UUW43

WINEP Optimisation

October 2023

Chapter 8 supplementary document

This document sets out variants to the UUW AMP8 WINEP for a limited number of facilities. These facilities have potential variations to their AMP8 WINEP drivers following correspondence with the Environment Agency in August and September 2023 regarding potential phased delivery into AMP9 for complex or technically challenging solutions. For more information on the background to inclusion of these variant, please refer to section 6.5 of supplementary document UUW79 – statutory obligations summary.

United Utilities

Water for the North West

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Appendices

1. Introduction

1.1.1 This document sets out variants to the UUW AMP8 WINEP for a limited number of facilities, set out below. These facilities have potential variations to their AMP8 WINEP drivers following correspondence with the Environment Agency in August and September 2023 regarding potential phased delivery into AMP9 for complex or technically challenging solutions. This enhancement case describes actions and options to meet more onerous Environmental Permit requirements as a result of drivers in the AMP8 WINEP, where phasing options remain under discussion, at the following wastewater treatment works (WwTW) and storm overflows:

- **Davyhulme WwTW - final effluent Biological Oxygen Demand (BOD)**
- **Wigan and Skelmersdale WwTW – final effluent phosphorus and ammonia**
- **Pennington Flash, (linked to the Wigan and Skelmersdale schemes) seven overflows with spill drivers**
- **Stockport, Salford and Sale - final effluent Biological Oxygen Demand (BOD) and ammonia for Salford**

1.1.2 In this document we will describe our core plan plus three additional variants for these facilities. All values in the document are stated at 2022/23 prices, post frontier shift and real price effects

1.1.3 The development of the WINEP has been informed by the key regulatory guidance including; the WINEP methodology, WINEP options development guidance, WINEP options assessment guidance, WINEP driver and supporting guidance.

1.1.4 As well as regulatory guidance described above we have discussed key schemes with the Environment Agency throughout the development of the plan. We have actively engaged with Defra and the Environment Agency's process for potential phased delivery into AMP9 of technically challenging schemes within the AMP8 WINEP. This engagement has covered all the facilities discussed in this document, with particular emphasis on the scope of the project at Davyhulme WwTW. Davyhulme serves Manchester and discharges into the Manchester Ship Canal which is a large, slow moving waterbody which creates a unique situation for these strategically important facilities.

1.1.5 In July 2023 we provided options for phasing within the framework set out by Defra and the Environment Agency, with subsequent feedback on our recommendations in August and September 2023.

1.1.6 As a result of decisions from the Environment Agency on 18 August 2023, 24 August 2023 and subsequent confirmation on 22 September 2023 that there are no further routes to review our adaptive plan, we have included in this document three variants to our core plan in our PR24 submission. We have adaptive plans covering these facilities and continue to have discussions with regulators. These schemes are complex, with inter-related facilities and regulatory drivers which can be optimised. We believe there are opportunities to deliver better long term value and resilience through the different investment variants.

1.1.7 For more information on the background to inclusion of these variant, please refer to section 6.5 of supplementary document *UUW79 – statutory obligations summary*.

1.1.8 In this document we will describe each facility, the interventions and timescales for each of the variants of the WINEP we propose at the time of business plan submission.

1.1.9 It also covers why these requirements are outside of management control, our approach to solution development and how we have ensured that costs are robust. It sets out the extensive interaction we have undertaken with the Environment Agency about delivering alternative solutions that will deliver significantly better value and are deliverable across a more controlled timescale.

1.1.10 We have completed the associated tables to support these alternative variants of our WINEP but note that for variants B, C and D we have included only the costs for the AMP8 period. Tables for transitional investment were not requested at this stage, however to achieve the regulatory dates proposed for these WINEP variants transitional investment would be required. When we have definition of the variants to progress we will refine the delivery profile that will including transitional investment.

1.1.11 In terms of the interface with other functions of PR24 submission, we would note that:

- For each of these cases, we believe that it should be feasible to manage the uncertainty in delivery timing through the use of PCDs, which should be designed to compensate customers for any time value of money benefit arising for the company in the event that one or more schemes are deferred. Likewise, if any schemes are later deemed not to be required, the PCD should (if designed appropriately) compensate customers fairly for the company's avoided costs.
- Given the potential inter-AMP nature of these variants, it seems that it will be necessary to ensure that PCDs are either:
  - established as multi AMP PCDs
  - any PCD delivery payments (excluding time value/late delivery payments) due at the end of AMP8 are agreed to be transferred into AMP9 cost allowances to ensure AMP9 delivery is appropriately funded (this is equivalent to the shortfalling approach that Ofwat utilised up until it was removed at PR14)
- As PCDs are still an emerging methodological approach, we will undoubtedly engage further with Ofwat to ensure that the PCDs set at final determinations both protect customers, whilst not being unduly punitive for companies is these such cases whereby the timing of requirements is not currently 100% certain;
- For DPC schemes, any change in their DPC status should be manageable through the DPC IDoK process

1.1.12 A summary of the variants to our WINEP, in addition to the core plan, is as follows: -

Table 1: Investment plan variants for Pennington Flash, Sale, Salford & Stockport, Davyhulme and Wigan & Skelmersdale

Scheme & Regulatory Date	Variant A Core PR24 submission	Variant B Non optimised AMP8 delivery of all requirements	Variant C Non optimised AMP8 delivery with adaptive plan for Davyhulme	Variant D Non optimised AMP8 delivery with adaptive plan for Davyhulme, Wigan and Skelmersdale and Pennington Flash
Pennington Flash (31/03/2030)	**£0.4m** Cost to complete investigation only in AMP8	**£631m** Full scheme costs included in AMP8. Investigations cost removed and assumed dealt with as part of optioneering full scheme	**£631m** Full scheme costs included in AMP8. Investigations cost removed and assumed dealt with as part of optioneering full scheme	**£0.4m** No change from core PR24 submission
Manchester Ship Canal BOD (Salford / Sale / Stockport) (31/03/2030)	**£27m** Cost of DPC management only. Assumes delivery by DPC in 2033.	**£323m** DPC management costs removed and replaced with full scheme costs for AMP8 delivery	**£323m** DPC management costs removed and replaced with full scheme costs for AMP8 delivery	**£323m** DPC management costs removed and replaced with full scheme costs for AMP8 delivery
Davyhulme BOD removals (31/03/2030)	**£784m** Full scheme costs included in AMP8 for delivery by 2030	**£784m** No change from core PR24 submission	**£52m** Interim solution to deliver 8mg/l BOD as part of adaptive pathway	**£52m** Interim solution to deliver 8mg/l BOD as part of adaptive pathway
Wigan and Skelmersdale (31/03/2030)	**£344m** Full scheme costs included in AMP8 for delivery by 2030	**£344m** No change from core PR24 submission	**£344m** No change from core PR24 submission	**£29m** Revert to DPC scheme starting in AMP8 once investigations complete and deliver by 2035
14 schemes with 2026 regulatory date profiled later in AMP (2006)	**£437m** Continue with PR24 submission with completion later in AMP through WINEP alteration process	**£437m** No change from core PR24 submission	**£437m** No change from core PR24 submission	**£437m** No change from core PR24 submission

2. Wigan, Skelmersdale and Pennington Flash

2.1.1 This section sets out the enhancement case of £974.44m totex to allow UUW to meet more onerous Environmental Permit requirements for final effluent phosphorus at Skelmersdale WwTW and final effluent phosphorus and ammonia at Wigan WwTW, as a result of drivers in the AMP8 WINEP. Additionally, this document sets out the case for enhancement investment for seven overflows in the Wigan WwTW drainage area which impact Pennington Flash. It is a standalone enhancement case, separate from UUW WINEP Final effluent limits and UUW WINEP storm overflows, because of the late change to our WINEP. The no-regrets phosphorus removal solution for Wigan and Skelmersdale is included within the Ww WINEP final effluent enhancement case, this case is for enhancement over and above this.

2.1.2 It is in this section we will cover why these requirements are outside of management control, our approach to solution development and how we have ensured that costs are robust. It also sets out the interaction we have undertaken with the Environment Agency about an adaptive plan for Wigan which would postpone the very low phosphorus and ammonia requirements until AMP9, and leave the least regrets interventions in AMP8. This is explained in section 2.1.3 which details the key regulatory interactions in relation to this enhancement. In addition it sets out an alternative pathway for the Pennington Flash overflows which maximises the opportunity for rainwater management thereby leading to some catchment and nature-based solutions. In the case of the Pennington Flash storm overflows the scale of costs and deliverability risk and the limited time we have had to develop solutions has led us to continue to review options and we will be in a position to provide an update on our final options development by 18 December 2023.

2.1.3 In our WINEP submission in January 2023 we identified the low phosphorus and ammonia requirements for Wigan and Skelmersdale WwTW as AMP9 drivers. By delivering them in this timeframe it would allow us to deliver to our adaptive plan that would give us 2025-30 to exploit rainwater management opportunities before having to lock in the final design for a new wastewater treatment works taking flows from both Wigan and Skelmersdale WwTW. This was also aligned with the need for Wigan WwTW to meet the storm overflow discharge reduction plan requirements by 2035.

2.1.4 In the 3 July 2023 version of the WINEP Wigan and Skelmersdale WwTW's were changed from AMP9 to AMP8 schemes. We now understand this was done due to a WFD_IMPg driver being associated with Wigan and Skelmersdale WwTWs. Our proposal was to phase these into AMP9 which was submitted as part of the joint regulators' request for proposals to phase investment, we included both Wigan, Skelmersdale WwTW and the Pennington Flash overflows in our phasing submission which we made on 19 July 2023. We made this phasing proposal on the understanding that the WFD improvement driver was statutory plus and thus there was some room for regulatory flexibility. A view supported by the fact that we had been directed by the Environment Agency to submit the alternative proposals we had identified to the national WINEP panel so they could be considered.

2.1.5 As a result of the decision from the Environment Agency on 18 August 2023 and subsequent confirmation on 24 August 2023 the Environment Agency's phasing decisions directed us to the phasing spreadsheet which stated that the proposals were rejected with the comment "Does not align to steer; WFD driver requires delivery within AMP8". As a result of this there was no route to re-consider this decision in light of the opportunity to deliver rainwater management options in partnership, and to maximise the potential for long term sustainable wastewater treatment. We have therefore included the full scheme to build combined new treatment facilities for the flows from Wigan and Skelmersdale WwTW's in our PR24 submission. Our cost estimate for this scheme in AMP8 is a gross totex value of £343.83m. Cost and scope items of this solution are included in Table 2. Additionally, variants B and C of our business plan tables include the Pennington Flash overflows at a totex value of £630.6m. Pennington Flash has not been included in our core plan as it was a late addition to our WINEP and it is a complex drainage area. In the time available a robust solution was not able to be defined and there remains

uncertainty in the deliverability and operability of the scheme. However, a high level solution and estimate has been possible and this is set out in variants B and C of this case. Our core plan includes an investigation to explore rainwater management options and a more optimised scheme for this drainage area that is in-line with our adaptive plan. This requires further discussion with the Environment Agency.

2.1.6 Where possible we are making use of phasing and adaptive planning to ensure we meet statutory requirements in a way that balances costs across the AMPs and prioritises delivery of least-, low- or no-regret measures first. This ensures we capture new statutory requirements and that we continue to meet existing ones despite changes in demand and climate change. This was the intention of the phasing of the low phosphorus and ammonia requirements into AMP9 to align with the adaptive plan. Variant D of our business plan tables reflects the full impact of this phasing if the Environment Agency were able to support it. As it stands the Environment Agency letter of 22 September 2023 makes it clear that their expectation is that we will deliver both the Wigan/Skelmersdale WwTW and the Pennington Flash overflow schemes by 2030 so they are both included in variants B and C of our data tables.

Table 2: Overview of requirements included in this enhancement case and associated totex included in this enhancement case

Driver	Scope	AMP8 Capex (£m)	AMP8 Opex (£m)	AMP8 Totex (£m)
Phosphorus removal Wigan and Skelmersdale 0.25mg/l EnvAct and WFDR Ammonia 1mg/l	**At Wigan WwTW** • New biological phosphorus activated sludge plant for combined flows of Wigan and Skelmersdale • New final tanks • New rapid gravity filters (RGF) • Sludge thickening and blending is also included to accommodate biological phosphorus sludge production. **At Skelmersdale WwTW** • Installation of diversion pipework to an existing pipeline to Wigan WwTW to join the Wigan effluent downstream of the primary settlement tanks.	343.83	0	343.83

Driver	Scope	AMP8 Capex (£m)	AMP8 Opex (£m)	AMP8 Totex (£m)
WFD requirement to reduce phosphorus loading on Pennington Flash by 260 kg/yr Environment Act 10 spills per annum for seven overflows	Individual overflows in Hindley PS drainage area • WIG0128 Bickershaw Lane PS – 6,000m3 storage tank requiring 13,000m3 excavation, CSO chamber and screen • WIG0129 Crankwood PS – 1650m3 storage tank requiring 4,295m3 excavation, CSO chamber and screen • WIG0216 & WIG0130 Abram Hall & Abram Hall PS – 2,400m3 storage requiring 5456m3 excavation, CSO chamber and screen • WIG00153 Strangeways PS – 850m3 storage requiring 2,451m3 excavation, CSO chamber and screen • WIG0095 Templeton Road PS – 6000m3 storage requiring 14,800m3 excavation, CSO chamber and screen **Hindley pumping station (includes for grouting mine shafts)** • 5,000m3 storage requiring CSO chamber and excavation • Additional transfer pumping station to pump an extra 400l/s • 3.6km of rising main (600mm diameter) **Ince pumping station** • Additional transfer pumping station to pump 400 l/s to trunk sewer • 0.6km of rising main (600mm diameter) **Trunk sewer** • Additional 12.5km of 1.2m diameter trunk sewer from Wigan town centre to Wigan WwTW **Wigan WwTW** • Additional scope to allow for 400l/s increase in flow to full treatment (dependent on Wigan and Skelmersdale WwTW solution being built)	630.61		630.61

2.1.7 The development of the WINEP has been informed by the key regulatory guidance including; the WINEP methodology, WINEP options development guidance, WINEP options assessment guidance, WINEP driver and supporting guidance. Our approach reflects the specific context within which we operate in the North West of England. Where there is uncertainty we are proposing investigations ahead of action so subsequent investment can be best value. Further detail on wastewater investigations is available in enhancement case UUW63_WINEP Investigations. We are also actively seeking partnerships to help spread costs across responsible and/or benefitting parties.

2.1.8 The Wigan and Skelmersdale drainage areas are in the South East of the Douglas catchment, with a mix of industrial, residential and mixed purpose land use. The Wigan drainage area covers approximately 82,500 properties, with a residential population of over 200,000 people and one of the largest industrial discharges in the North West. The population equivalent (PE) of the industrial contributions to Wigan is over 115,000. Wigan WwTW is our largest trickling filter plant. It also provides UV disinfection to the effluent from neighbouring Skelmersdale WwTW as part of a shared treatment stage.

2.1.9 Pennington Flash is a water body that was designated by Natural England as a National Nature Reserve in October 2022 and is located within the Glaze catchment. There are overflows which spill to Hey Brook upstream of the lake which have been identified in the latest version of the AMP8 WINEP. Resolution of these WINEP drivers is complex as the scale of change required means that storage alone will not solve the driver and we need to pass forward significant additional flows all the way to Wigan WwTW which involves new rising mains and tunnelling a new sewer as well as upgrades to the WwTW which are additional to that required to meet the drivers of the Wigan and Skelmersdale WwTW scheme.

2.1.10 Historically, discharges from Wigan and Skelmersdale WwTW have attracted environmental drivers under the Water Framework Directive, Bathing Water Directive, Shellfish Water Directive and Urban Wastewater Treatment Directive. Changes in legislation have led to improvements at the treatment facilities, as well as storm storage and overflow improvements on the drainage network. The Wigan and Skelmersdale catchments have multiple investment drivers in both AMP8 and beyond (Table 3).

2.1.11 To ensure our plan is consistent with the WINEP, costs are included in this enhancement case for the 0.25mg/l phosphorus and 1mg/l ammonia drivers at Wigan and Skelmersdale (Table 2). The costs for the Urban wastewater solutions are included within the Ww WINEP Final effluent enhancement case.

2.1.12 Other AMP8 costs for this catchment are included in the storm overflows enhancement case (Hindley and Templeton Road PSs) and the Wastewater WINEP Investigations enhancement case (EnvAct_INV4 Integrated water management investigation, Pennington Flash). These are independent drivers and remain in the plan in the event that the full Pennington Flash schemes is removed. Schemes are detailed in Table 3.

Table 3: WINEP drivers for Wigan and Skelmersdale WwTW AMP8 (and beyond)

Site	Driver Code	Determinand	Permit limit	Delivery timeframe	Enhancement case
Wigan	WFD_NDLS_CHEM1	Cypermethrin	0.003589 ug/l (99%ile) 0.0156518 ug/l (Upper Tier)	AMP8	Ww WINEP final effluent limits
Wigan	U_IMP2	Phosphorus	1 mg/l annual average	AMP8	Ww WINEP final effluent limits
Skelmersdale	U_IMP2	Phosphorus	2 mg/l annual average	AMP8	Ww WINEP final effluent limits
Wigan	U_MON4	Flow	Process Returns and 2 minute monitoring	AMP8	Ww WINEP Monitoring
Hindley PS	EnvAct_IMP5	Screen	Screening to 6mm in 2 dimensions and 1-in-5 storm return period standards	AMP8	Ww WINEP Storm Overflows
Hindley PS and Templeton Road PS	EnvAct_IMP2	Spill	Storage volume to meet Ammonia and DO standards in Hey Brook	AMP8	Ww WINEP Storm Overflows
Wigan	EnvAct_IMP1	Phosphorus	0.25 mg/l annual average	AMP8	**This enhancement case**
Wigan	WFD_IMPm	Ammonia	1 mg/l (95%ile)	AMP8	**This enhancement case**
Skelmersdale	EnvAct_IMP1	Phosphorus	0.25 mg/l annual average	AMP8	**This enhancement case**
Wigan catchment u/s of Hindley PS	EnvAct_INV4	Spill	Integrated water management investigation. Wigan WwTW drainage area u/s of Hindley PS	2027	Ww WINEP Investigations
WFD Pennington Flash	EnvAct_IMP4	Spill	73 per cent load removal to be met through improvements at Hindley PS, Templeton Rd PS, Bickershaw Lane PS, Crankwood Road PS, Abram Hall PS, Abram Hall CSO, and Strangeways CSO. Source apportionment has been agreed with Environment Agency for up to 20 overflows	AMP9	**This enhancement case**
Wigan Storm Tanks	EnvAct_IMP4	Spill	10 Spills/annum	AMP9	Future driver
All Wigan/ Skelmersdale CSOs	EnvAct_IMP4	Spill	10 Spills/annum	AMP10 - 12	Future driver

3. Need for enhancement investment

3.1.1 **This section details the environmental driver and legislation which supports the need for investment and our approach to addressing these requirements.**

3.1.2 We set out to develop the AMP8 WINEP proposal within the long-term context to ensure that our plan is balancing investment across the AMPs and intervening at the most appropriate time. Where appropriate, we have made use of long-term adaptive planning approaches to plan a low regrets route to meet long-term targets whilst also meeting our statutory obligations.

3.1.3 We have followed the Environment Agency driver guidance to identify needs for enhancement investment at WwTW within the UUW area. Where there are sites which require investment to achieve new permit limits for enhancement and have likely predicted growth within the catchment (which cannot be accommodated at the works) we have included provision within the Ww Supply & Demand enhancement case (further detail is included in the supplementary document *UUW65 – Wastewater Quality Enhancement case 16*).

3.1.4 We have specifically factored the impact of climate change into the development of our WINEP in several ways, for example we account for climate change in our hydraulic models when identifying the need for storm overflow improvement schemes (further detail in Storm Overflows enhancement case) and developing options to address the drivers. We also include for climate change when modelling the future requirements for our wastewater treatment works permits. Where impact is forecast in the near future (AMP8 or 9) we will look to factor adaptation to climate change into solutions for wastewater treatment works. This means we can deliver improvements to the resilience of water courses to climate change in an efficient way as we go about meeting other statutory drivers.

3.2 Phosphorus management

3.2.1 Phosphorus is a nutrient which is essential to life and as such, is found in high concentrations in wastewater. However, if too much phosphorous is released into the environment within the final effluent from a wastewater treatment works (WwTW), its nutritional properties can cause excessive plant or algae growth and lead to an alteration of the ecosystem from the natural state. It can also cause blue-green algal blooms in some waterbodies, which can prevent people and animals from using the waterbody and can damage the wider ecology of the habitat.

3.2.2 Reducing the concentrations of phosphorus in the final effluent reduces the risk of adverse environmental impacts. The AMP8 WINEP requires us to meet new low phosphorous limits at many treatment works in order to meet the targets of various Regulations and Acts, with the cost for Wigan and Skelmersdale WwTW being driven by the Water Environment (Water Framework Directive) Regulations 2017, as well as the Environment Act 2021.

