	N	Alternative option
Longrigg (Swallwell) St	Gravity Transfer	2.562	N	Alternative option
Longrigg (Swallwell) St	Pumped Transfer	3.158	Y	Preferred option
Low Worsall St	Biological Filter	2.592	N	Alternative option
Low Worsall St	Constructed Wetlands	3.549	N	Alternative option
Low Worsall St	Package STW option RBC	2.782	N	Alternative option
Low Worsall St	Package STW option SAF	3.035	N	Alternative option
Low Worsall St	Gravity Transfer	3.239	N	Alternative option
Low Worsall St	Pumped Transfer	3.292	N	Alternative option
Low Worsall St	Vertical Flow Reed Beds	3.627	Y	Preferred option
Marske Machine Company	Pumped Transfer	1.078	Y	Preferred option
Middleton Beach Hartlepool	Pumped Transfer	2.961	Y	Preferred option
Moor Court	Constructed Wetlands	3.532	N	Alternative option
Moor Court	Package STW option RBC	2.793	N	Alternative option
Moor Court	Package STW option SAF	3.048	N	Alternative option
Moor Court	Gravity Transfer	3.239	N	Alternative option
Moor Court	Pumped Transfer	3.445	N	Alternative option
Moor Court	Vertical Flow Reed Beds	3.627	Y	Preferred option
Moor Court	Biological Filter	2.647	N	Alternative option
Newminster Terrace St (Morpeth)	Pumped Transfer	3.245	Y	Preferred option
Old Park Terrace St (Byers Green)	Biological Filter	3.535	Y	Alternative option
Old Park Terrace St (Byers Green)	Constructed Wetlands	3.383	N	Alternative option
Old Park Terrace St (Byers Green)	Package STW option RBC	2.739	N	Alternative option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Old Park Terrace St (Byers Green)	Package STW option SAF	3.021	N	Alternative option
Old Park Terrace St (Byers Green)	Pumped Transfer	3.136	N	Alternative option
Old Park Terrace St (Byers Green)	Vertical Flow Reed Beds	3.543	N	Preferred option
Pear Tree	Biological Filter	3.553	Y	Preferred option
Pear Tree	Constructed Wetlands	3.424	N	Alternative option
Pear Tree	Package STW option RBC	2.750	N	Alternative option
Pear Tree	Package STW option SAF	3.025	N	Alternative option
Pear Tree	Pumped Transfer	2.984	N	Alternative option
Pear Tree	Vertical Flow Reed Beds	3.520	N	Alternative option
Pier Cottages (Spanish Battery)	Pumped Transfer	3.267	Y	Preferred option
Pier Cottages (Spanish Battery)	Gravity Transfer	2.860	N	Alternative option
Radcliffe Road	Pumped Transfer	2.347	Y	Preferred option
Railtrack Signalling Box	Pumped Transfer	2.985	Y	Preferred option
Rothbury St Caravan Park	Biological Filter	3.659	N	Alternative option
Rothbury St Caravan Park	Constructed Wetlands	3.654	N	Alternative option
Rothbury St Caravan Park	Package STW option RBC	2.825	N	Alternative option
Rothbury St Caravan Park	Package STW option SAF	3.058	N	Alternative option
Rothbury St Caravan Park	Pumped Transfer	3.590	N	Alternative option
Rothbury St Caravan Park	Vertical Flow Reed Beds	3.627	N	Alternative option
Rothbury St Caravan Park	Gravity Transfer	3.642	Y	Preferred option
Ryton Willows St	Pumped Transfer	3.180	Y	Preferred option
Scremerston	Biological Filter	2.591	N	Alternative option
Scremerston	Constructed Wetlands	3.545	N	Alternative option
Scremerston	Pumped Transfer	3.300	N	Alternative option
Scremerston	Package STW option RBC	2.781	N	Alternative option
Scremerston	Package STW option SAF	3.035	N	Alternative option
Scremerston	Vertical Flow Reed Beds	3.627	Y	Preferred option
Shores Dean	Biological Filter	3.311	Y	Alternative option
Shores Dean	Constructed Wetlands	2.870	N	Alternative option
Shores Dean	Pumped Transfer	1.307	N	Alternative option
Shores Dean	Package STW option RBC	2.602	N	Alternative option
Shores Dean	Package STW option SAF	2.976	N	Alternative option
Shores Dean	Vertical Flow Reed Beds	3.487	N	Preferred option
South Hylton St	Pumped Transfer	2.972	Y	Preferred option
South Hylton St	Gravity Transfer	2.609	N	Alternative option
The Lee (Embleton Terrace)	Biological Filter	3.383	Y	Least cost
The Lee (Embleton Terrace)	Constructed Wetlands	3.037	N	Alternative option
The Lee (Embleton Terrace)	Package STW option SAF	2.991	N	Alternative option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
The Lee (Embleton Terrace)	Pumped Transfer	-3.356	N	Alternative option