3.2.3 Historically our approach to phosphorus removal has been based on chemical treatment to meet specific permit requirements. In AMP6 and AMP7, we changed our strategy to embrace biological phosphorus removal; leading the way with delivering innovative Nereda plants for four wastewater treatment works. We also successfully used catchment offsetting to achieve phosphorus targets in catchments. We have also worked with the Environment Agency on the implementation of a catchment permit for phosphorus in order to prevention deterioration in phosphorus concentrations in the Manchester Ship Canal by optimising phosphorus removal across the upstream catchment.

3.2.4 Chemical solutions are the most common intervention because they tend to have the lowest whole-life cost. However, through AMP7 and our AMP8 approach we are seeking to deliver phosphorous reductions through innovative interventions where appropriate and economic. Below are examples from AMP7 where we have taken an alternative approach to phosphorus management, for example:

- Through nutrient catchment balancing in the River Petteril catchment;

- Through the River Irwell flexible phosphorus permit;
- Through catchment permit balancing at Bowdon and Macclesfield WwTW;
- Through biological nutrient removal at our Nereda plants; and,
- Through installation of biological nutrient removal using mobile organic biofilm (MOB) technology at Macclesfield WwTW.

3.2.5 The introduction of the Environment Act 2021 long term phosphorus target means that UUW needs to remove another 1,000 tonnes per day of phosphorus to achieve its share of the industry's target by 2038. While much of this target includes achievement of Water Environment (Water Framework Directive) Regulations 2017 standards, it will require us to implement schemes previously deemed to be disproportionately costly. This is a significant change that puts added focus on the sustainability and resilience of the chemical supply chain as well as the logistics of frequent chemical delivery to sustain wastewater treatment and the ever increasing quantity of phosphorus rich sludge that needs to be recycled to a land-bank under pressure. Wigan WwTW is UUW's second largest WwTW requiring first time phosphorus removal to meet the long term Environment Act target and thus it is of significant importance in terms of the long term sustainability of phosphorus removal.

3.2.6 There is a global shortage of rock phosphorus with a heavy reliance on Morocco for resources and biological phosphorus removal presents an opportunity in the longer term to build a circular economy to put phosphorus back into the supply chain through phosphorus recovery. At the same time the North West has a surplus of phosphorus that contributes to the growing pressure we see around recycling biosolids to land thereby making the ability to move phosphorus out of the North West attractive.

3.2.7 Biological phosphorus removal is most cost effective at scale and in particular when the sewage strength is strong enough to sustain the bacteria. We have therefore evaluated our largest wastewater treatment works with phosphorus removal requirements and developed an option for biological phosphorus removal for those that are best suited. Wigan WwTW is one such site where we have evaluated biological phosphorus removal in the context of all the drivers visible to us over the near and longer term. Our proposal for this location is to deliver the long term environmental requirements as a combined solution. This joins flows from both treatment facilities through a transfer of Skelmersdale flows to Wigan WwTW and utilising a new biological phosphorous removal activated sludge plant. The approach has been assessed against alternative chemical dosing options and treatment at the respective works individually.

3.2.8 In addition to phosphorus removal Wigan WwTW has a WINEP requirement for a tighter ammonia permit limit of 1mg/l to meet Water Environment (Water Framework Directive) Regulations 2017 standards. This low ammonia along with the low phosphorus makes biological phosphorus removal the preferred long term solution for this site.

3.3 Storm overflow improvements with the Wigan WwTW network for the benefit of Pennington Flash

3.3.1 The future investment drivers for the Wigan and Skelmersdale drainage areas mean that we need to drive a significant transition in both the sewer network and treatment works. For the Wigan sewer network our preference is to deliver rainwater management solutions where it offers best value to address both storm overflow spills and flood risk. Reducing the amount of rainwater in the system will then ensure that the downstream treatment works can operate as sustainably as possible which is particularly important if we are to enable biological phosphorus removal which is most efficient and effective if is not left to treat dilute sewage for prolonged periods of time. There is therefore benefit to a biological phosphorus removal strategy if we can reduce the amount of sewage we are storing and draining down through the WwTW by separating out surface water and managing it in the environment local to where it falls.

3.3.2 In addition, we have identified that the Hindley part of the Wigan drainage area has a particular hydraulic constraint which means that we cannot achieve the storm overflow discharge reduction plan targets through storing sewage or treating sewage locally. There is insufficient hydraulic capacity in the downstream network to drain tanks within the required period.

3.3.3 Seven of the overflows in this area (Table 13 in the appendix) had new requirements added to our AMP8 WINEP in July 2023 in order to reduce the phosphorus loading on Pennington Flash (the Flash). This followed a study in AMP7 which identified the source apportionment for phosphorus into the Flash. The Flash is a water body that formed due to mining subsidence and it is fed by Hey Brook which receives discharges from multiple UUW storm overflows which have been shown to contribute to 15% of the phosphorus load to the water body. In 2022, Pennington Flash was designated as a National Nature Reserve in recognition of its remarkable natural beauty and immense ecological importance of the wetland habitats which were originally and uniquely formed by the 'flash' flooding of former coal mining sites.

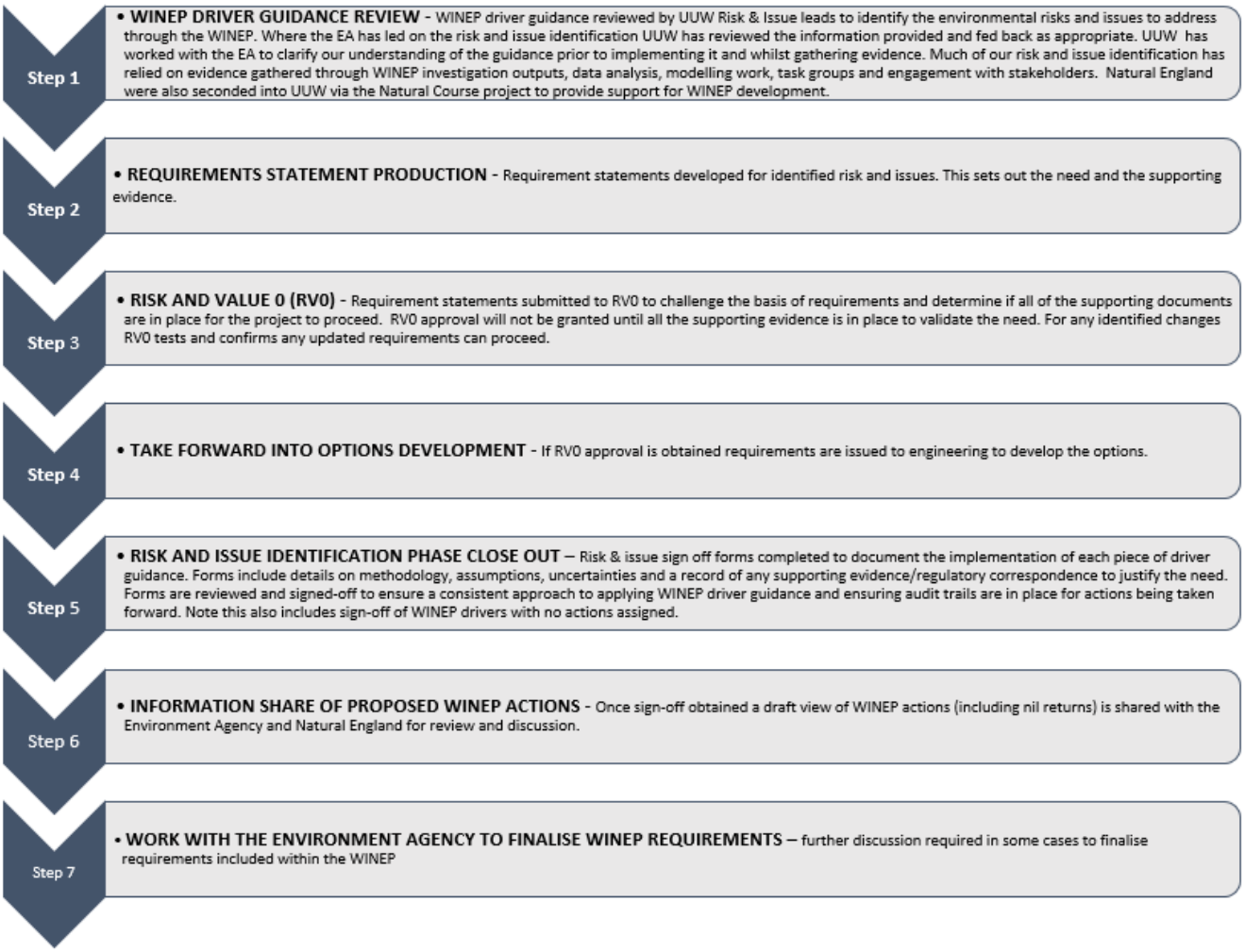
3.3.4 To address the requirements for this part of the drainage area we must therefore either target significant surface water separation from the combined system or upsize the downstream infrastructure to manage higher flows. Both these scenarios are presented in our PR24 submission, with variants A and D including for a strategic investigation to determine if widespread surface water removal can lead to the avoidance of the need for significant downstream infrastructure. In this variant, opportunities arising could be taken forward into delivery in AMP8 through our Advanced WINEP subject to meeting the criteria. In variants B and C of our plan we include for the full cost of the grey infrastructure solution we have been able to develop in the time available prior to our PR24 submission.

3.3.5 There is significant opportunity to work in partnership to manage rainwater differently in this area as more water is needed in the local landscape to support the landscape recovery ambitions of the Wigan Greenheart project. As a result of this we proposed phasing of investment in this area in our submission to the regulators on 19 July 2023. The first step on our plan was a proposal to investigate how management of rainwater can be reimagined in this area. This would then inform future decisions on infrastructure investment to address the multiple drivers of change in this area. This proposal was rejected by the Environment Agency stating that schemes with WFD drivers need to be delivered by 2030. Following discussion with Defra, Ofwat and EA on this matter and the loss of opportunity for rainwater management interventions, the Environment Agency confirmed in writing on 22 September that they expect us to fully address the requirements for these storm overflows in AMP8. As a result of this the full grey infrastructure scheme is included in variants B and C of the plan.

3.4 Approach to risk and issue identification

3.4.1 The approach we have taken to identify WINEP actions is in line with Stage 2 of the Environment Agency's WINEP methodology. This involves collaboratively identifying environmental issues that need addressing and risks that require further monitoring/investigation through the WINEP. Our risk and issue identification process follows a stage approached, shown in Figure 1, which has enabled us to identify where action is required to deliver compliance with our environmental obligations.

Figure 1: Risk and issue identification process stages



3.4.2 This collaborative process has ensured that we are prioritising and investing in areas which have a well evidenced environmental need, and that we are meeting those needs in the most efficient way. Where evidence of environmental impact is uncertain, we have proposed AMP8 investigations to ensure that any interventions are based on good evidence. In the case of the Pennington Flash overflows we are proposing an investigation to identify the opportunity to reimagine how rainwater is managed in this area. We have also sought to identify opportunities for partnership working, such that the best value for customers and the environment is secured.

3.5 Customer support

3.5.1 Customer research indicates protecting the environment is a key priority. Research for the Drainage and Wastewater Management Plan and Water Resources Management Plan carried out in April 2021 showed that 21% of those customers surveyed ranked removal of wastewater in the top three greatest long term challenges. It was also noted that aspects such as maintaining the network and wastewater treatment are often fairly easy for people to envisage, but happen in the background. When asked what people themselves feel is important; 'the impact on the environment is a constant concern' and customers 'love living in an area with lots of countryside and green space (perhaps heightened by Covid) and want this to be preserved'. We consider this to be evidence that customers support UUW's continued compliance with its environmental obligations.

3.5.2 UUW holds a library of customer insights for projects we have delivered within AMP7 (currently in progress from 2020 – 25). Each insight and research project has used an appropriate method to capture a variety of customer and stakeholder opinions, ensuring a representative view of the diverse customer base across the North West. This insight has been incorporated in to the options development and

selection process undertaken. Further information can be found in the UUW's WINEP approach to WINEP development and our insight and research library[1].

3.6 Management Control

3.6.1 Enhancements to performance included in the WINEP are outside of management control. The botex allowance maintains compliance with current permits. To enable compliance with new, more onerous permits, such as in this case, investment to enhance current assets or to deliver new assets is required. In certain cases sites can be optimised to achieve new limits with no or very little additional cost. An assessment of where this can be achieved has been undertaken and these schemes are included in the schemes listed in Appendix 2 of the *UUW63 Wastewater Quality Treatment enhancement case 11*.

3.6.2 As previously discussed, on 3 July 2023 the EA issued a version of the WINEP to reflect the latest position and, whist this reflected many of the changes we were expecting. It also included in AMP8 the significant investment drivers for Wigan and Skelmersdale WwTWs that had previously been in AMP9.

3.6.3 In response to the joint regulators' request for proposals to phase investment we included both Wigan, Skelmersdale WwTW and the Pennington Flash overflows in our phasing submission which we made on 19 July 2023. This was because phasing some of this investment into AMP9 would unlock two key aspects of a more sustainable solution, firstly we could drive rainwater management solution delivery in partnership as far as possible and secondly, we would allow the time to build a new biological phosphorus removal treatment works which would limit our increasing reliance on chemicals for phosphorus removal.

3.6.4 On 24 Aug 2023 it was confirmed by our account manager that there was no route to re-consider this decision in light of the opportunity to deliver rainwater management options in partnership and to maximise the potential for long term sustainable wastewater treatment. We have therefore included the full scheme to build combined new treatment facilities for the flows from Wigan and Skelmersdale WwTW in our AMP8 business plan. The solutions put forward in this enhancement case are the best value interventions, but there is a challenge to deliver this particular scheme within the AMP8 period.

3.6.5 For the Pennington Flash overflows we have only included the solutions to meet the needs of the immediate watercourse, Hey Brook, in variants A and D of the plan (*UUW64 – Wastewater Quality Overflows enhancement case 13*) as the full solution to meet the phosphorus standards will involve significant re-engineering of the downstream system from Hindley pumping station if we do not have time to exploit rainwater management at scale. We have included an investigation in the plan to investigate the most sustainable long term solution option for these overflows, there is more detail of this investigation in the Ww WINEP Investigations enhancement case. In variants B and C of the plan we have included the full grey infrastructure solution for the seven overflows on the basis this is currently the only known way we can meet the regulatory requirement by the 2030 regulatory date although deliverability would be very challenging. Further work is being undertaken to determine if we can improve the value, operability and deliverability of the scheme, and to determine if there are any further options in light of the scale of investment required.

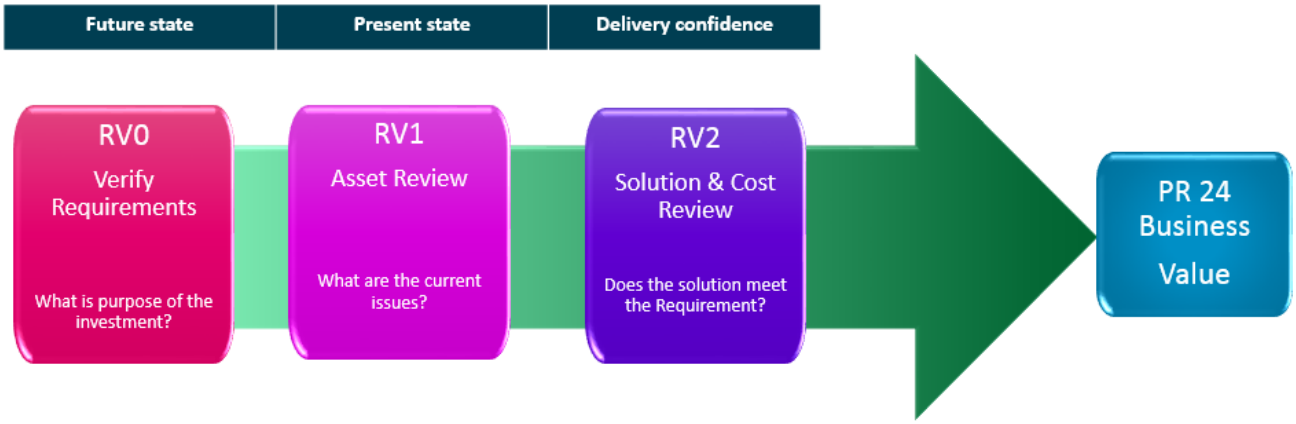
[1] 2023 (UUW) Customer insight and research library. Available here: https://www.unitedutilities.com/corporate/about-us/our-future-plans/listening-to-our-customers/insight-and-research-library/

4. Best option for customers

4.1 Options development

4.1.1 PR24 options development followed the fundamental principles UUW defined value management process. Risk and Value for PR24 (RV) was a three stage process (shown in the diagram below), aimed at positively challenging our projects to ensure we have sufficient evidence behind decisions. It provides UUW with confidence that they are proposing the right projects for the AMP8 Programme and therefore managing and maximising the value for their customers from their investments. It also ensures that the organisation adopts the correct approach to option identification, development and selection to maximise the realisation of benefits associated with these investments.

Figure 2: Risk and value process



4.1.2 Once the requirements have been clearly verified RV1 was completed in order to understand the current asset condition and performance. Without this understanding there is significant risk that proposed solutions will fail to deliver the value intended and may even fail to satisfy the requirements. This initial baselining was essential in order to allow identification of possible options against the generic high level solutions (GHLS).

4.1.3 Options to address PR24 requirements passed through a series of stages before the agreed solution was confirmed, from an initial 'un-constrained' list of options through to confirmation of the defined and estimated scope associated with a preferred solution.

4.1.4 Within the options development process, un-constrained options were identified against a list of GHLS categories. If un-constrained options were deemed viable then additional screening was carried out to identify 'constrained' options, with further screening taking place to refine the feasible solutions and determine those to be progressed to detailed scope development and estimating. In developing feasible options the engineer will always have taken which solution could represent the best value to the customer into consideration.

Table 4: Generic High Level Solutions (GHLS)

GHLS	Description
Monitor & Respond	*Accept risk with agreed contingency plan*
Operational Intervention	*Solve need by identifying targeted maintenance to restore performance*
Optimise Asset	*Solve need by improving performance of existing equipment*
Partnership	*Solving need by assistance of third parties, i.e. assisting farmers reduce pollution of watercourses*
Refurbish Asset	*Major asset refurbishment to restore asset life and performance*
Replacement	*Replace asset(s) on like for like basis*
New Asset	*Build new asset when all other options are not possible (this could be a NBS)*
Integrated Approach	*Integrated solution across asset boundaries e.g. network, process, bio-resources or catchment level solutions. An integrated solution is a Systems Thinking response and could be a combination of the above solution types.*
Combination of generic high level solutions	*Example - SuDS and a storage tank to address storm overflows*

4.1.5 Should a refurbishment, replacement or new asset solution be identified, a number of design tools were used to develop the requirement through to an estimated solution. Base design data was gathered from UUW's corporate systems to inform the design, including flow, quality and treatment performance data. In the majority of cases a 2050 design forecast was used, the exception being when there was a high level of uncertainty in the design forecast thus ensuring the most efficient design for the future.

4.1.6 A standardised methodology to solution identification was developed for wastewater treatment works to ensure a consistent approach. The 'Process Decision Support Tool' cross referenced permit values, population and flow data with UUW treatment processes and asset standards to identity and size interventions to meet the requirements. Solutions proposed by the tool included conventional (including chemical and biological phosphorus removal) innovative and nature based solutions (NBS).

4.1.7 If nature-based solutions were identified these were investigated further using a GiS constraints tool. The aim was to interrogate the NBS opportunities within the catchments, using a basic data set to include topographical information, land availability, soil type etc. alongside Farmscoper and SIMCAT SAGIS models. The opportunity was screened against the layers to identify if the NBS was a viable option. Widespread use of this methodology was adopted across the programme in order to maximise NBS opportunities.

4.1.8 Where a potential partnership opportunity was identified, a partnership-based option was developed using the UUW partnership framework. The framework sign posts tools that can be used to support the assessment of suitable potential partnerships and formation of successful partnerships. This will have been developed in collaboration with the strategy managers to identify relevant partners, seek opportunities for co-funding and assess technical feasibility.

4.1.9 Use of these optioneering tools ensured the process was proportionate to the scale of the risk to be addressed. They provided a quick and effective way of ruling out unsuitable options and identifying feasible solutions over a range of different option types. A detailed engineered design was then developed for all the feasible solutions identified during this screening process in order to provide comprehensive cost and carbon data.

4.1.10 It is at this stage that the options were also assessed for deliverability. A review was undertaken by the Planning, Land & Environmental Team and UUW's Construction Services which allowed identification of risks and potential mitigation measures. This will have improved the cost accuracy associated with implementing the PR24 solution, it also allowed elimination of options which are not deliverable thereby confirming feasibility. This also included an assessment of the likely delivery route (including Direct Procurement for Customers) which was then used as the basis for the Contractor add-ons in the cost estimate.

4.1.11 In the case of the Pennington Flash overflows which are included in scenarios B and C we have had limited time to fully implement this process and we continue to work on ensuring we have the best option. We will continue to develop the maturity of this scheme and welcome further discussion with regulators on the preferred approach.

4.2 Innovation

4.2.1 For the Wigan WwTW drainage area further innovation and continual improvements related to Dynamic Network Management (DNM) will enable targeted interventions on the sewer network to be prioritised. The in-sewer monitoring, artificial intelligence (AI) platform and operational interventions we are seeing from DNM provides a new level of situational awareness that we have not had before. As we, and the AI system, learn more about the system performance we forecast to be able to operate, and also intervene, more effectively. This innovation will enable improvements to operational effectiveness of the system. There are however hydraulic challenges within these drainage areas and targeted enhancements are required across the 25-year planning horizon.

Adaptive plan and rainwater management

4.2.2 Our proposal for a combined Wigan and Skelmersdale adaptive plan has been identified through our Drainage and Wastewater Management Plan (DWMP). Through our DWMP risk assessments and needs identification we propose a strategy that seeks to balance requirements across the network and treatment assets, as well as optimise the timings of interventions. The future investment drivers for the Wigan and Skelmersdale drainage areas mean that we need to drive a significant change in both the sewer network and treatment works.

4.2.3 For the Wigan sewer network our plan would be to drive rainwater management as a preferred option where it offers best value to address both storm overflow spills and flood risk. Reducing the amount of rainwater in the system will then ensure that the downstream treatment works can operate as sustainably as possible. The plan has identified that the preferred pathway is to combine the two treatment works into one new biological phosphorus removal activated sludge plant (BioP ASP) which should offer benefits to priority substances as well as phosphorus loading in the watercourse. This will minimise the reliance of our third largest treatment works on chemical dosing to achieve phosphorus removal.

Partnership opportunity

4.2.4 Wigan Greenheart is a partnership including Wigan Council, Greater Manchester Combined Authority, Lancashire Wildlife Trust, Natural England and the Forestry Commission. It is driving a Landscape Recovery Scheme that has been established to develop a plan to further rejuvenate the landscape from its industrial past and help deliver the local Nature recovery network strategy. The scheme is currently funded for a two year development stage which will produce a plan to 2050. This plan will be delivered in a 20 year implementation phase supported by blended public-private funding approach

4.2.5 The scheme has a number of environmental and social objectives well aligned with UUW's strategic priorities. The environmental objectives align with the challenges UUW has in the Hindley part of the Wigan drainage area offer opportunities for surface water management.

4.2.6 Discussions with Wigan Greenheart have revealed the shared direction and timing of the projects. A natural partnership to co-develop plans for the catchment is emerging and the potential for development of an integrated water management plan for the Flashes of Wigan and Leigh National Nature Reserve. To seize this partnership opportunity we would need the flexibility to drive forwards with rainwater management ahead of locking in the grey infrastructure solutions that would be needed to complement it. This opportunity will be significantly diminished with a requirement to deliver a full solution by 2030.

4.3 Options selection

4.3.1 We are moving towards the 'best value' approach, promoted by the regulators, with a best value option being one which drives the best outcomes for the environment, customers, society and UUW over the long term.

4.3.2 The value associated with the various options was assessed using the value assessment tool developed by UUW specifically for this purpose. This tool lists intervention type and pulls through the associated benefits and value. It assesses value against a number of benefits including all the wider environmental outcomes as requested in the EA WINEP Options Development Guidance. The benefits were drawn from the MyRisk Risk Breakdown Structure, currently widely used in UUW. The wider value element, was also taken from the EA's WINEP guidance on Wider Environmental Outcomes.

4.3.3 The inputs to the value tool included costs (capex, opex and whole life), carbon (embedded, operation and whole life), data on biodiversity plus risks and benefits as described above. The outputs from the tool included a cost benefit analysis and allowed the selection of the preferred solution based on the comparison of value between the various options (RV2). The option selected was therefore that which provides the best value to our customers.

4.3.4 To ensure consistency and oversight, the WINEP Programme Scenario Development Group has reviewed the overall programme summary in terms of cost, value, benefits and carbon to ensure decisions on preferred options are well evidenced and in customers' interests. The group has focused on reviewing where the outcome of the best value assessment has led to marginal differences between options. This group reviewed the value assessment and the analysis indicates that the combined BioP ASP solution has a lower whole life cost than for the separate solutions.

5. Cost efficiency

5.1.1 This section sets out how we have calculated the value of this enhancement case, how we have challenged our assumptions to develop efficient costs and how these have been benchmarked and assured.

5.2 Approach to cost build

5.2.1 Costs for projects which have a final effluent improvement requirement have been assessed using site specific information. In some cases such as those projects associated with the Wigan solution detailed optioneering has taken place to ensure we are addressing requirements in line with the adaptive plan in a least cost, low/no regrets order in AMP8, ensuring our plan is as efficient as possible and in line with future environmental drivers we know are imposed in AMP9 and beyond.

5.2.2 Our UUW engineering team has developed solutions for each individual site based on the sites specific requirements and the future permit requirements of the WINEP. This assessment resulted in a scope items list and sizing which was passed to the estimating team to build the individual direct capital costs. An example of these scope items is detailed in the Ww WINEP Final effluent enhancement case. This case also includes detailed case studies for the estimating breakdown of the costs submitted in our plan.

Wigan and Skelmersdale WwTW 0.25mg/l phosphorus and 1mg/l ammonia solution

5.2.3 The solution to achieve the technically achievable limit for phosphorus and the 1mg/l ammonia permit at Wigan WwTW is to construct a new biological phosphorus removal activated sludge plant. Total capex for this is £343.83m. Following commissioning of this plant the ongoing opex costs are assessed as £9.70m per annum.

5.2.4 Wigan WwTW is currently the largest filter works in the North West. To enable efficient phosphorus removal and to achieve the low ammonia permit an activated sludge process is required. This solution will treat the effluent from both Wigan and Skelmersdale WwTW. These sites are very close to each other and currently the flows come together ahead of the joint UV treatment.

5.2.5 The proposal joins flows from both treatment facilities through a transfer of Skelmersdale flows to Wigan WwTW and utilising a new biological phosphorous removal (Bio P) activated sludge plant (ASP). The approach has been assessed against alternative chemical dosing options and treatment at the respective works individually. At Wigan WwTW this solution includes: new biological phosphorus ASP, new final tanks and new rapid gravity filters (RGF). Sludge thickening and blending is also included to accommodate biological phosphorus sludge production.

5.2.6 The solution at Skelmersdale WwTW includes the installation of diversion pipework to a connection to an existing pipeline to Wigan WwTW. The effluent from Skelmersdale will join the Wigan effluent downstream of the primary settlement tanks.

5.2.7 With rainwater management interventions within the upstream catchment and optimisation we are striving to avoid, or at least minimise, any increase to existing flow to full treatment, beyond the increase of transferred flow from Skelmersdale to Wigan. The design assumptions and process unit sizing allow capacity for projected growth in both catchments. A wastewater treatment model based on wastewater characterisation sampling data demonstrated the sizing of the units is appropriate and will operate as intended and the effluent has been assessed as being suitable for enhanced biological phosphorous removal (EBPR) throughout the year due to significant trade effluent contribution and hence strong crude influent.

5.2.8 An alternative approach to delivering Wigan and Skelmersdale is to optimise the project and explore a DPC delivery route into AMP9. In variant D of this case we have included £28.9m to develop this option.

Pennington Flash storm overflows

5.2.9 Seven storm overflows have been identified in the Hindley area as requiring improvement to reduce spill frequency to an average of no more than 10 per annum in order to deliver our fair share reduction in phosphorus loading to Pennington Flash which is 260kg/yr. The options considered ahead of costing a solution were those set out in Table 5.

5.2.10 This initial exercise identified that the only viable options are those that increase capacity downstream of Hindley pumping station, either through increasing pass forward flow or by reducing demand.

5.2.11 The solution in variants B and C of our plan involves storage at six overflows and a significant increase in pass forward flow from Hindley pumping station through which all the other tanks would need to empty including the one for Hindley pumping station itself. This increase in pass forward flow from Hindley pumping station drives 86% of the scheme cost as the hydraulic constraint exists down the full drainage system all the way to Wigan WwTW and includes the treatment works itself. Due to the significance of this cost we continue to refine this solution and will be in a position to provide an update on this by 18 December 2023.

5.2.12 The delivery of the Pennington Flash scheme is dependent on the delivery of the Wigan and Skelmersdale WwTW scheme which is also included in this document. There is also a need for some additional expenditure at Wigan WwTW driven purely by the increase in pass forward flow from Hindley pumping station which is included in the Pennington Flash scheme cost. This cost is to accommodate an increase in pass forward flow of 400l/s at Wigan WwTW.

5.2.13 The cost for increasing pass forward flow from Hindley PS includes for a new transfer pumping station to pass forward flows to Ince PS which will also require upgrade. In total over 4km of new rising main are required and 12.5km of gravity sewer which will need to be laid by tunnelling. This new sewer will need to cross six railway lines including the West Coast mainline, the M6, Leeds Liverpool Canal and will include seven river crossings. This will add to the risk and deliverability associated with the scheme which is why we continue to develop this variant proposal.

5.2.14 We have also taken account of some known risk associated with the mining history in the area which means we will need to stabilise the ground in at least three locations to ensure solutions do not suffer from subsidence.

Table 5: Options considered to address the Pennington Flash overflow WINEP drivers

Option	Cost £m	Impact on Ww Network system operation	Impact on Ww Treatment works	Impact on Hey Brook & Pennington Flash	Impact on River Douglas
Build 35,000 m3 storage at Hindley WwPS and no increase in pass forward flow from Hindley	N/A does not meet WINEP requirement	Draindown of the storage would be impossible due to lack of available headroom in downstream system	Minimal as pass forward flow is not increased. There will be an increase in average flows	Inability to drain down storage will mean the 10 spill per annum requirement will not be met	Limited as there is no increase in pass forward flow
Build new WwTW to discharge to Hey Brook	N/A does not meet WINEP requirement	Significant reduction of pressure on the wastewater network downstream of Hindley PS	Positive impact on Wigan WwTW reducing flows and load significantly	The phosphorus load reduction target cannot be met as the technically achievable limit of 0.25mg/l P for WwTW equates to an increase of 1500kg/yr P against a target reduction of 260kg/yr	Positive impact through reduction in flows arriving at Wigan WwTW
Reduce flows to Hindley WwPS by SW removal	N/A at this stage as we seek to understand viability through the AMP8 study which is included in scenarios A & D	Positive impact on network, reduced flows	May improve efficiency and effectiveness of biological phosphorus removal	Uncertain whether we can take sufficient pressure off the combined sewer system to meet the spill performance without the need to upsize assets downstream of Hindley PS	Positive impact through reduction in flows arriving at Wigan WwTW
Build storage and increase pass forward of the drainage system from Hindley PS up to and including Wigan WwTW	£631m (incl in scenario B & C)	Neutral, as the increased pass forward flow allows the solutions to drain down	Requires an increase in FTFT at Wigan WwTW which is included in scope	Meets WINEP requirement	Scheme includes for increasing FTFT at Wigan WwTW to avoid adverse impact

5.2.15 The total cost of the Pennington Flash scheme is estimated at £630.6m.

5.2.16 In scenario D of our business plan tables we set out an alternative option which takes a more adaptive approach involves where we would undertake the following in AMP8:

- Develop an integrated urban drainage model with partners;
- Complete a feasibility study on the removal of water from the network and the potential to deliver nature based solutions in conjunction with Wigan Greenheart;
- Potential to deliver rainwater management interventions through UUWs Advanced WINEP subject to criteria being met;
- Deliver WFD solutions to meet standards for Hey Brook which would meet 25% of the overall P load removal target and address the immediate local impact of two overflows (Hindley PS and Templeton Road). Note: the lesser storage volume for Hindley PS can be drained down and is complimentary to a future pass forward solutions;
- Start work in the major scheme for Wigan/Skelmersdale WwTW which requires land purchase; and
- Set up contractual arrangements for delivery through Direct Procurement for Customers.

5.2.17 In this scenario D we would then complete the following in AMP9:

- Delivery of improvements at Wigan/Skelmersdale WwTW with the scheme finishing by 2035; and
- Delivery of the remainder of the grey infrastructure element of the Pennington Flash overflow solution.

5.2.18 This scenario would open up the opportunity to ensure we were able to fully explore the potential for catchment and nature based solutions with the potential to deliver better value.

5.2.19 In view of the likely cost of the Pennington Flash storm overflow scheme we have given consideration to delivery through Direct Procurement for Customers (DPC). As this scheme already has significant deliverability risk to meet the 2030 regulatory date the addition of the time required to deliver through DPC will further add to this issue. In the same way as the EA has been clear that the proposed DPC scheme for Salford WwTW must be delivered by 2030, the same issue would apply to the Pennington Flash overflows and therefore we do not consider this scheme suitable for DPC.

5.3 Approach to challenging our assumptions

5.3.1 There are several aspects of project costs, which are impacted by the scale of the programme and thus as the AMP8 programme matures, they may be subject to change. Current assumptions include an estimated 7% allowance for corporate overhead. This is estimated on high level anticipated organisational structures needed to support the programme. This has been calculated based on current delivery assumptions, which is a largely outsourced design and build basis.

5.3.2 UUW's AMP8 WINEP is substantially larger in scale than that seen previously, and larger than the whole WINEP for England in AMP7. Additionally, we also expect the AMP9 WINEP to be substantial in scale given the longer-term environmental requirements that are already visible today. As a result of this, it is more important than ever that we can give regulators, customers and stakeholders confidence around the development of the WINEP and so we commissioned Arup to run an independent scrutiny and challenge process on the development of the PR24 WINEP. Arup worked with specialists across UUW to understand how we had arrived at the scope, the approach to developing costs and whether the programme had been appropriately optimised.

5.3.3 Feedback from Arup: "Overall, we note the very significant amount of work that was done by UUW in the short time between our reviews…we found that UUW responded positively to the challenge and scrutiny applied to it from Arup and the Panel members, with a very significant amount of work undertaken after our initial review. We observed that progress had been made by UWW in many areas that we highlighted in our original review. As part of this, we also noted a strong push across the leadership and the operational teams on trying to ensure that the programme achieves a balance of solutions across traditional engineered approaches and alternative solutions where these are feasible and appropriate.".

5.3.4 The WINEP scrutiny and challenge panel consisted of: Trevor Bishop (Independent, Panel Chair), Bernice Law (Independent (and Chair of UUW's YourVoice ICG panel)), Alastair Chisholm (Director of Policy, CIWEM), Simon Wright OBE (Independent) and Ryan Harris (Senior Commercial Director, Arcadis). The panel concluded: "It is reassuring to see the company embracing and positively responding to the key challenges set by the panel of independent experts on its WINEP programme. Whilst the company's WINEP programme is, by necessity of the environmental issues to be resolved in the North West, both substantial and complex the panel is encouraged to see a carefully balanced programme being developed. The use of adaptive planning was noted by the panel who strongly supported the approach to ensure further optimisation of value for money and reductions in carbon as solutions are refined through experience."[2]

5.3.5 Following the initial review by Arup we incorporated their feedback into our plan. Particularly relevant to this case is the cost estimating methodology which following the second review they concluded that UUW costing methodologies largely comply with the requirements of WINEP guidance as well as standard industry practice. However, they did raise concern that "across a broad programme the level of risk allowance is at the lower end of the range we would expect". We have further developed our plan to ensure concerns raised are addressed within the final estimates.

[2] 2023, Arup, WINEP Scrutiny and challenge Independent review report – Final

5.4 Third party assurance

Bottom-up benchmarking (Faithful and Gould)

5.4.1 Faithful and Gould (F&G) undertook a bottom-up deep dive into the cost efficiency of our enhancement cases. This involved a close examination of our cost base relating to a sample of our enhancement programme, with comparisons made to similar activity carried out by third party companies across a variety of sectors.

5.4.2 F&G looked at our direct costs across each of the following categories:

(a) Staff including site supervision

(b) Mobilisation and site set up, running and removal of site offices and welfare

(c) Temporary services for general site use, such as water to wash out concrete skips

(d) Attendant plant and equipment, such as cranes, forklift for unloading deliveries etc.

(e) Attendant labour, defined as hourly paid operatives not involved in productive works

(f) Site consumables, such as waste skips

(g) Set-up site compounds, erecting hoardings etc.

(h) O&M manuals

(i) Health and safety

5.4.3 It also looked at the contractor's indirect costs (e.g. overhead and design costs) and UUW's indirect costs (e.g. land acquisition costs). Due to the size of the programme, F&G examined a sample of our enhancement cases. However, this sample included projects from each of our enhancement categories and covered £1.246bn of expenditure. Therefore, we consider this sample to be representative of our overall enhancement programme.

5.4.4 F&G noted the effectiveness of UUW's cost estimation process:

"In addition to the benchmarking data held by Faithful+Gould we understand that UUW has applied multiple internal and external challenges to progressively refine the cost estimation undertaken to date. In particular we note UUW's use of its Investment Programme Estimating System (IPES) which is a bespoke parametric estimating tool containing data from AMP3 to AMP7, to provide historical cost curves alongside estimated data from third party organisations."

5.4.5 F&G found that our proposed costs are in line with rates typically seen across the industry:

"Overall, UUW's approach of utilising historic cost curves, market testing and obtaining specialist third party quotations demonstrates a sound proactive approach to cost planning. In total £1.2bn of schemes underwent targeted cost assessment with £573m making up the construction works element.

After presenting our initial findings it was encouraging to see UUW's commitment to addressing our findings and applying these to the wider enhancement estimates, charting a strategic route towards greater efficiency and scope clarification.

In light of this Cost Assurance work and evidence of UUW's responsive actions we have concluded that the data we have benchmarked is within a reasonable alignment with anticipated market rates."

6. Customer protection

6.1.1 This section outlines how customers are protected from non-delivery of schemes including the impact on Outcome Delivery Incentives and Price Control Deliverables.

6.2 Managing uncertainty

6.2.1 It is important that customers have confidence that we will deliver the enhancement schemes that get reflected in our PR24 final determinations and they are suitably protected in the event of non-delivery, or if there are material changes to deliverables (including changes to dates), which lead to a change in cost (including changes in the timing of required expenditure). Ofwat proposes that, if companies fail to deliver or are late delivering improvements to customers, then price control deliverables (PCDs) should be used to compensate customers. In our PR24 plan (*Chapter 8 – Delivering at efficient cost* and related enhancement claims) we have proposed an approach to PCDs that aims to provide customer protection, such that customers are fairly compensated for non-delivery (such as due to a change in regulatory requirements) or late delivery (including as a result of a change to a regulatory date), between PCDs, any related ODI underperformance payments, and cost sharing arrangements.

6.2.2 We consider, in this case, that if a WINEP improvement scheme is no longer required, then this should not constitute a failure to deliver. This situation is the action of a regulator, outside of company control and not the result of company failure or action. In this situation, it is particularly important that there should be no punitive component to any PCD (I.e. it should focus on restoration of customer bill impacts). This approach would then protect customers from non-delivery of improvements and protects companies from a change in regulatory requirements.

6.2.3 Customers are also protected from non-delivery through the following ODIs:

- Improving river water quality (phosphorus) – the phosphorus reduction projects are built into the baseline of this performance commitment, therefore if they are not delivered the WwTW will not achieve the required phosphorus load removal and we will incur an underperformance payment through this ODI. As this PC is measured on a calendar year the schemes at Wigan and Skelmersdale are not included within the AMP8 baseline as they do not deliver until March 2025; and
- Discharge permit compliance - if we fail to deliver improvements to our discharges on time we would still expect the Environment Agency to issue the revised permit which we would be at high risk of failing to achieve. If we failed to achieve the new final effluent permit standards we will incur an underperformance payment through this ODI.

6.2.4 Additional consequences of non-delivery include:

- Prosecution and fines due to non-compliance with permits;
- Reputational impact of Environmental Performance Assessment;
- Loss of trust with customers and stakeholders; and
- Loss of trust with the Environment Agency leading to less support for innovative approaches to delivering environmental improvement.

6.3 Managing change

6.3.1 It is reasonable to expect that customers should only pay for enhancement outcomes that are actually delivered. Due to rapidly evolving environmental legislation and supporting Environment Agency driver guidance, uncertainty is inherent in this submission and both customers and companies need a mechanism to manage this uncertainty.

6.3.2 It may be possible to make use of Ofwat's proposed Price Control Deliverables (PCD) mechanism, if appropriately specified, to help manage this uncertainty. We explore this further below.