The Lee (Embleton Terrace)	Vertical Flow Reed Beds	3.499	N	Preferred option
The Lee (Embleton Terrace)	Package STW option RBC	2.647	N	Alternative option
Tommy The Millers Field (Castlegate)	Biological Filter	3.702	N	Alternative option
Tommy The Millers Field (Castlegate)	Constructed Wetlands	3.736	N	Alternative option
Tommy The Millers Field (Castlegate)	Pumped Transfer	3.523	N	Alternative option
Tommy The Millers Field (Castlegate)	Infiltration Systems	3.919	Y	Preferred option
Tommy The Millers Field (Castlegate)	Package STW option RBC	2.830	N	Alternative option
Tommy The Millers Field (Castlegate)	Package STW option SAF	3.051	N	Alternative option
Tommy The Millers Field (Castlegate)	Vertical Flow Reed Beds	3.627	N	Alternative option
Tosson Tank	Biological Filter	3.706	N	Alternative option
Tosson Tank	Constructed Wetlands	3.742	N	Alternative option
Tosson Tank	Infiltration Systems	3.919	Y	Preferred option
Tosson Tank	Package STW option RBC	2.800	N	Alternative option
Tosson Tank	Package STW option SAF	3.024	N	Alternative option
Tosson Tank	Pumped Transfer	-1.645	N	Alternative option
Tosson Tank	Vertical Flow Reed Beds	3.627	N	Alternative option
Tursdale St (Old Mill/Metal Bridge)	Pumped Transfer	3.173	Y	Preferred option
Walpole	Pumped Transfer	3.256	Y	Preferred option
Wapping Street St (Comical Corner)	Pumped Transfer	3.094	Y	Preferred option
Wapping Street St (Comical Corner)	Gravity Transfer	3.009	N	Alternative option
Warden Village	Biological Filter	3.510	Y	Alternative option
Warden Village	Constructed Wetlands	3.327	N	Alternative option
Warden Village	Package STW option RBC	2.740	N	Alternative option
Warden Village	Package STW option SAF	3.030	N	Alternative option
Warden Village	Pumped Transfer	1.495	N	Alternative option
Warden Village	Gravity Transfer	-0.630	N	Alternative option
Warden Village	Vertical Flow Reed Beds	3.543	N	Preferred option
Warkworth Helsay Farm St	Pumped Transfer	2.874	Y	Preferred option
Warkworth WTW St (Bungalows 1&2)	Biological Filter	2.630	N	Alternative option
Warkworth WTW St (Bungalows 1&2)	Constructed Wetlands	3.654	Y	Preferred option
Warkworth WTW St (Bungalows 1&2)	Package STW option RBC	2.809	N	Alternative option
Warkworth WTW St (Bungalows 1&2)	Package STW option SAF	3.044	N	Alternative option
Warkworth WTW St (Bungalows 1&2)	Pumped Transfer	3.233	N	Alternative option
Warkworth WTW St (Bungalows 1&2)	Gravity Transfer	2.443	N	Alternative option
Warkworth WTW St (Bungalows 1&2)	Vertical Flow Reed Beds	3.627	N	Alternative option
Wearhead WTW St (Site Klargester)	Biological Filter	2.630	N	Alternative option
Wearhead WTW St (Site Klargester)	Constructed Wetlands	3.655	Y	Preferred option

Site Name	Option	Value NPV £M	Least Cost	Chosen Option
Wearhead WTW St (Site Klargester)	Pumped Transfer	3.046	N	Alternative option
Wearhead WTW St (Site Klargester)	Package STW option SAF	3.044	N	Alternative option
Wearhead WTW St (Site Klargester)	Vertical Flow Reed Beds	3.627	N	Alternative option
Wearhead WTW St (Site Klargester)	Package STW option RBC	2.809	N	Alternative option
Whittle Dene WTW	Biological Filter	2.630	N	Alternative option
Whittle Dene WTW	Constructed Wetlands	3.655	Y	Preferred option
Whittle Dene WTW	Package STW option RBC	2.778	N	Alternative option
Whittle Dene WTW	Package STW option SAF	3.017	N	Alternative option
Whittle Dene WTW	Pumped Transfer	2.067	N	Alternative option
Whittle Dene WTW	Gravity Transfer	0.044	N	Alternative option
Whittle Dene WTW	Vertical Flow Reed Beds	3.627	N	Alternative option
Wyndon Burn St (Wyndon Burn House)	Pumped Transfer	3.198	Y	Preferred option
Zenith Plumbpoint (Vickers)	Gravity Transfer	2.117	N	Alternative option
Zenith Plumbpoint (Vickers)	Pumped Transfer	3.058	Y	Preferred option
Whickhope (Kielder)	Biological Filter	2.630	N	Alternative option
Whickhope (Kielder)	Constructed Wetlands	3.654	Y	Preferred option
Whickhope (Kielder)	Package STW option RBC	2.778	N	Alternative option
Whickhope (Kielder)	Package STW option SAF	3.016	N	Alternative option
Whickhope (Kielder)	Pumped Transfer	0.670	N	Alternative option
Whickhope (Kielder)	Vertical Flow Reed Beds	3.627	N	Alternative option

Source: Northumbrian Water