6.3.3 Any changes to our programme will be made in agreement with the Environment Agency and Your Voice to ensure confidence that we are only working on improvements that are fully justified. In response to the Environment Agency's phasing decisions communicated in August 2023 we wrote to them on 31 August 2023 explaining where there are non-cost beneficial schemes or those which do not align to the longer term adaptive plan which included, Wigan and Skelmersdale WwTW and the Pennington Flash overflows. This letter has been submitted in lieu of the PR24 change control process which the EA has confirmed will not be available until the start of AMP8. A copy of this letter is available in Appendix B. The Environment Agency responded on 22 September 2023 setting out that Wigan/Skelmersdale WwTW and Pennington Flash schemes must be delivered by 2030 and so we have included them in scenarios A, B and C for Wigan/Skelmersdale WwTW and scenarios B and C for Pennington Flash.

6.3.4 In reconciling performance at PR29, our 'Output in use certificate' (or equivalent documentation once formalised) would be used as appropriate evidence for the Price Control Deliverable that the scheme has been delivered. The delivery of schemes are also reported by the Environment Agency on the Defra SharePoint site that is used for WINEP development. If, at the time of submission for PR29, this documentation had not been received, we would provide the appropriate evidence and assurance that delivery would be achieved before 31 March 2030 or the Price Control Deliverable would take effect and return the allowance to customers.

6.3.5 We propose to apply the same level of assurance to this Price Control Deliverable as we propose for the AMP8 Outcome Delivery Incentives, which we also expect to be in line with our AMP7 assurance framework

6.4 Price Control Deliverable (PCD)

6.4.1 Price Control Deliverables have been developed to protect customers from:

- Non-delivery of enhancement programmes; and,
- Late delivery, including any agreement between UUW and the regulators (such as the Environment Agency) that an output is no longer required.

6.4.2 In the context of managing changes to requirements or delivery dates, PCDs should be designed to compensate customers for any time value of money benefit arising for the company in the event that one or more schemes are deferred. Likewise, if any schemes are deemed not to be required, the PCD should (if designed appropriately) compensate customers fairly for the company's avoided costs.

6.4.3 We have set out more details regarding our approach to PCDs in *Chapter 8 – Delivering at efficient cost, section 8.8.9.*

6.4.4 Given the potential inter-AMP nature of these variants, it seems that it will be necessary to ensure that PCDs are either:

- established as multi AMP PCDs
- any PCD delivery payments (excluding time value/late delivery payments) due at the end of AMP8 are agreed to be transferred into AMP9 cost allowances to ensure AMP9 delivery is appropriately funded (this is equivalent to the shortfalling approach that Ofwat utilised up until it was removed at PR14).

6.4.5 As PCDs are still an emerging methodological approach, we will undoubtedly engage further with Ofwat to ensure that the PCDs set at final determinations both protect customers, whilst not being unduly punitive for companies in these such cases whereby the timing of requirements is not currently 100% certain.

Wigan and Skelmersdale PCD

6.4.6 This PCD reflects our core plan (Variant A) as well representing Variants B and C.

Table 6: PCD summary

Scheme delivery expectations	
Description of deliverable	Deliver enhancement to meet the needs of the AMP8 WINEP for 0.25mg/l Phosphorus at Wigan and Skelmersdale WwTW and 1mg/l ammonia at Wigan WwTW
Output measurement and reporting	We have calculated the cumulative PCD deliverables based on delivery of the scheme in AMP8. As stated in the enhancement case delivery of this project is not achievable within the AMP8 period. We have proportioned the milestones as 20% for Contract Award, 40% Start on Site and 40% Project in Use. We propose the completion of site schemes will be reported through the APR process. Whilst these tables do not currently allow for project milestone delivery, this additional detail could be set out in table commentary. No delivery completion is forecast in year 1. This year will be spent in design and definition project phase, and tendering contracts.
Assurance	In line with EA guidance completion of an action will require the live WINEP/NEP to have been signed off by UUW with the relevant Output in Use evidence pack uploaded to the EA WINEP SharePoint. The EA will then also need to sign the live WINEP/NEP to confirm they are happy that the scheme has been completed. For schemes with a regulatory date of 31 March the EA has until 15 May in order to review the evidence and sign-off. EA sign-off provides third party assurance.
Conditions on scheme	None
Impact on PCs	We have assumed no impact, given our expectation of a deferral to the compliance date. If that is not the case, then delays to this scheme would impact the treatment works compliance PCL and hence lead to a penalty, which would need to be deducted from any PCD payment.

6.4.7 In our PCD template *UUW32-PCD Excel Sheet* we have assumed a wholesale WACC of 3.23%, in line with Ofwat's guidance. We have assumed a 50% totex cost sharing rate, which is applied before calculating PCDs. We have applied a further 50% for Bioresources (where applicable), to ensure that only 25% of Bioresources totex is at risk from PCDs, given the lack of RCV guarantee, and general uncertainty in cost recovery from future Bioresources price controls. For late delivery we have applied a proportionate value of annual opex, and assumed 3.5% of capex, which provides a fair reflection of the time value of money of any related deferred capital spend.

Table 7: PCD delivery profile

	Unit	AMP8	2024	2025	2026	2027	2028	2029	2030	Ultimate delivery
Cumulative delivery target for PCD	**% delivered**		**0**	**0**	**0**	**20**	**60**	**60**	**100**	**100**
AMP8 Capex (22/23 pb)	£	343,829,451	-	-	17,150,678	34,232,350	88,207,650	139,007,968	65,230,806	
AMP8 Opex (22/23 pb)	£	0	-	-	-	-	-	-	-	
ODI impact per unit of PCD volume	£/% delivered	0.00								

Table 8: Price Control Allocation

Price Control	Unit	Price Control Allocation
Water resources	%	0.00%
Water network+	%	0.00%
Wastewater Network+	%	100.00%
Bioresources	%	0.00%

Table 9: PCD Incentive rates

	Unit	WR	WN+	WwN+	BR
Overall delivery	£/% delivered	0	0	1,719,147	0
Time value rate	£/% delivered	0	0	55,528	0
Late delivery	£/% delivered	0	0	115,699	0

Table 10: Wigan and Skelmersdale PCD totex (£m) – variant D

Scheme	2026	2027	2028	2029	2030	Total
Phosphorus removal Wigan and Skelmersdale DPC management costs	-	4,443.436	12,013.371	5,188.786	7,251.072	28,896.665
DPC Milestone	2	3	3	3	3	3

6.4.8 These PCD inputs have been put together to reflect delivery of Wigan & Skelmersdale as a DPC delivered project, that could be used (following finalisation of the cost estimate) to develop a PCD.

6.4.9 We have provided an indicative delivery profile, reflecting the DPC milestones (per the Manchester Ship Canal BOD PCD) set out below in section 12.3, whereby successful delivery of a DPC procurement results in the appointment of a competitively appointed provider (CAP), split into three milestones:

- Stage 2: Gain consent on procurement plans, commercial model and designation of the project
- Stage 3: Gain consent to procure the project
- Stage 4: Gain consent to enter into a CAP Agreement.

Pennington Flash PCD

6.4.10 In our core plan (Variant A) and Variant D, Pennington Flash is a very low cost investigation scheme in AMP8, and therefore would not require a PCD.

6.4.11 This following outline PCD has been put together to reflect Variants B and C. These PCD inputs have been put together to reflect delivery of the seven overflows discharging into Pennington Flash.

6.4.12 We have provided an indicative delivery profile that could be used (following finalisation of the cost estimate) to develop a PCD, using the same approach as Wigan & Skelmersdale in Table 7 above, whereby we have proportioned the milestones as 20% for Contract Award, 40% Start on Site and 40% Project in Use.

Table 11: Pennington Flash PCD totex (£m) – variant B and C

Scheme	2026	2027	2028	2029	2030	Total
Pennington Flash full costs for 7 overflows	94,346.876	185,471.217	202,120.171	101,510.926	47,161.670	630,610.861
Delivery %	20	60	60	60	100	100

7. Manchester Ship Canal BOD Programme

7.1.1 This section sets out the enhancement case for £323m totex to allow UUW to meet more onerous environmental permit requirements for final effluent Biological Oxygen Demand (BOD) at Salford WwTW, Sale WwTW and Stockport WwTW as a result of drivers in the AMP8 WINEP. The three wastewater treatment works discharge directly or indirectly to the Manchester Ship Canal and are referred to collectively as the Manchester Ship Canal BOD Programme.

7.1.2 In our core PR24 submission plan the Manchester Ship Canal BOD Programme is included as a candidate for Direct Procurement for Customers (DPC). In this section we describe variants to the core plan which outline alternative delivery dates through a non-DPC approach.

7.1.3 It also covers why these requirements are outside of management control, our approach to solution development and how we have ensured that costs are robust.

7.1.4 The development of the WINEP has been informed by the key regulatory guidance including; the WINEP methodology, WINEP options development guidance, WINEP options assessment guidance, WINEP driver and supporting guidance. Our approach reflects the specific context within which we operate in the North West of England.

7.1.5 As well as regulatory guidance described above we have discussed key schemes with the Environment Agency throughout the development of the plan.

7.1.6 Where possible we are making use of phasing and adaptive planning to ensure we meet statutory requirements in a way that balances costs across the AMPs and prioritises delivery of least-, low- or no-regret measures first. This ensures we capture new statutory requirements and that we continue to meet existing ones despite changes in demand and climate change.

7.1.7 As a result of decisions from the Environment Agency on 18 August 2023, 24 August 2023 and subsequent confirmation on 22 September 2023 there are no further routes to review our adaptive plan. We have included in this document the proposed enhancement expenditure for the Manchester Ship Canal BOD Programme referenced as variants B-D described in table 14. Our core plan includes the Manchester Ship Canal BOD Programme as a candidate programme for DPC. You can read the full case for the DPC proposal in *UUW53 Candidate DPC Projects*.

7.1 Manchester Ship Canal BOD Programme

7.1.1 The Manchester Ship Canal BOD programme consists of schemes at Salford WwTW, Sale WwTW and Stockport WwTW to allow UUW to meet more onerous environmental permit requirements for final effluent BOD in AMP8. An assessment of delivery timescales has been completed and is shown in Table 12.

Table 12: Manchester Ship Canal BOD programme – assessment of delivery timescales

Project Name	Existing consents	WINEP consents (AMP8)	BAU contract award	BAU PIU	Current regulatory date
SALFORD WwTW (BOD)	30mg/l	6mg/l	Apr-25	Oct-31	31/03/2030
STOCKPORT WwTW (BOD)	20mg/l	15mg/l	Jun 25	Jun 29	31/03/2030
SALE WwTW (BOD)	30mg/l	10mg/l	Aug 25	Sep-29	31/03/2030

7.1.2 A summary of the AMP8 enhancement investment (Capex) is shown in Table 13.

Table 13: Manchester Ship Canal BOD Programme AMP8 Capex for variants B, C and D

Project	Capex (£m)
STOCKPORT WwTW (BOD)	29.5
SALFORD WwTW - BOD	255.4
SALE WwTW (BOD)	38.5
Total	323.4

8. Need for enhancement investment

8.1.1 This section details the context, environmental drivers and legislation that supports the need for investment at Salford WwTW, Sale WwTW and Stockport WwTW and our approach to addressing these requirements.

8.1 Manchester Ship Canal

8.1.1 The Manchester Ship Canal (MSC) between Salford Quays and Bollin Point replaced the natural river system when it was constructed in 1894 and since then has been subject to a range of pressures that, combined with its physical properties, have impacted water quality, leading to the current unique challenges in meeting the requirements of the Water Framework Directive (WFD).

8.1.2 The wastewater from a growing population of 2.8 million people, (population equivalent of over 3.5 million), in Greater Manchester drains via the Ship Canal catchment. Figure 3 below outlines the key wastewater discharges within the Manchester Ship Canal catchment that have been evidenced as impacting water quality and are to be considered as part of WINEP and our adaptive plan.

8.1.3 Furthermore, it highlights AMP7 and AMP8 investment as part of the MSC adaptive plan. The plan outlines our current view of benefits associated with the Manchester Ship Canal that are primarily associated with those sites with direct discharges i.e. Salford WwTW, Eccles WwTW and Davyhulme WwTW. However, wider system benefits, mainly through phosphorus removal (including associated BOD improvements) and storm water management, also contribute at varying scales both now (in AMP7) and as part of the long-term adaptive plan.

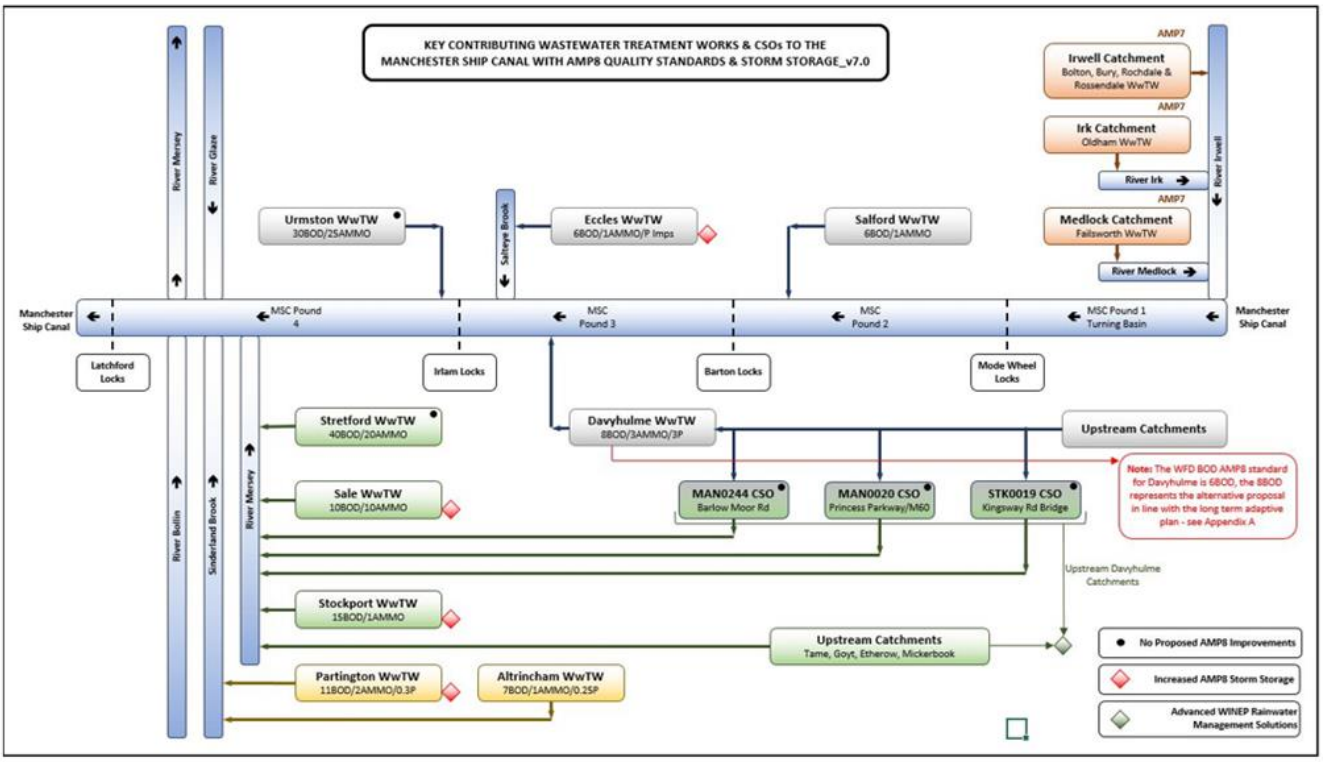
8.1.4 The impact of our operational discharges and third-party industrial discharges, as well as run off to the canal from heavily populated catchments, is exacerbated by the structure and nature of the canal. This deep, slow moving body of water is separated into pounds by a lock system that, while serving navigation and flood mitigation needs, promotes stagnation, stratification and sediment retention causing low dissolved oxygen and barriers to fish migration. The canal also experiences high levels of nutrient loading (including phosphorus), creating pressures for deterioration in WFD classifications.

8.1.5 It has been evidenced through robust water quality modelling that improving the water quality within the canal, to meet WFD compliance and support migratory fish populations, cannot be achieved by our interventions alone. This is because the canal does not act like a normal river system and in particular it suffers from low levels of dissolved oxygen during warmer weather and lower flow conditions.

8.1.6 As water quality improvements require multiple stakeholders to contribute to the solution, the establishment of the Mersey Rivers Trust hosted Manchester Ship Canal Partnership Forum has been key to leading the co-design and co-delivery of a long-term multi beneficial environmental improvement strategy for the canal.

8.1.7 In-line with the Partnership Forum plan we have conducted significant investigations and modelling of the Manchester Ship Canal which have led to investment at treatment facilities and storm overflows discharges, directly and indirectly to the canal. These historical interventions have improved water quality and met environmental standards where technically feasible. However, challenges remain with WFD targets, along with new and stretching environmental legislation which leads us to the development of the MSC adaptive plan.

Figure 3: Key wastewater discharges within the Manchester Ship Canal catchment



Source: Internal source from MSC adaptive plan

8.2 Environmental drivers

8.2.1 We have followed the Environment Agency's driver guidance to identify needs for enhancement investment at WwTWs within the UUW area. Where there are sites which require investment to achieve new permit limits for enhancement and have likely predicted growth within the catchment (which cannot be accommodated at the works) we have included provision within the Ww Supply & Demand enhancement case (further detail is included in the *UUW65 – Wastewater Quality Enhancement case 16*). Solutions have been identified to accommodate both of these requirements and investment split across these two enhancement cases accordingly.

8.2.2 We have specifically factored the impact of climate change into the development of our WINEP in several ways, for example, we account for climate change in our hydraulic models when identifying the need for storm overflow improvement schemes (further detail can be found in *UUW64 – Wastewater Quality Overflows enhancement case 13*) and developing options to address the drivers. We also include for climate change when modelling the future requirements for our wastewater treatment works permits. Where impact is forecast in the near future (AMP8 or 9) we will look to factor adaptation to climate change into solutions for wastewater treatment works. This means we can deliver improvements to the resilience of water courses to climate change in an efficient way as we go about meeting other statutory drivers.

8.2.3 We have developed the AMP8 WINEP proposal within the long-term context to ensure that our plan is balancing investment across the AMPs and intervening at the most appropriate time. Where appropriate, we have made use of long-term adaptive planning approaches to plan a low regrets route to meet long-term targets whilst also meeting our statutory obligations.

8.2.4 The following sections outline the need for enhancement investment at Salford WwTW, Sale WwTW and Stockport WwTW as part of the Manchester Ship Canal BOD Programme for AMP8.

8.3 Salford WwTW BOD scheme

8.3.1 Salford WwTW discharges into the Manchester Ship Canal and the works outlined are intended as part of the long-term adaptive planning strategy of the region. A programme of enhancement works is required to meet EA water quality thresholds in relation to biological oxygen demand (BOD) and ammonia in final effluent. This site also needs to accommodate an increase in population within the catchment. In addition, existing assets must be decommissioned to make way for the new plant.

8.3.2 UUW will specify Best Available Technique (BAT) solutions at Salford WwTW to meet the new BOD (6mg/l) and ammonia (1mg/l) consents. The principal components of the AMP8 solution are a new enhanced biological phosphorus removal activated sludge plant (BioP ASP), surplus activated sludge thickening, new final tanks and refurbishment of existing primary settlement tanks and supporting ancillary works. The solution sits within the existing footprint. Figure 4 below shows an aerial photograph of the existing site and WwTW and Figure 5 shows the proposed new layout of the site.

8.3.3 Within the options development process, a series of unconstrained options have been identified against a list of Generic High-Level Solution (GHLS) categories. Two viable options were considered:

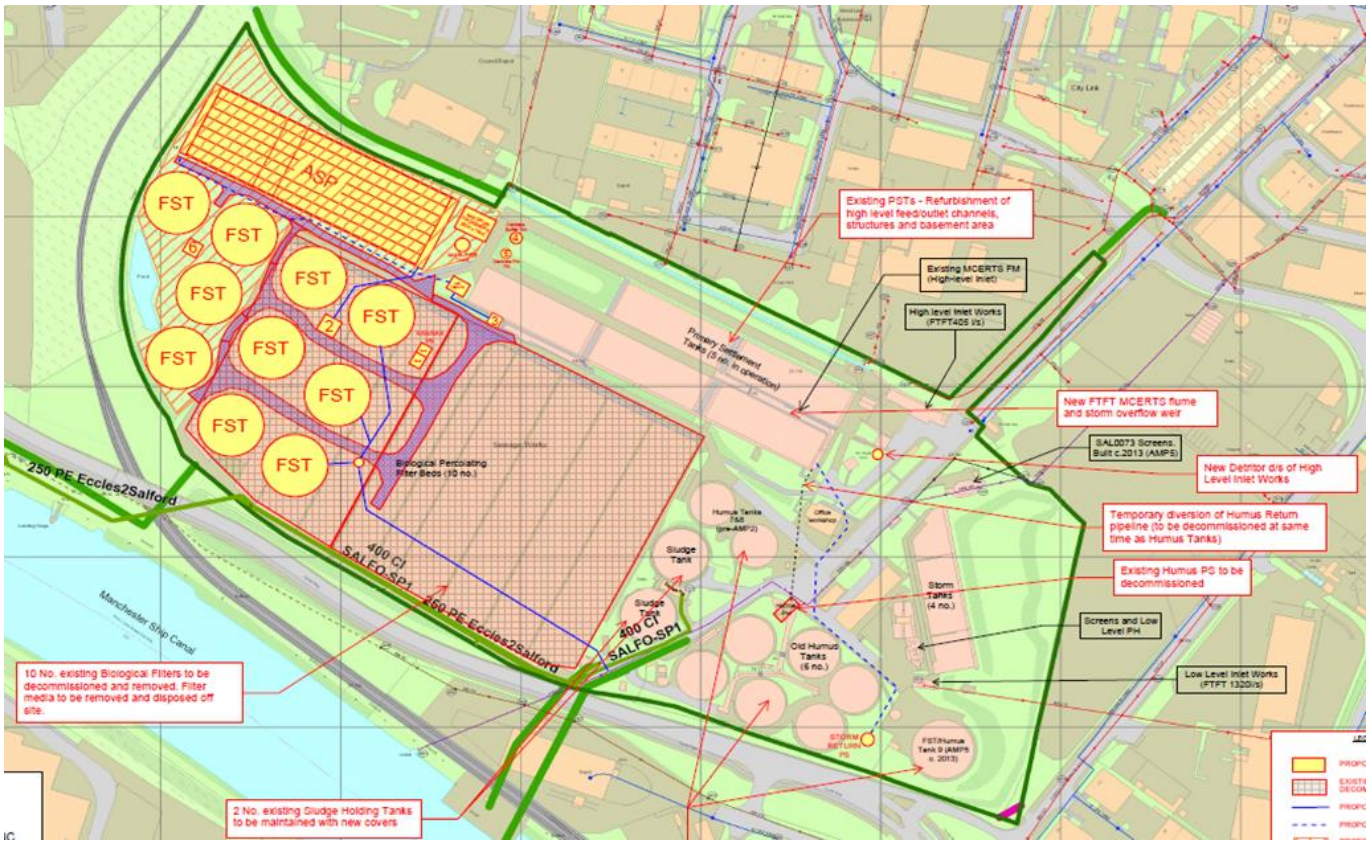
- New Asset Option 1 - Refurbishment of existing primary settlement tanks, new Bio-P activated sludge process with secondary activated sludge thickening and new final tanks; and
- New Nature Based Solution Option 2 - New Asset Option 1 - refurbishment of existing primary settlement tanks, new Bio-P activated sludge process with Secondary Activated Sludge thickening and new final tanks.

8.3.4 Between the two feasible alternatives proposed, the nature-based solution was deemed inadequate due to the lack of available land near the asset.

8.3.5 The New Asset Option 1 was chosen as the least cost and preferred option on the basis that it meets the requirements, is technically feasible and is assessed as being deliverable.

Figure 4: Salford WwTW - Aerial photograph – Existing site layout

Figure 5: Salford WwTW- Plan – Proposed site layout



8.3.6 Salford WwTW is included within the innovative MSC Catchment Flexible Permit for Phosphorus Operating Techniques Agreement (OTA). This flexible permit forms part of the MSC adaptive plan for the Manchester Ship Canal managing investment across a suite of assets over the next 25 years. This plan targets a phosphorus load reduction, which must be achieved as a collective across eight sites within the catchment where, we currently collectively control the chemical dosing to manage performance and maximise opex efficiency.

8.3.7 The site also interfaces with Bioresource operations. There is an existing sludge pipeline that sends sludge to Eccles WwTW and on to the Manchester Bioresource Centre (MBC) for processing. The sludge from Salford is pumped to Eccles and then onto MBC. Both these sites are constrained, with limited storage capacity at Eccles and processing capacity at MBC. This was considered in the option development for the proposed scheme.

8.4 Sale WwTW BOD scheme

8.4.1 UUW's plan is to optimise interventions across its asset base to improve the dissolved oxygen (DO) levels within the Manchester Ship Canal. While currently our actions alone cannot meet the expectations for DO, we can make significant contributions towards the objective for DO. We will continue to model the best interventions and propose significant BOD reductions to the discharges from Davyhulme, Salford and Eccles as part of the MSC adaptive plan. Following investigation and modelling, we propose these interventions ahead of spill reduction interventions, as these are modelled to make the largest step change to the DO in the canal.

8.4.2 To supplement the direct discharges into the MSC indirectly in the Upper River Mersey at Sale WwTW which will deliver to tighter BOD (10mg/l) consent, with a focus on storm storage improvements to at least WFD standards within AMP8.

8.4.3 The solution at Sale will be to provide improvements to the primary settlement tanks, re-purposing of combined primary settlement tanks/storm tank to storm tank only and new Primary Settlement Tanks (PSTs).

8.4.4 Within the options development process, a series of unconstrained options have been identified against a list of Generic High-Level Solution categories. Three options were considered:

- New Asset Option 1 - Process improvements to deliver quality drivers with new PSTs and refurbishment;
- Nature-Based New Asset Option 1 - As option 1, but with an augmented open surface wetland to resolve the phosphorus driver; and,
- New Asset Option 2 - As option 1, but with conversion/new assets to provide an enhanced biological phosphorus removal activated sludge process with Mobile Organic Biofilm and tertiary solids removal process with tertiary chemical dosing.

8.4.5 Between the two feasible alternatives proposed, the New Asset Option 1 was chosen as the least cost and preferred option on the basis that it meets the requirements, is technically feasible and is assessed as being deliverable – moreover, it will improve water quality and catchment resilience.

8.4.6 Figure 6 below shows an aerial photograph of the existing site and WwTW and Figure 7 shows the proposed new layout of the site.

8.4.7 The nature-based solution Option 1 was deemed to be undeliverable due to the lack of available land on or around the site for the area of wetland required.

Figure 6: Sale WwTW - Aerial photograph – Existing site layout

Figure 7: Sale WwTW - Plan – Proposed site layout

8.4.8 The site also interfaces with Bioresource operations due to the sludge processing assets on site. This was considered during option development for the proposed scheme.

8.5 Stockport WwTW BOD scheme

8.5.1 UUW's plan is to optimise interventions across its asset base to improve the dissolved oxygen (DO) levels within the Manchester Ship Canal. While currently our actions alone cannot meet the expectations for DO, we can make significant contributions towards the objective for DO. We will continue to model the best interventions and propose significant BOD reductions to the discharges from Davyhulme WwTW, Salford WwTW and Eccles WwTW as part of the MSC adaptive plan. Following investigation and modelling, we propose these interventions ahead of spill reduction interventions, as these are modelled to make the largest step change to the DO in the canal.

8.5.2 The solution is intended to supplement the direct discharges into the MSC indirectly in the Upper River Mersey at Stockport WwTW which will deliver to tighter BOD (15mg/l), with a focus on storm storage improvements to at least WFD standards within AMP8. Low phosphorus solutions are proposed to be progressed for 2037 as part of the adaptive plan (currently in the scope for 2030).

8.5.3 The solution at Stockport will provide new primary treatment and improved sludge management.

8.5.4 Within the options development process, a series of unconstrained options have been identified against a list of Generic High-Level Solution (GHLS) categories. The two key options considered were:

- New Asset Option 1 - Process improvements to deliver quality drivers with new Primary Settlement Tanks (PSTs) and sludge thickening; and,
- New Nature-Based Asset Option 1 - As option 1, but with an augmented open surface wetland to resolve the phosphorus driver.

8.5.5 Among the two feasible alternatives proposed, the New Asset Option 1 was chosen as the least cost and preferred option on the basis that it meets the requirements, is technically feasible and is assessed as being deliverable – moreover, it will improve water quality and catchment resilience.

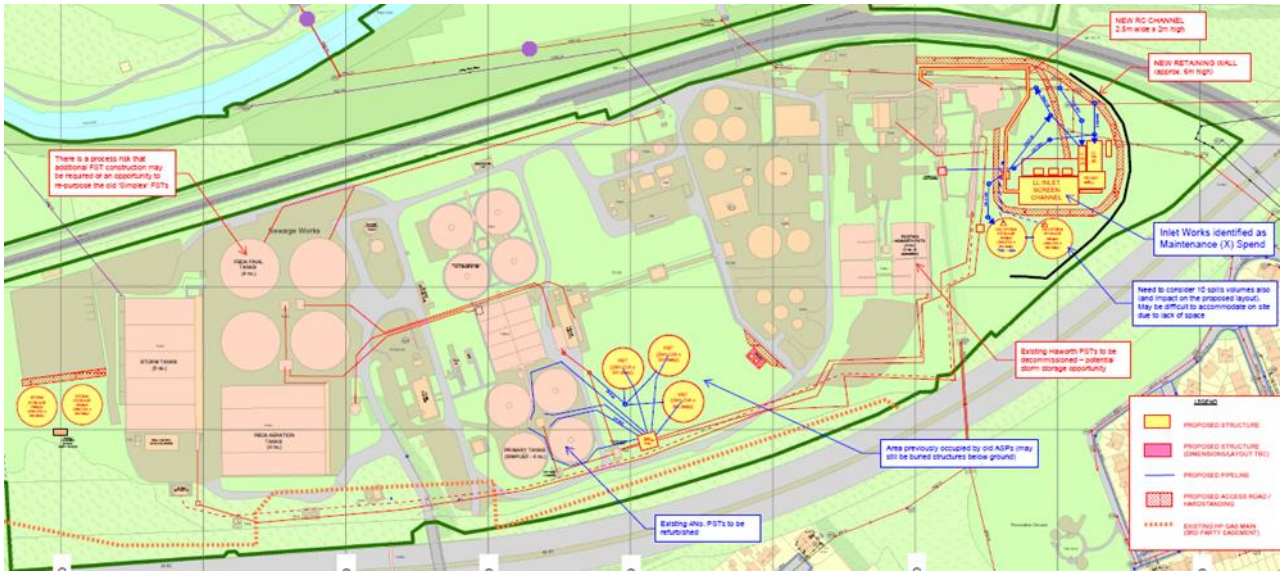
8.5.6 Figure 8 below shows an aerial photograph of the existing site and WwTW and Figure 9 shows the proposed new layout of the site.

8.5.7 The Nature-Based Solution Option 1 was deemed to be undeliverable due to the lack of available land on or around the site for the area of wetland required.

8.5.8 New Asset Option 1 remains a viable alternative.

Figure 8: Stockport WwTW - Aerial photograph – Existing site layout

Figure 9: Stockport WwTW - Plan – Proposed site layout



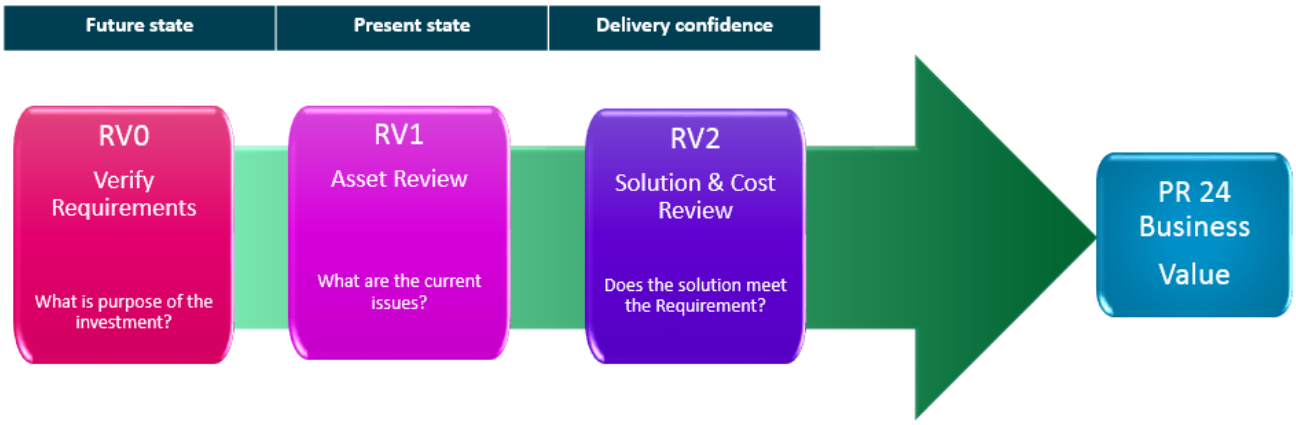
9. Best Options for Customers

9.1.1 Our approach to delivering best value is robust and consistent across all of our enhancement cases. Our approach uses a rich mix of metrics to help us drive value and efficiency in developing our business plan. Consistency of the approach is driven through our PR24 Value Tool, which allows us to quantify and value environmental and social benefits, costs and risks.

9.1 Options development

9.1.1 PR24 options development followed the fundamental principles UUW defined value management process. Risk and Value for PR24 (RV) was a three stage process (shown in the diagram below), aimed at positively challenging our projects to ensure we have sufficient evidence behind decisions. It provides UUW with confidence that they are proposing the right projects for the AMP8 Programme and therefore managing and maximising the value for their customers from their investments. It also ensures that the organisation adopts the correct approach to option identification, development and selection to maximise the realisation of benefits associated with these investments.

Figure 10: Risk and value process



9.1.2 Once the requirements have been clearly verified RV1 was completed in order to understand the current asset condition and performance. Without this understanding there is significant risk that proposed solutions will fail to deliver the value intended and may even fail to satisfy the requirements. This initial baselining was essential in order to allow identification of possible options against the generic high level solutions (GHLS), shown in Table 14.

9.1.3 Options to address PR24 requirements passed through a series of stages before the agreed solution was confirmed, from an initial 'un-constrained' list of options through to confirmation of the defined and estimated scope associated with a preferred solution.

9.1.4 Within the options development process, un-constrained options were identified against a list of GHLS categories. If un-constrained options were deemed viable then additional screening was carried out to identify 'constrained' options, with further screening taking place to refine the feasible solutions and determine those to be progressed to detailed scope development and estimating. In developing feasible options the engineer will always have taken which solution could represent the best value to the customer into consideration.

Table 14: Generic High Level Solutions (GHLS)

GHLS	Description
Monitor & Respond	*Accept risk with agreed contingency plan*
Operational Intervention	*Solve need by identifying targeted maintenance to restore performance*
Optimise Asset	*Solve need by improving performance of existing equipment*
Partnership	*Solving need by assistance of third parties, i.e. assisting farmers reduce pollution of watercourses*
Refurbish Asset	*Major asset refurbishment to restore asset life and performance*
Replacement	*Replace asset(s) on like for like basis*
New Asset	*Build new asset when all other options are not possible (this could be a NBS)*
Integrated Approach	*Integrated solution across asset boundaries e.g. network, process, bio-resources or catchment level solutions. An integrated solution is a Systems Thinking response and could be a combination of the above solution types.*
Combination of generic high level solutions	*Example - SuDS and a storage tank to address storm overflows*

9.1.5 Should a refurbishment, replacement or new asset solution be identified, a number of design tools were used to develop the requirement through to an estimated solution. Base design data was gathered from UUW's corporate systems to inform the design, including flow, quality and treatment performance data. In the majority of cases a 2050 design forecast was used, the exception being when there was a high level of uncertainty in the design forecast thus ensuring the most efficient design for the future.

9.1.6 A standardised methodology to solution identification was developed for wastewater treatment works to ensure a consistent approach. The 'Process Decision Support Tool' cross-referenced permit values, population and flow data with UUW treatment processes and asset standards to identity and size interventions to meet the requirements. Solutions proposed by the tool included chemical and biological phosphorus removal, innovative and nature-based solutions.

9.1.7 Use of these optioneering tools ensured the process was proportionate to the scale of the risk to be addressed. They provided a quick and effective way of ruling out unsuitable options and identifying feasible solutions over a range of different option types. For the larger, more complex schemes a more bespoke approach was adopted.

9.1.8 A detailed engineered design was then developed for all the feasible solutions identified during this screening process in order to provide comprehensive cost and carbon data. The exception to this would have been for some of the simple, repeatable options for which the cost and carbon estimates were extrapolated based on data from previous projects of similar size and complexity.

9.1.9 It is at this stage that the options were also assessed for deliverability. A review was undertaken by the Planning, Land & Environmental Team and UUW Construction Services which allowed identification of risks and potential mitigation measures. This will have improved the cost accuracy associated with implementing the PR24 solution, it also allowed elimination of options which are not deliverable thereby confirming feasibility.

9.2 Innovation

9.2.1 Our adaptive planning approach for the Manchester Ship Canal catchment, including Salford, Sale and Stockport WwTWs, is an innovative approach, it has been developed addressing known future environmental requirements to ensure they are met in the most cost effective way for customers.

9.2.2 We investigated several new scenarios on the Manchester Ship Canal model – the conclusion, which supports the adaptive plan approach, shows that improved end of pipe water quality from Davyhulme and associated treatment works (including Salford, Sale and Stockport WwTWs) becomes more beneficial than storm water retention or treatment.

9.3 Options selection

9.3.1 The water sector is embracing a 'best value' approach, promoted by the regulators, with the best value option being one which drives the best outcomes for the environment, society and UUW over the long term.

9.3.2 We assessed the value associated with the various options using the value assessment tool developed by UUW specifically for this purpose. This tool lists intervention type and pulls through the associated benefits and value. It assesses value against a number of benefits including all the wider environmental outcomes as requested in the EA WINEP Options Development Guidance. The benefits were drawn from the MyRisk Risk Breakdown Structure (RBS), currently widely used in UUW. The wider value element, was also taken from the EA's WINEP guidance on Wider Environmental Outcomes.

9.3.3 The inputs to the value tool included costs (capex, opex and whole life), carbon (embedded, operation and whole life), data on biodiversity plus risks and benefits as described above. The outputs from the tool included a cost benefit analysis and allowed the selection of the preferred solution based on the comparison of value between the various options (RV2). The option selected was therefore that which provides the best value to our customers.

9.3.4 To ensure consistency and oversight, the WINEP Programme Scenario Development Group has reviewed the overall programme summary in terms of cost, value, benefits and carbon to ensure decisions on preferred options are well evidenced and in customers' interests. The group has focused on reviewing where the outcome of the best value assessment has led to marginal differences between options. A summary of the decisions made and programme metrics including value were then provided to the UUW Executive WINEP Steering Group.

10. Cost efficiency

10.1.1 This section sets out how we have calculated the value of this enhancement case, how we have challenged our assumptions to develop efficient costs and how costs have been benchmarked and assured.

10.1 Approach to cost build

10.1.1 Costs for projects which have a final effluent improvement requirement have been assessed using site specific information. For the case of Salford, Sale and Stockport WwTWs BOD, detailed optioneering has taken place to ensure we are addressing requirements in line with the adaptive plan in a least cost, low/no regrets order in AMP8, ensuring our plan is as efficient as possible and in line with future environmental drivers we know are imposed in AMP9 and beyond.

10.1.2 Our UUW engineering team has developed solutions for each individual site based on the sites specific requirements and the future permit requirements of the WINEP. This assessment resulted in a scope items list and sizing which was passed to the estimating team to build the individual direct capital costs.

10.1.3 A breakdown of the AMP8 capex for Salford, Sale and Stockport WwTW BOD schemes is summarised in Table 15.

Table 15: MSC BOD programme AMP8 totex – variants B, C and D

Project	Capex (£m)
STOCKPORT WwTW (BOD)	29.5
SALFORD WwTW - BOD	255.4
SALE WwTW (BOD)	38.5
Total	323.4

10.1.4 Delivering these full schemes to meet a 2030 deadline may incur additional and inefficient cost that could otherwise be avoided relative to the proposed “Core PR24 submissions” variant for Salford, Stockport and Sale that assumed delivery by 2033 through DPC. We have removed the relevant DPC management costs. Additional costs relate to delivering within compressed timescales and include additional workforce and the potential for temporary power if permanent supplies cannot be secured within the regulatory timeframe.

10.2 Approach to challenging our assumptions

10.2.1 There are several aspects of project costs, which are impacted by the scale of the programme and thus as the AMP8 programme matures, they may be subject to change. UUW’s AMP8 WINEP is substantially larger in scale than that seen previously, and larger than the whole WINEP for England in AMP7. Additionally, we also expect the AMP9 WINEP to be substantial in scale given the longer-term environmental requirements that are already visible today. As a result of this, it is more important than ever that we can give regulators, customers and stakeholders’ confidence around the development of the WINEP and so we commissioned Arup to run an independent scrutiny and challenge process on the development of the PR24 WINEP. Arup spent time working with specialists across UUW to understand how we had arrived at the scope, the approach to developing costs and whether the programme had been appropriately optimised.

10.2.2 Feedback from Arup: ‘Overall, we note the very significant amount of work that was done by UUW in the short time between our reviews…we found that UUW responded positively to the challenge and scrutiny applied to it from Arup and the Panel members, with a very significant amount of work undertaken after our initial review. We observed that progress had been made by UWW in many areas

that we highlighted in our original review. As part of this, we also noted a strong push across the leadership and the operational teams on trying to ensure that the programme achieves a balance of solutions across traditional engineered approaches and alternative solutions where these are feasible and appropriate.'

10.2.3 The WINEP scrutiny and challenge panel consisted of: Trevor Bishop (Independent, Panel Chair), Bernice Law (Independent (and Chair of UUW's YourVoice ICG panel)), Alastair Chisholm (Director of Policy, CIWEM), Simon Wright OBE (Independent) and Ryan Harris (Senior Commercial Director, Arcadis). The panel concluded:

"It is reassuring to see the company embracing and positively responding to the key challenges set by the panel of independent experts on its WINEP programme. Whilst the company's WINEP programme is, by necessity of the environmental issues to be resolved in the North West, both substantial and complex the panel is encouraged to see a carefully balanced programme being developed. The use of adaptive planning was noted by the panel who strongly supported the approach to ensure further optimisation of value for money and reductions in carbon as solutions are refined through experience."

10.2.4 Following the initial review by Arup we incorporated their feedback into our plan. Particularly relevant to this case is the cost estimating methodology which following the second review they concluded that UUW costing methodologies largely comply with the requirements of WINEP guidance as well as standard industry practice. However, they did raise concern that "across a broad programme the level of risk allowance is at the lower end of the range we would expect' we have further developed our plan to ensure concerns raised are addressed within the final estimates.

10.3 Third party assurance

Bottom-up benchmarking (Faithful and Gould)

10.3.1 Faithful and Gould (F&G) undertook a bottom-up deep dive into the cost efficiency of our enhancement cases. This involved a close examination of our cost base relating to a sample of our enhancement programme, with comparisons made to similar activity carried out by third party companies across a variety of sectors.

10.3.2 F&G looked at our direct costs across each of the following categories:

(a) Staff including site supervision

(b) Mobilisation and site set up, running and removal of site offices and welfare

(c) Temporary services for general site use, such as water to wash out concrete skips

(d) Attendant plant and equipment, such as cranes, forklift for unloading deliveries etc

(e) Attendant labour, defined as hourly paid operatives not involved in productive works

(f) Site consumables, such as waste skips

(g) Set-up site compounds, erecting hoardings etc

(h) O&M manuals

(i) Health and safety

10.3.3 It also looked at the contractor's indirect costs (e.g. overhead and design costs) and UUW's indirect costs (e.g. land acquisition costs). Due to the size of the programme, F&G examined a sample of our enhancement cases. However, this sample included projects from each of our enhancement categories and covered £1.246bn of expenditure. Therefore, we consider this sample to representative of our overall enhancement programme.

10.3.4 F&G noted the effectiveness of UUW's cost estimation process:

"In addition to the benchmarking data held by Faithful+Gould we understand that UUW has applied multiple internal and external challenges to progressively refine the cost estimation undertaken to date. In particular we note UUW's use of its Investment Programme Estimating System (IPES) which is a bespoke parametric estimating tool containing data from AMP3 to AMP7, to provide historical cost curves alongside estimated data from third party organisations."

10.3.5 F&G found that our proposed costs are in line with rates typically seen across the industry:

"Overall, UUW's approach of utilising historic cost curves, market testing and obtaining specialist third party quotations demonstrates a sound proactive approach to cost planning. In total £1.2bn of schemes underwent targeted cost assessment with £573m making up the construction works element.

After presenting our initial findings it was encouraging to see UUW's commitment to addressing our findings and applying these to the wider enhancement estimates, charting a strategic route towards greater efficiency and scope clarification.

In light of this Cost Assurance work and evidence of UUW's responsive actions we have concluded that the data we have benchmarked is within a reasonable alignment with anticipated market rates."

11. Customer protection

11.1.1 This section outlines how customers are protected from non-delivery of schemes including the impact on Outcome Delivery Incentives and Price Control Deliverables.

11.1 Managing uncertainty

11.1.1 It is important that customers have confidence that we will deliver the enhancement schemes that get reflected in our PR24 final determinations and they are suitably protected in the event of non-delivery, or if there are material changes to deliverables (including changes to dates), which lead to a change in cost (including changes in the timing of required expenditure). Ofwat proposes that, if companies fail to deliver or are late delivering improvements to customers, then price control deliverables (PCDs) should be used to compensate customers. In our PR24 plan (*Chapter 8 – Delivering at efficient cost* and related enhancement claims) we have proposed an approach to PCDs that aims to provide customer protection, such that customers are fairly compensated for non-delivery (such as due to a change in regulatory requirements) or late delivery (including as a result of a change to a regulatory date), between PCDs, any related ODI underperformance payments, and cost sharing arrangements.

11.1.2 We consider, in this case, that if a WINEP improvement scheme is no longer required, then this should not constitute a failure to deliver. This situation is the action of a regulator, outside of company control and not the result of company failure or action. In this situation, it is particularly important that there should be no punitive component to any PCD (I.e. it should focus on restoration of customer bill impacts). This approach would then protect customers from non-delivery of improvements and protects companies from a change in regulatory requirements.

11.1.3 For Salford, Sale and Stockport WwTWs BOD, customers are protected from non-delivery through the following ODI:

- Discharge permit compliance - if we fail to deliver improvements to our discharges on time we would still expect the Environment Agency to issue the revised permit which we would be at high risk of failing to achieve. If we failed to achieve the new final effluent permit standards we will incur an underperformance payment through this ODI.

11.1.4 Additional consequences of non-delivery include:

- Prosecution and fines due to non-compliance with permits;
- Reputational impact of Environmental Performance Assessment;
- Loss of trust with customers and stakeholders; and,
- Loss of trust with the Environment Agency leading to less support for innovative approaches to delivering environmental improvement.

11.2 Managing change

11.2.1 It is reasonable to expect that customers should only pay for enhancement outcomes that are actually delivered. Due to rapidly evolving environmental legislation and supporting Environment Agency driver guidance, uncertainty is inherent in this submission and both customers and companies need a mechanism to manage this uncertainty.

11.2.2 It may be possible to make use of Ofwat's proposed Price Control Deliverables (PCD) mechanism, if appropriately specified, to help manage this uncertainty. We explore this further below.

11.2.3 Any changes to our programme will be made in agreement with the Environment Agency and Your Voice to ensure confidence that we are only working on improvements that are fully justified. As part of the AMP8 WINEP development we have submitted a letter to the Environment Agency and copied in Ofwat

dated 31 August 2023. Included within this letter are details of discussions with the Environment Agency on our adaptive plan for Davyhulme detailing where the current WINEP does not align to the longer term adaptive plan for the catchment. This letter has been submitted in lieu of the PR24 change control process, which the Environment Agency has confirmed will not be available until the start of AMP8. A copy of this letter is available in Appendix B. Our submission reflects this with outputs and totex aligned to an achievable date.

11.2.4 In reconciling performance at PR29, our 'Output in use certificate' (or equivalent documentation once formalised) would be used as appropriate evidence for the Price Control Deliverable that the scheme has been delivered. The delivery of schemes are also reported by the Environment Agency on the Defra SharePoint site that is used for WINEP development. If, at the time of submission for PR29, this documentation had not been received, we would provide the appropriate evidence and assurance that delivery would be achieved before 31 March 2030 or the Price Control Deliverable would take effect and return the allowance to customers.

11.3 Protection via a Price Control Deliverable

11.3.1 Price Control Deliverables have been developed to protect customers from:

- Non-delivery of enhancement programmes; and,
- Late delivery, including any agreement between UUW and the regulators (such as the Environment Agency) that an output is no longer required.

11.3.2 In the context of managing changes to requirements or delivery dates, PCDs should be designed to compensate customers for any time value of money benefit arising for the company in the event that one or more schemes are deferred. Likewise, if any schemes are deemed not to be required, the PCD should (if designed appropriately) compensate customers fairly for the company's avoided costs.

11.3.3 We have set out more details regarding our approach to PCDs in *Chapter 8 – Delivering at efficient cost, section 8.8.9*.

11.3.4 Given the potential inter-AMP nature of these variants, it seems that it will be necessary to ensure that PCDs are either:

- established as multi AMP PCDs
- any PCD delivery payments (excluding time value/late delivery payments) due at the end of AMP8 are agreed to be transferred into AMP9 cost allowances to ensure AMP9 delivery is appropriately funded (this is equivalent to the shortfalling approach that Ofwat utilised up until it was removed at PR14).

11.3.5 As PCDs are still an emerging methodological approach, we will undoubtedly engage further with Ofwat to ensure that the PCDs set at final determinations both protect customers, whilst not being unduly punitive for companies in these such cases whereby the timing of requirements is not currently 100% certain.

11.3.6 The following PCD reflects our core plan (Variant A).

Table 16: PCD summary

Scheme delivery expectations	
Description of deliverable	Successful delivery of a DPC procurement of the BOD schemes for Salford, Sale and Stockport, resulting in the appointment of a competitively appointed provider (CAP). Split into 3 milestones: - Stage 2: Gain consent on procurement plans, commercial model and designation of the project - Stage 3: Gain consent to procure the project - Stage 4: Gain consent to enter into a CAP Agreement

Scheme delivery expectations	
Output measurement and reporting	Output measured by UUW achieving Ofwat consent to proceed to the next stage of activity. Ofwat will be notified of UUW progress through the defined stage review process as set out in Ofwat's latest DPC guidance.
Assurance	Each milestone is completed with Ofwat's confirmed consent.
Conditions on scheme	If at any point the project exits the DPC process (and hence is subject to a DPC IDoK), then this PCD and any remaining milestones will be rescinded. The DPC IDoK will ensure customers are protected against any appropriate change in efficient costs.
Impact on PCs	None

11.3.7 In our PCD template *UUW32-PCD Excel Sheet* we have assumed a wholesale WACC of 3.23%, in line with Ofwat's guidance. We have assumed a 50% totex cost sharing rate, which is applied before calculating PCDs. We have applied a further 50% for Bioresources (where applicable), to ensure that only 25% of Bioresources totex is at risk from PCDs, given the lack of RCV guarantee, and general uncertainty in cost recovery from future Bioresources price controls. For late delivery we have applied a proportionate value of annual opex, and assumed 3.5% of capex, which provides a fair reflection of the time value of money of any related deferred capital spend.

Table 17: PCD delivery profile

	Unit	AMP8	2024	2025	2026	2027	2028	2029	2030	Ultimate delivery
Cumulative delivery target for PCD	milestones		-	-	2	3	3	3	3	3
AMP8 Capex (22/23 pb)	£	24,075,761	-	-	20,450,225	3,625,536	-	-	-	
AMP8 Opex (22/23 pb)	£	0	-	-	-	-	-	-	-	
ODI impact per unit of PCD volume	£/milestones	0.00								

Table 18: Price Control Allocation

Price Control	Unit	Price Control Allocation
Water resources	%	0.00%
Water network+	%	0.00%
Wastewater Network+	%	100.00%
Bioresources	%	0.00%

Table 19: PCD Incentive rates

	Unit	WR	WN+	WwN+	BR
Overall delivery	£/milestones	0	0	4,012,627	0
Time value rate	£/milestones	0	0	129,608	0
Late delivery	£/milestones	0	0	270,050	0

11.4.1 The following PCD outline reflects variants B, C and D.

11.4.2 These PCD inputs have been put together to reflect delivery of 'in-house' delivery of the BOD schemes for Salford, Sale and Stockport, rather than them being delivered through DPC.

11.4.3 We have provided an indicative delivery profile that could be used (following finalisation of the cost estimate) to develop a PCD, using the same approach as Wigan & Skelmersdale in Table 7 above, whereby we have proportioned the milestones as 20% for Contract Award, 40% Start on Site and 40% Project in Use.

Table 20: MSC BOD Programme PCD totex (£m) – variants B, C and D

Requirement	2025-26	2026-27	2027-28	2028-29	2029-30	AMP8 total
Full scheme cost - Salford	14.082	72.771	114.681	44.969	8.846	255.349
Full scheme cost - Stockport	1.344	7.066	11.362	4.368	0.873	29.533
Full scheme cost - Sale	1.750	9.199	14.792	5.686	1.136	38.450
Full scheme cost - Total	17.176	89.037	140.835	55.024	10.855	323.332
Delivery %	20	60	60	60	100	100

12. Davyhulme BOD

12.1.1 This document sets out the enhancement case of £784.251m totex to allow UUW to meet more onerous Environmental Permit requirements for final effluent Biological Oxygen Demand (BOD) at Davyhulme WwTW as a result of drivers in the AMP8 WINEP. This is our core plan and within our PR24 submission and meets a permit standard of 6mg/l.

12.1.2 It also describes variants to the core plan which outline alternative delivery dates and interventions to meet a BOD permit standard of 8mg/l.

12.1.3 It covers why these requirements are outside of management control, our approach to solution development and how we have ensured that costs are robust. It sets out the extensive interaction we have undertaken with the Environment Agency about delivering an alternative scheme for Davyhulme WwTW which would meet a more cost effective BOD permit limit but deliver significantly better value and is deliverable within AMP8. This is explained in Table 23 which details the key regulatory interactions in relation to this enhancement.

12.1.4 As a result of the decision from the Environment Agency on 18 August 2023 and subsequent confirmation on 24 August 2023 that there are no further routes to review our proposal, we have no option but to include the full 6mg/l BOD option in our business plan. This option will deliver the permit requirement of 6mg/l BOD, however this is not achievable in the AMP8 time period as it involves very significant construction activity on a site with limited land availability and in close proximity to a major motorway bridge that requires extensive monitoring to ensure stability. An alternative solution to achieve a more cost effective 8mg/l BOD aligned to the adaptive plan for Davyhulme has been extensively discussed with the EA. Cost and scope items of the two solutions is included in Table 21.

12.1.5 The development of the WINEP has been informed by the key regulatory guidance including; the WINEP methodology, WINEP options development guidance, WINEP options assessment guidance, WINEP driver and supporting guidance. Our approach reflects the specific context within which we operate in the North West of England.

12.1.6 As well as regulatory guidance described above we have discussed key schemes with the Environment Agency throughout the development of the plan.

12.1.7 Where possible we are making use of phasing and adaptive planning to ensure we meet statutory requirements in a way that balances costs across the AMPs and prioritises delivery of least-, low- or no-regret measures first. This ensures we capture new statutory requirements and that we continue to meet existing ones despite changes in demand and climate change. Despite on-going discussions, given the latest version of the WINEP includes the 6mg/l BOD driver, we are currently unable to follow the adaptive plan for Davyhulme WwTW (delivering 8mg/l BOD). As a result we have included the full 6mg/l BOD option in our core business plan, variant A. This is the same scope and timescales as variant B in the WINEP scenarios, set out in the introduction to this document.

12.1.8 In addition to our core plan, variant A, and as a result of decisions from the Environment Agency on 18 August 2023, 24 August 2023 and subsequent confirmation on 22 September 2023 we have included in this document the proposed enhancement expenditure for the Davyhulme 8mg/l BOD Programme referenced as Variant C-D in the “Up front WINEP scenarios” document provided.

Table 21: Davyhulme WwTW 6mg/l BOD and 8mg/l BOD costs and scope

Driver	Scope	AMP8 Capex (£m)	AMP8 Opex (£m)	AMP8 Totex (£m)
Variant A and B Sanitary Determinands WFD_IMPg BOD 6mg/l	Purchase of land New Stream 4 BioP Activated Sludge Plant and associated odour control Demolition of ASP1 Existing ASP3 conversion to Biological P removal operation Phosphorus Recovery and Liquor Treatment Plant for the additional sludge production (this is also required to achieve the future P limit)	784.251	0	784.251
Variant C and D Sanitary Determinands WFD_IMPg BOD 8mg/l	Purchase of land Primary Settlement Tanks automatic de-sludge Enhancements to existing Activated Sludge Plant (ASP2) to fine bubble diffuse air activated sludge process Enhancement of Biological Aerated Flooded Filter (BAFF) including enhanced BAFF media and re-distribution Upgrade final tank scrapers with a technologically efficient solution Sludge thickening, storage and odour control	52.761	0	52.761

12.1.9 Davyhulme WwTW has multiple investment drivers in both AMP8 and beyond. These are shown in Table 22.

Table 22: WINEP drivers for Davyhulme WwTW (AMP8 and beyond)

Driver	Determinand	Permit limit	Delivery timeframe
U_MON3	Spill	Mcertification of EDM	2026
U_MON4	Flow	2 minute flow monitoring	2026
WFD_NDLS_CHEM2	Cypermethrin	0.0076296ug/l (99%ile)	2027
WFD_NDLS_CHEM2	Nonyl-phenol	2.4ug/l (99%ile)	2027
WFD_NDLS_CHEM2	PFOS	0.0433095ug/l (95%ile)	2027
EnvAct_INV4	Spill	Integrated water management investigation for Irwell catchment including Davyhulme drainage area	2027
EnvAct_INV4	Spill	Storm water treatment study	2027
WFD_ND	Phosphorus	3mg/l	2030
WFD_IMPg	Biological Oxygen Demand	6mg/l	2030
Env Act IMP1	Phosphorus	0.25mg/l	2038
EnvAct_IMP4	Spill	Improvements to storm tank spill frequency to meet SODRP requirements	2045

13. Need for enhancement investment

13.1.1 This section details the environmental driver and legislation which supports the need for investment at Davyhulme WwTW and our approach to addressing these requirements.

13.1.2 We have followed the Environment Agency driver guidance to identify needs for enhancement investment at WwTW within the UUW area. Where there are sites which require investment to achieve new permit limits for enhancement and have likely predicted growth within the catchment (which cannot be accommodated at the works) we have included provision within the Ww Supply & Demand enhancement case (further detail is included in the Ww Supply & Demand enhancement document Ww5). Solutions have been identified to accommodate both of these requirements and investment split across these two enhancement cases accordingly.

13.1.3 We have specifically factored the impact of climate change into the development of our WINEP in several ways, for example we account for climate change in our hydraulic models when identifying the need for storm overflow improvement schemes (further detail in *UUW64 – Wastewater Quality Overflows enhancement case 13*) and developing options to address the drivers. We also include for climate change when modelling the future requirements for our wastewater treatment works permits. Where impact is forecast in the near future (AMP8 or 9) we will look to factor adaptation to climate change into solutions for wastewater treatment works. This means we can deliver improvements to the resilience of water courses to climate change in an efficient way as we go about meeting other statutory drivers.

13.1.4 We have developed the AMP8 WINEP proposal within the long-term context to ensure that our plan is balancing investment across the AMPs and intervening at the most appropriate time. Where appropriate, we have made use of long-term adaptive planning approaches to plan a low regrets route to meet long-term targets whilst also meeting our statutory obligations.

13.2 Biological Oxygen Demand (BOD) – 6mg/l BOD (variant A and B)

13.2.1 Davyhulme is the largest wastewater treatment works operated by United Utilities Water (UUW) and serves a population equivalent of 1,189,236 (APR23) making it a key part of the pollution prevention infrastructure for the city of Manchester and surrounding boroughs. The final effluent and storm tanks both discharge to the Manchester Ship Canal (MSC) and the requirements of this water body are driving significant investment as it is not and does not, act like a natural river system. This canal is a key part of the industrial legacy of Manchester, which is considered to be the world's first industrial city. As a result of the canal's construction to support rapid industrialisation virtually all urban run-off, storm discharges and treated sewage effluent from the city region drain through a water body that lacks the natural characteristics to reaerate the water flowing through it.

13.2.2 The Manchester Ship Canal is a unique waterbody due to its history and the complex interactions between the canal, which connects the River Irwell to the River Mersey, and the multiple drainage systems which discharge into it. Due to the unique nature of the Manchester Ship Canal location and physical properties we have for some time adopted an adaptive approach to manage water quality in relation to our operations. This deep, slow moving water body has a legacy of issues with dissolved oxygen which leads to ecological impacts and does not comply with The Water Environment (Water Framework Directive) 2017 Regulations with respect to dissolved oxygen.

13.2.3 To ensure the best long term approach for customers to this challenge, in collaboration with the Environment Agency, we have revised our adaptive plan for the Manchester Ship Canal to support meeting emerging and existing water quality challenges in an integrated way. Through aligned investment we believe it is possible to achieve far greater integrated and connected delivery of multiple environmental needs. This can be achieved in a phased and co-ordinated way that introduces multiple benefits for people; improving place, the environment and reducing costs to deliver.

13.2.4 Our detailed Manchester Ship Canal Water Quality study from 2008 is used by the Environment Agency and ourselves to guide the development of our long-term plans for assets discharging via the Manchester Ship Canal. This model was used to identify that the only way to achieve the dissolved oxygen standards was to artificially aerate the canal and improve some of the storm overflows. This is a strategy we were delivering however in AMP6 we identified the need to adapt the plan as it was found to be practically infeasible to aerate a key section of the Manchester Ship Canal which receives discharges from Davyhulme along with Salford, Eccles and some smaller WwTW. This triggered the need for the key discharges to the canal to require significant changes to the BOD permits to mitigate the issue. As it is not feasible to meet the dissolved oxygen standards we were asked by the Environment Agency to develop solutions to meet the best available technology standards (6mg/l BOD). Davyhulme WwTW currently has a BOD permit of 20mg/l so this represents a significant change in requirement and thus a substantial change to the process.

13.2.5 As part of our development of options for Davyhulme WwTW we also modelled the sensitivity of the Ship Canal dissolved oxygen concentrations to changes in BOD permit at Davyhulme WwTW. This was important as there is no defined end point for developing the BOD permit standard as the in-river dissolved oxygen standards cannot be met for this water body. The results of this modelling work showed that the majority of the benefit to dissolved oxygen from changing the Davyhulme BOD permit is delivered by meeting an 8mg/l BOD permit. Whilst moving to a 6mg/l BOD permit limit delivers some further benefit this is marginal compared to the gains achieved from moving from the current 20mg/l to 8mg/l. The results of this modelling work have been accounted for in our Manchester Ship Canal Adaptive Plan.

13.2.6 As a result of not just the substantial investment requirement for BOD, but also visibility of the requirements arising from the Environment Act 2021, we updated the adaptive plan. The current adaptive plan is focused on the enhancement of Davyhulme WwTW through to 2045/2050, along with increased storm water storage and other low phosphorus solutions (being taken to the technically achievable limit 0.25mg/l) at many individual treatment facilities in the catchment in the shorter-term. Timing and the extent of interventions has also been a key consideration, as we seek to avoid abortive spend and deliver optimal solutions such as biological P-removal and sustainable drainage solutions in the catchment.

13.3 Phosphorus management – applicable to all variants (A-D)

13.3.1 Whilst this enhancement case is primarily focusing on the enhanced BOD permit at Davyhulme the investment is also part of the future AMP9 phosphorus requirement, it is therefore relevant to understand the longer term direction in relation to phosphorus as this integrated planning is vital to delivering long term resilience and value for customers.

13.3.2 Phosphorus is a nutrient which is essential to life and as such, is found in high concentrations in wastewater. However, if too much phosphorous is released into the environment within the final effluent from a wastewater treatment works (WwTW), its nutritional properties can cause excessive plant or algae growth and lead to an alteration of the ecosystem from the natural state. It can also cause blue-green algal blooms in some waterbodies, which can prevent people and animals from using the waterbody and can damage the wider ecology of the habitat.

13.3.3 Reducing the concentrations of phosphorus in the final effluent reduces the risk of adverse environmental impacts. The long term phosphorus target set under the Environment Act 2021 requires an 80% reduction in phosphorus load from wastewater effluents by 2038 against a 2020 baseline. For UUW, Davyhulme will represent our biggest contribution to meeting this national target, due to the large proportion of the population we serve being connected to this works. The introduction of the Environment Act 2021 long term phosphorus target means that UUW needs to remove another 1,000 tonnes per year of phosphorus to achieve its share of the industry's target by 2038. Davyhulme WwTW represents 303 tonnes of this target.

13.3.4 Historically our approach to phosphorus removal has been based on chemical treatment to meet specific permit requirements. In AMP6 and AMP7, we changed our strategy to embrace biological phosphorus removal; leading the way with delivering innovative Nereda plants for four wastewater treatment works. We also successfully used catchment offsetting to achieve phosphorus targets in catchments. We have also worked with the Environment Agency on the implementation of a catchment permit for phosphorus in order to prevention deterioration in phosphorus concentrations in the Manchester Ship Canal by optimising phosphorus removal across the upstream catchment.

13.3.5 Chemical solutions are the most common intervention because they tend to have the lowest whole-life cost. However, through AMP7 and our AMP8 approach we are seeking to deliver phosphorous reductions through innovative interventions where appropriate and economic. Below are examples from AMP7 where we have taken an alternative approach to phosphorus management, for example:

- Through nutrient catchment balancing in the River Petteril catchment;
- Through the River Irwell flexible phosphorus permit;
- Through catchment permit balancing at Bowdon and Macclesfield WwTW;
- Through biological nutrient removal at our Nereda plants; and,
- Through installation of biological nutrient removal using mobile organic biofilm (MOB) technology at Macclesfield WwTW.

13.3.6 There is a global shortage of rock phosphorus with a heavy reliance on Morocco for resources and biological phosphorus removal presents an opportunity in the longer term to build a circular economy to put phosphorus back into the supply chain through phosphorus recovery. At the same time the North West has a surplus of phosphorus that contributes to the growing pressure we see around recycling biosolids to land thereby making the ability to move phosphorus out of the North West attractive.

13.3.7 Biological phosphorus removal is most cost effective at scale and in particular when the sewage strength is strong enough to sustain the bacteria. We have therefore evaluated our largest wastewater treatment works with phosphorus removal requirements and developed an option for biological phosphorus removal for those that are best suited. This has identified that the best option to meet all long term requirements for Davyhulme is a biological phosphorus removal activated sludge plant with tertiary processes to achieve the low phosphorus standard. This same process will also give very good BOD performance as we will need to achieve very low levels of suspended solids to achieve the phosphorus standard and a consequence of this will be enhanced performance for BOD.

13.3.8 Although biological treatment to remove phosphorus does have the potential for lower chemical operational costs, it does have a relatively high initial capital outlay. Where there are no other environmental drivers, investment in biological phosphorus removal is not usually the preferred solution as it has a higher whole life cost than chemical precipitation. Also, to robustly achieve the technically achievable limit of 0.25mg/l phosphorus, a chemical ‘trim’ plus tertiary solids removal may be needed in addition to the biological removal process. Biological phosphorus removal requires an activated sludge process. By developing an aligned plan for all drivers a biological phosphorus removal process is shown to be the preferred option for Davyhulme WwTW. This is an important step in ensuring the long term sustainability of our phosphorus removal capability as a company as this is not just our largest WwTW but it is also our largest sludge treatment centre so it is central to any strategy that involves ensuring we don’t significantly increase our reliance on chemicals for phosphorus removal. Further detail on the rationale for our adaptive plan can be found in the separate document: Manchester Ship Canal Adaptive Plan.

13.3.9 Our adaptive plan for Davyhulme WwTW, our largest treatment works, includes the construction of a phosphorus recovery plant for the sludge liquor stream in AMP8 (this is included in a separate enhancement case Ww WINEP Final Effluent UUW63). This first step of our plan will satisfy the requirement to prevent deterioration in phosphorus concentrations in the Manchester Ship Canal by

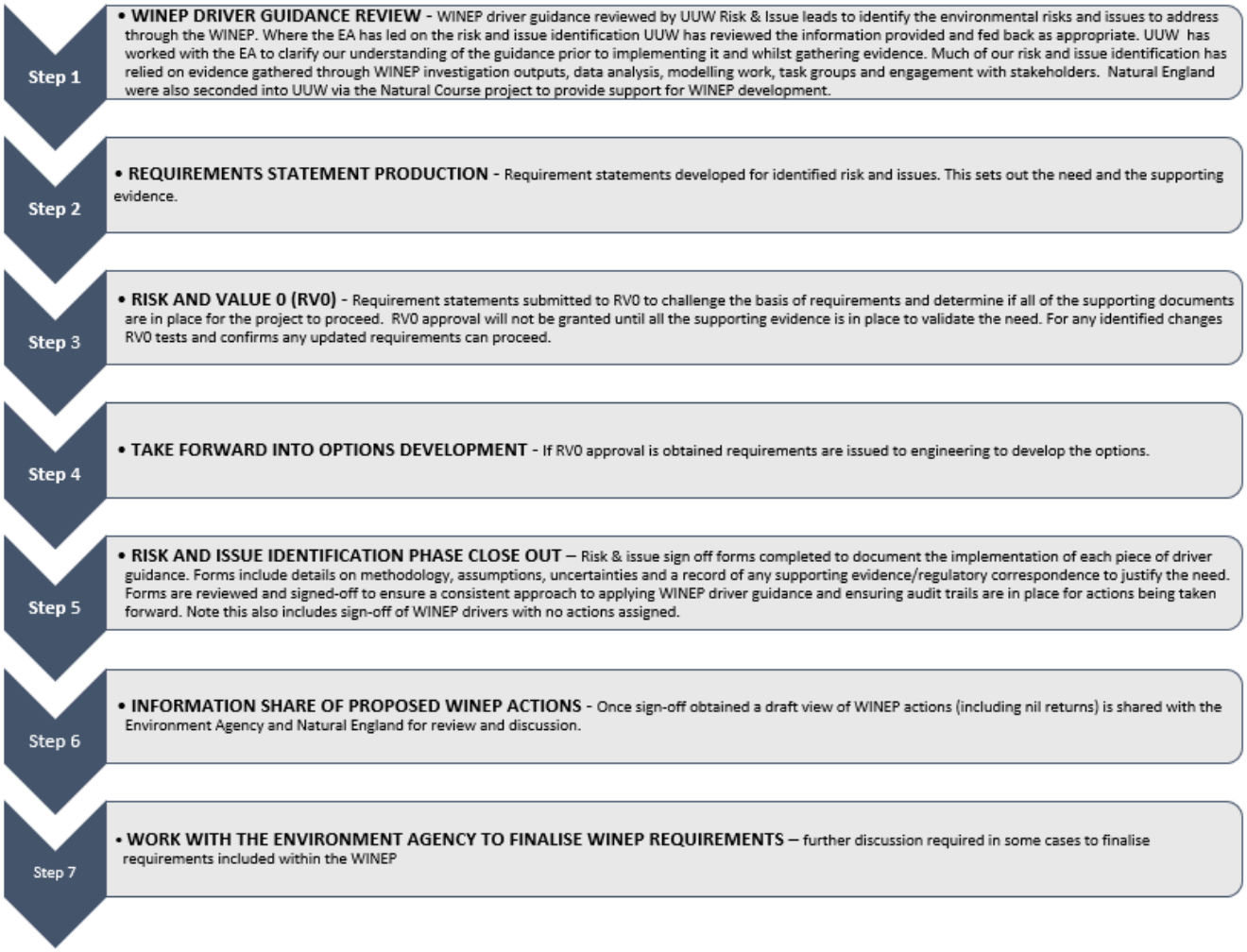
reducing the phosphorus loading on the treatment works. This process will reduce phosphorus by removing it from the sludge liquor stream, therefore reducing the load back to the head of the works.

13.3.10 In AMP9/10 we will then need to deliver further enhancement for phosphorus removal at Davyhulme to meet the 0.25mg/l Environment Act requirement. This will benefit from the delivery of a biological activated sludge plant in the prior AMP and the remaining scope can be added as required. Additional scope is likely to involve some tertiary solids removal and a chemical dosing trim to polish up the effluent to very low levels of phosphorus. This scope is all complementary to the BOD scheme as proposed.

13.4 Approach to risk and issue identification

13.4.1 The approach we have taken to identify WINEP actions is in line with Stage 2 of the Environment Agency's WINEP methodology. This involves collaboratively identifying environmental issues that need addressing and risks that require further monitoring/investigation through the WINEP. Our risk and issue identification process follows a stage approached, shown in Figure 11, which has enabled us to identify where action is required to deliver compliance with our environmental obligations.

Figure 11: Risk and issue identification process stages



13.4.2 This collaborative process has ensured that we are prioritising and investing in areas which have a well evidenced environmental need, and that we are meeting those needs in the most efficient way. Where evidence of environmental impact is uncertain, we have proposed AMP8 investigations to ensure that any interventions are based on good evidence. We have also sought to identify opportunities for partnership working, such that the best value for customers and the environment is secured.

13.5 Customer support

13.5.1 Customer research indicates protecting the environment is a key priority. Research for the Drainage and Wastewater Management Plan and Water Resources Management Plan carried out in April 2021 showed that 21% of those customers surveyed ranked removal of wastewater in the top three greatest long term challenges. It was also noted that aspects such as maintaining the network and wastewater treatment are often fairly easy for people to envisage, but happen in the background. When asked what people themselves feel is important; 'the impact on the environment is a constant concern' and customers 'love living in an area with lots of countryside and green space (perhaps heightened by Covid) and want this to be preserved'. We consider this to be evidence that customers support UUW's continued compliance with its environmental obligations.

13.5.2 UUW holds a library of customer insights for projects we have delivered within AMP 7 (currently in progress from 2020 – 25). Each insight and research project has used an appropriate method to capture a variety of customer and stakeholder opinions, ensuring a representative view of the diverse customer base across the North West. This insight has been incorporated in to the options development and selection process undertaken. Further information can be found in the UUW's WINEP approach to WINEP development and our insight and research library[3].

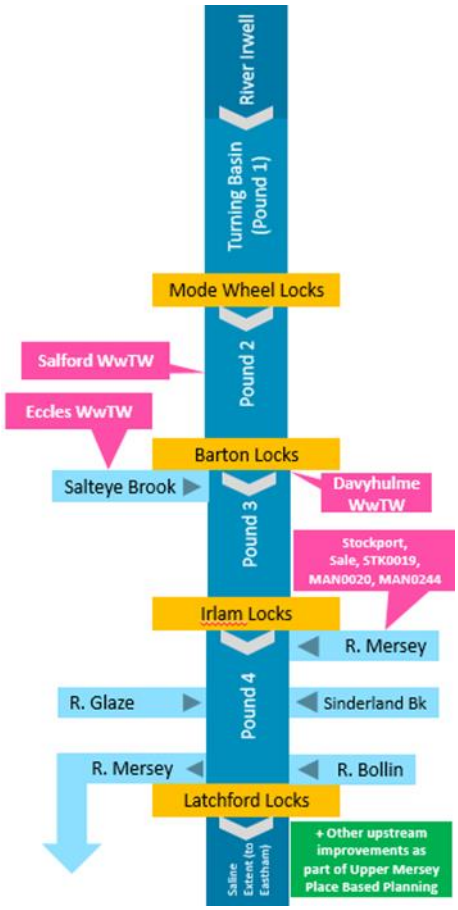
13.6 Management Control

13.6.1 Enhancements to performance included in the WINEP are outside of management control. Base totex allowance maintains compliance with current permits which for Davyhulme WwTW BOD is 20mg/l. To enable compliance with new, more onerous permits, investment to enhance current assets or to deliver new assets is required.

13.6.2 In the case of Davyhulme WwTW we have worked extensively since AMP3 to ensure that the investment requirements for our discharges to the Manchester Ship Canal are well evidenced and that a full catchment system approach is taken. This led to the development of a 3D model of the Manchester Ship Canal in AMP4 which we have since upgraded and rely upon to define the best point across the water body to intervene.

[3] 2023 (UUW) Customer insight and research library. Available here: https://www.unitedutilities.com/corporate/about-us/our-future-plans/listening-to-our-customers/insight-and-research-library/

Figure 12: Diagram of Manchester Ship Canal



13.6.3 Our initial plan was to aerate the Ship Canal (Figure 12) was successful in AMP5 for the Turning Basin area located near Media City in Salford, however in AMP6 we found that the canal section downstream of Mode Wheel Locks had a different construction and despite extensive work with experts in the field of aeration we could not find a technical solution that would enable adequate aeration whilst avoiding conflicts with shipping in the canal. This issue was caused by the water depth being very shallow at the edges of the canal and only deep enough for aeration equipment in the shipping lanes.

13.6.4 Following this conclusion we have used the Manchester Ship Canal model to identify the most effective interventions to mitigate the dissolved oxygen issues in the Manchester Ship Canal recognising it cannot be fully resolved. As Davyhulme WwTW final effluent is the most significant of UUW's discharges to the Canal it naturally plays a role. Our sensitivity testing demonstrated that whilst a 6mg/l BOD permit is most beneficial an 8mg/l permit would deliver a significant portion of the benefit and we could deliver this for significantly less money and importantly this is deliverable within AMP8. We also know over time as we deliver the Environment Act phosphorus requirements that BOD performance will continue to improve as a by-product of delivering a solution to the low phosphorus standard.

Actions taken to ensure full consideration of the option for an alternative BOD permit limit for Davyhulme WwTW

13.6.5 We have engaged in significant interaction with the Environment Agency over an extended period of time to ensure the 8mg/l BOD opportunity for Davyhulme received full consideration. The key points in this interaction are set out in Table 23.

Table 23: Key regulatory interactions in relation to consideration of Davyhulme WwTW 8mg/l BOD proposal

Date	Regulatory interaction
24th Jan 2023	We first formally tabled the 8mg/l BOD option with the Environment Agency in our 25th January 2023 WINEP options development submission. At this point we identified that if the AMP8 requirement could be altered to 8mg/l BOD instead of 6mg/l BOD the cost would reduce by around £700m capex.
9th Feb 2023	We followed up our WINEP options submission with a presentation of the 8mg/l BOD opportunity for Davyhulme with the EA.
24th Mar 2023	The EA confirmed they had identified the established route for our proposals for Davyhulme WwTW to be reviewed which was through a national WINEP assessment panel. Responses to EA queries were provided on 30 Mar 2023 to inform the panel.
14th April 2023	Following feedback from the national assessment panel UUW was advised to submit an alteration form for Davyhulme to request the 8mg/l BOD proposal is included in the WINEP.
5th May 2023	EA write to companies asking them to set out which parts of the WINEP and WRMP they have concerns about and 'If so, which parts of the programmes would you choose to phase beyond AMP8 if you could and why'. The letter also offered a chance of a meeting with the regulators that we took and where we presented our proposals.
16th May 2023	UUW respond to the letter of 5th May. One of our proposals here is to deliver a solution at Davyhulme to meet 8mg/l BOD rather than 6mg/l BOD as this would be significantly lower cost, be more sustainable, deliver the majority of the intended benefit and keep open the option of us being able to use more sustainable treatment processes in the future for phosphorus removal.
25th May 2023	Meeting with EA, Ofwat and Defra to discuss our proposals. There was positive feedback from the session about how informative and constructive dialogue was. There was subsequently no further decisions or actions from the regulators specific to our proposals.
5th July 2023	EA write to water companies asking them to set out if their WINEP is deliverable, affordable and financeable and if not we were to propose options to phase investment. In the pre-meet with regulators it was made clear that if companies have concerns about deliverability, affordability and financeability they should be taking advantage of this opportunity.
19 July 2023	UUW submit completed EA phasing spreadsheet with proposals for review. This included Davyhulme WwTW 8mg/l BOD opportunity.
21st July 2023	EA email to inform UUW that the WINEP change process is not live for AMP8 schemes until after the Final Determination. UUW had been verbally informed of this on 19th July so we included the Davyhulme 8mg/l BOD option in the phasing submission.
27th July 2023	Further data provided by UUW to support the phasing submission (costs for phasing options for Davyhulme).
18th Aug 2023	UUW received a short email setting out the EA's position on emergency overflow monitoring and septic tanks (common to all companies) as well as pointing companies to their decisions on phasing which were on the EA SharePoint. The feedback given in the phasing spreadsheet for rejecting our proposal Davyhulme proposal was "Does not align to steer; WFD driver requires delivery within AMP8".
22nd Aug 2023	UUW email our EA account manager to seek clarification on whether the specific situation around the Manchester Ship Canal has been considered in the EA's decision to reject our proposal for Davyhulme WwTW as this was unclear from the very brief feedback. Additional clarity was sought on whether there were any routes left open for the proposal to be considered.
24 Aug 2023	Response received from EA stating that our phasing proposals did not meet the Secretary of State steer due to there being no flexibility to delay WFD improvements beyond 2030 and that the decision had been shared with Defra.
31st Aug 2023	Letter sent to EA from Jo Harrison, Asset Management Director which set out two key concerns arising from the decision relating to Davyhulme, firstly that it would lead to sub-optimal environmental improvements and secondly that the absence of a process to agree deliverable regulatory dates ahead of final determination is not acceptable.

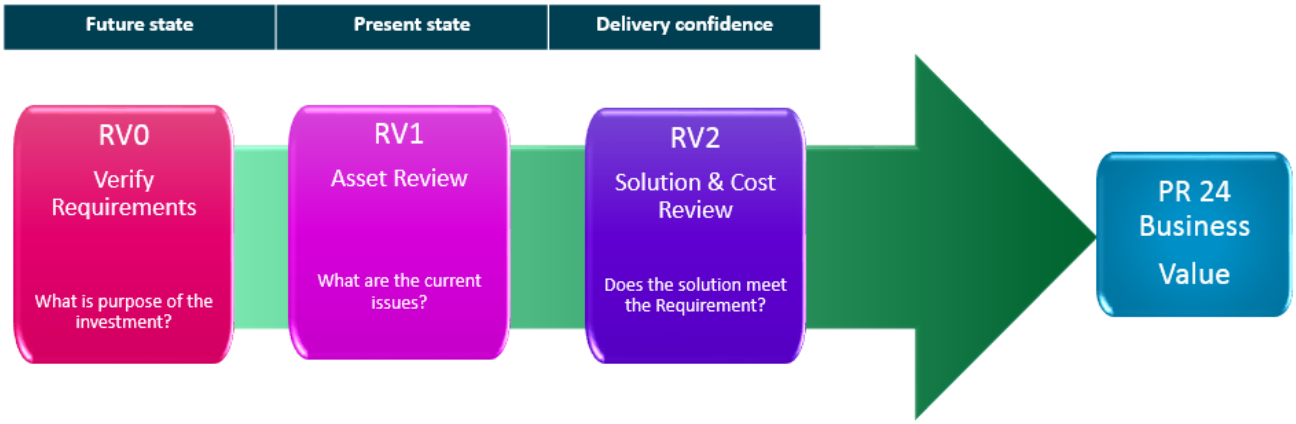
Date	Regulatory interaction
22nd Sept 2023	Letter received from Anne Dacey the EA's Deputy Director, Operations Catchment Services, regarding WINEP scope and delivery dates. This letter sets out the EA's position on Davyhulme, Wigan, Skelmersdale, Pennington Flash, Salford, Sale and Stockport and informs the variants we describe in this document.

14. Best option for customers

14.1 Options development

14.1.1 PR24 options development followed the fundamental principles UUW defined value management process. Risk and Value for PR24 (RV) was a three stage process (shown in the diagram below), aimed at positively challenging our projects to ensure we have sufficient evidence behind decisions. It provides UUW with confidence that they are proposing the right projects for the AMP8 Programme and therefore managing and maximising the value for their customers from their investments. It also ensures that the organisation adopts the correct approach to option identification, development and selection to maximise the realisation of benefits associated with these investments.

Figure 13: Risk and value process



14.1.2 Once the requirements have been clearly verified RV1 was completed in order to understand the current asset condition and performance. Without this understanding there is significant risk that proposed solutions will fail to deliver the value intended and may even fail to satisfy the requirements. This initial baselining was essential in order to allow identification of possible options against the generic high level solutions (GHLS).

14.1.3 Options to address PR24 requirements passed through a series of stages before the agreed solution was confirmed, from an initial 'un-constrained' list of options through to confirmation of the defined and estimated scope associated with a preferred solution.

14.1.4 Within the options development process, un-constrained options were identified against a list of GHLS categories. If un-constrained options were deemed viable then additional screening was carried out to identify 'constrained' options, with further screening taking place to refine the feasible solutions and determine those to be progressed to detailed scope development and estimating. In developing feasible options the engineer will always have taken which solution could represent the best value to the customer into consideration.

Table 24: Generic High Level Solutions (GHLS)

GHLS	Description
Monitor & Respond	*Accept risk with agreed contingency plan*
Operational Intervention	*Solve need by identifying targeted maintenance to restore performance*
Optimise Asset	*Solve need by improving performance of existing equipment*

Partnership	*Solving need by assistance of third parties, i.e. assisting farmers reduce pollution of watercourses*
Refurbish Asset	*Major asset refurbishment to restore asset life and performance*
Replacement	*Replace asset(s) on like for like basis*
New Asset	*Build new asset when all other options are not possible (this could be a NBS)*
Integrated Approach	*Integrated solution across asset boundaries e.g. network, process, bio-resources or catchment level solutions. An integrated solution is a Systems Thinking response and could be a combination of the above solution types.*
Combination of generic high level solutions	*Example - SuDS and a storage tank to address storm overflows*

14.1.5 Should a refurbishment, replacement or new asset solution be identified, a number of design tools were used to develop the requirement through to an estimated solution. Base design data was gathered from UUW's corporate systems to inform the design, including flow, quality and treatment performance data. In the majority of cases a 2050 design forecast was used, the exception being when there was a high level of uncertainty in the design forecast thus ensuring the most efficient design for the future.

14.1.6 A standardised methodology to solution identification was developed for wastewater treatment works to ensure a consistent approach. The 'Process Decision Support Tool' cross referenced permit values, population and flow data with UUW treatment processes and asset standards to identity and size interventions to meet the requirements. Solutions proposed by the tool included chemical and biological phosphorus removal, innovative and nature-based solutions.

14.1.7 Use of these optioneering tools ensured the process was proportionate to the scale of the risk to be addressed. They provided a quick and effective way of ruling out unsuitable options and identifying feasible solutions over a range of different option types. For the larger, more complex schemes a more bespoke approach was adopted for example phosphorus recovery at Davyhulme.

14.1.8 A detailed engineered design was then developed for all the feasible solutions identified during this screening process in order to provide comprehensive cost and carbon data. The exception to this would have been for some of the simple, repeatable options for which the cost and carbon estimates were extrapolated based on data from previous projects of similar size and complexity.

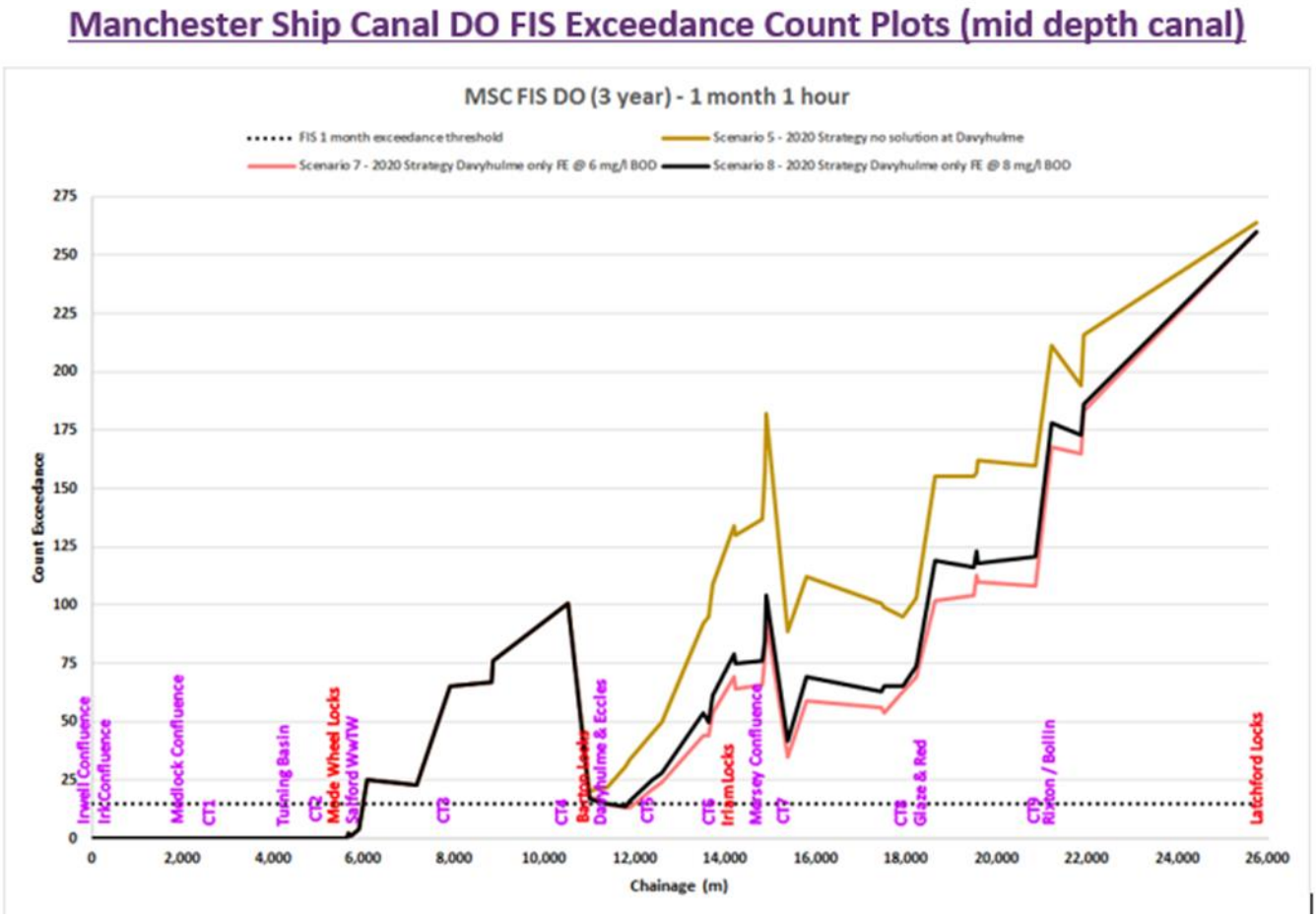
14.1.9 It is at this stage that the options were also assessed for deliverability. A review was undertaken by the Planning, Land & Environmental Team and UUW Construction Services which allowed identification of risks and potential mitigation measures. This will have improved the cost accuracy associated with implementing the PR24 solution, it also allowed elimination of options which are not deliverable thereby confirming feasibility. This also included an assessment of the likely delivery route (including Direct Procurement for Customers) which was then used as the basis for the Contractor add-ons in the cost estimate.

14.2 Innovation

14.2.1 Our adaptive planning approach for the Manchester Ship Canal catchment including Davyhulme WwTW is an innovative approach, it has been developed addressing known future environmental requirements to ensure they are met in the most cost effective way for customers. Several new scenarios have been

investigated on the Manchester Ship Canal model – the conclusion, which supports the adaptive plan approach, shows that improved end of pipe water quality from Davyhulme and associated treatment works becomes more beneficial than storm water retention or treatment. In addition the modelling work shows that the majority of the benefit of improvements at Davyhulme is derived from moving to an 8mg/l BOD permit at Davyhulme and the further gains of moving to 6mg/l BOD are marginal. For the future permit changes the model has been run "at permit" so it is likely that the benefits will be more significant than shown as some out performance of the permit is likely. The detail of these modelling results can be in Figure 14. This shows the modelled results of the current 20mg/l BOD permit at Davyhulme WwTW (yellow line), the variants C and D AMP8 8mg/l BOD (black line) and variants A and B requirement of 6mg/l BOD (red line). This demonstrates that there is little difference between the 8mg/l and 6mg/l and in some areas this is negligible. It also shows that the greatest benefit to dissolved oxygen in the canal is the movement from 20mgl BOD to 8mg/l BOD. The other aspect to note is that neither solution meets the fundamental intermittent standard (FIS) for the canal (dashed line).

Figure 14: Manchester Ship Canal DO FIS Plot – Davyhulme BOD scenarios



14.3 Options selection

14.3.1 The water sector is embracing a 'best value' approach, promoted by the regulators, with the best value option being one which drives the best outcomes for the environment, customers, society and UUW over the long term.

14.3.2 The value associated with the various options was assessed using the value assessment tool developed by UUW specifically for this purpose. This tool lists intervention type and pulls through the associated benefits and value. It assesses value against a number of benefits including all the wider environmental outcomes as requested in the EA WINEP Options Development Guidance. The benefits were drawn from the MyRisk Risk Breakdown Structure (RBS), currently widely used in UUW. The wider value element, was also taken from the EA's WINEP guidance on Wider Environmental Outcomes.

14.3.3 The inputs to the value tool included costs (capex, opex and whole life), carbon (embedded, operation and whole life), data on biodiversity plus risks and benefits as described above. The outputs from the tool included a cost benefit analysis and allowed the selection of the preferred solution based on the comparison of value between the various options (RV2). The option selected was therefore that which provides the best value to our customers.

14.3.4 To ensure consistency and oversight, the WINEP Programme Scenario Development Group has reviewed the overall programme summary in terms of cost, value, benefits and carbon to ensure decisions on preferred options are well evidenced and in customers' interests. The group has focused on reviewing where the outcome of the best value assessment has led to marginal differences between options. A summary of the decisions made and programme metrics including value were then provided to the UUW Executive WINEP Steering Group.

15. Cost efficiency

15.1.1 This section sets out how we have calculated the value of this enhancement case, how we have challenged our assumptions to develop efficient costs and how these have been benchmarked and assured.

15.2 Approach to cost build

15.2.1 Costs for projects which have a final effluent improvement requirement have been assessed using site specific information. For the case of Davyhulme BOD detailed optioneering has taken place to ensure we are addressing requirements in line with the adaptive plan in a least cost, low/no regrets order in AMP8, ensuring our plan is as efficient as possible and in line with future environmental drivers we know are imposed in AMP9 and beyond.

15.2.2 Our UUW engineering team has developed solutions for each individual site based on the sites specific requirements and the future permit requirements of the WINEP. This assessment resulted in a scope items list and sizing which was passed to the estimating team to build the individual direct capital costs. An example of these scope items is detailed in the Ww WINEP Final effluent enhancement case. This case also includes detailed cases studies for the estimating breakdown of the costs submitted in our plan.

15.2.3 Davyhulme WwTW has two activated sludge plants, including a modern one built in AMP6 and a tertiary ammonia removal process (Biologically aerated flooded filter/BAFF). Achievement of a BOD permit limit of 6mg/l requires the replacement of the oldest activated sludge plant (ASP2) at the treatment works. In development of the solution for AMP8 we need to be aware and take into consideration the longer term drivers for the site.

15.2.4 A short term solution in AMP8 would be costly and compromise the opportunity for the most sustainable solution in the longer term at Davyhulme WwTW. Therefore to achieve the 6 mg/l BOD requirement we have included the construction of a new biological phosphorus removal activated sludge plant in the location of the existing decommissioned ASP1, and conversion of the existing ASP3 to biological phosphorus removal. This includes the associated aeration, zone changes and return activated sludge (RAS) fermenter. This is significant construction at the site and would be extremely challenging to construct and commission within the AMP8 period.

15.2.5 An alternative chemical dosing solution for the longer term phosphorus limit was developed, however due to the size of the flow at Davyhulme the quantity of chemical which would need to be dosed would be extensive this was discounted. Rapid gravity filters to take all of the flow would be required and the ongoing opex for this solution would be disproportionately expensive compared with that for biological process, with chemical costs in excess of £30m per year, there would also be a high carbon impact. The installation of a chemical dosing solution in the short term would also use the last available land at the site compromising the construction of any further processes.

15.2.6 The alternative AMP8 solution aligned with the adaptive plan for Davyhulme has a much lesser construction requirement within AMP8. This would be achieved with targeted enhancement on the existing activated sludge plant (ASP2) and the existing biological aerated flooded filter (BAFF) plant.

15.2.7 Available land is a constraint within the Davyhulme site boundary. Within both options we have included the cost of land purchase which is essential for the long term plan for Davyhulme. Table 21 outlines the scope and totex of both 6mg/l and 8mg/l BOD solutions.

15.3 Approach to challenging our assumptions

15.3.1 There are several aspects of project costs, which are impacted by the scale of the programme and thus as the AMP8 programme matures, they may be subject to change. UUW's AMP8 WINEP is substantially larger in scale than that seen previously, and larger than the whole WINEP for England in AMP7.

Additionally, we also expect the AMP9 WINEP to be substantial in scale given the longer-term environmental requirements that are already visible today. As a result of this, it is more important than ever that we can give regulators, customers and stakeholders' confidence around the development of the WINEP and so we commissioned Arup to run an independent scrutiny and challenge process on the development of the PR24 WINEP. Arup spent time working with specialists across UUW to understand how we had arrived at the scope, the approach to developing costs and whether the programme had been appropriately optimised.

15.3.2 Feedback from Arup: 'Overall, we note the very significant amount of work that was done by UUW in the short time between our reviews… We found that UUW responded positively to the challenge and scrutiny applied to it from Arup and the Panel members, with a very significant amount of work undertaken after our initial review. We observed that progress had been made by UWW in many areas that we highlighted in our original review. As part of this, we also noted a strong push across the leadership and the operational teams on trying to ensure that the programme achieves a balance of solutions across traditional engineered approaches and alternative solutions where these are feasible and appropriate.'

15.3.3 The WINEP scrutiny and challenge panel consisted of: Trevor Bishop (Independent, Panel Chair), Bernice Law (Independent (and Chair of UUW's YourVoice ICG panel)), Alastair Chisholm (Director of Policy, CIWEM), Simon Wright OBE (Independent) and Ryan Harris (Senior Commercial Director, Arcadis). The panel concluded: "It is reassuring to see the company embracing and positively responding to the key challenges set by the panel of independent experts on its WINEP programme. Whilst the company's WINEP programme is, by necessity of the environmental issues to be resolved in the North West, both substantial and complex the panel is encouraged to see a carefully balanced programme being developed. The use of adaptive planning was noted by the panel who strongly supported the approach to ensure further optimisation of value for money and reductions in carbon as solutions are refined through experience."[4]

15.3.4 Following the initial review by Arup we incorporated their feedback into our plan. Particularly relevant to this case is the cost estimating methodology which following the second review they concluded that UUW costing methodologies largely comply with the requirements of WINEP guidance as well as standard industry practice. However, they did raise concern that "across a broad programme the level of risk allowance is at the lower end of the range we would expect' we have further developed our plan to ensure concerns raised are addressed within the final estimates.

15.4 Third party assurance

Bottom-up benchmarking (Faithful and Gould)

15.4.1 Faithful and Gould (F&G) undertook a bottom-up deep dive into the cost efficiency of our enhancement cases. This involved a close examination of our cost base relating to a sample of our enhancement programme, with comparisons made to similar activity carried out by third party companies across a variety of sectors.

15.4.2 F&G looked at our direct costs across each of the following categories:

(a) Staff including site supervision

(b) Mobilisation and site set up, running and removal of site offices and welfare

(c) Temporary services for general site use, such as water to wash out concrete skips

(d) Attendant plant and equipment, such as cranes, forklift for unloading deliveries etc.

(e) Attendant labour, defined as hourly paid operatives not involved in productive works

[4] 2023, Arup, WINEP Scrutiny and challenge Independent review report – Final

(f) Site consumables, such as waste skips

(g) Set-up site compounds, erecting hoardings etc.

(h) O&M manuals

(i) Health and safety

15.4.3 It also looked at the contractor's indirect costs (e.g. overhead and design costs) and UUW's indirect costs (e.g. land acquisition costs). Due to the size of the programme, F&G examined a sample of our enhancement cases. However, this sample included projects from each of our enhancement categories and covered £1.246bn of expenditure. Therefore, we consider this sample to be representative of our overall enhancement programme.

15.4.4 F&G noted the effectiveness of UUW's cost estimation process:

"In addition to the benchmarking data held by Faithful+Gould we understand that UUW has applied multiple internal and external challenges to progressively refine the cost estimation undertaken to date. In particular we note UUW's use of its Investment Programme Estimating System (IPES) which is a bespoke parametric estimating tool containing data from AMP3 to AMP7, to provide historical cost curves alongside estimated data from third party organisations."

15.4.5 F&G found that our proposed costs are in line with rates typically seen across the industry:

"Overall, UUW's approach of utilising historic cost curves, market testing and obtaining specialist third party quotations demonstrates a sound proactive approach to cost planning. In total £1.2bn of schemes underwent targeted cost assessment with £573m making up the construction works element.

After presenting our initial findings it was encouraging to see UUW's commitment to addressing our findings and applying these to the wider enhancement estimates, charting a strategic route towards greater efficiency and scope clarification.

In light of this Cost Assurance work and evidence of UUW's responsive actions we have concluded that the data we have benchmarked is within a reasonable alignment with anticipated market rates."

16. Customer protection

16.1.1 This section outlines how customers are protected from non-delivery of schemes including the impact on Outcome Delivery Incentives and Price Control Deliverables.

16.2 Managing uncertainty

16.2.1 It is important that customers have confidence that we will deliver the enhancement schemes that get reflected in our PR24 final determinations and they are suitably protected in the event of non-delivery, or if there are material changes to deliverables (including changes to dates), which lead to a change in cost (including changes in the timing of required expenditure). Ofwat proposes that, if companies fail to deliver or are late delivering improvements to customers, then price control deliverables (PCDs) should be used to compensate customers. In our PR24 plan (*Chapter 8 – Delivering at efficient cos*t and related enhancement claims) we have proposed an approach to PCDs that aims to provide customer protection, such that customers are fairly compensated for non-delivery (such as due to a change in regulatory requirements) or late delivery (including as a result of a change to a regulatory date), between PCDs, any related ODI underperformance payments, and cost sharing arrangements.

16.2.2 We consider, in this case, that if a WINEP improvement scheme is no longer required, then this should not constitute a failure to deliver. This situation is the action of a regulator, outside of company control and not the result of company failure or action. In this situation, it is particularly important that there should be no punitive component to any PCD (I.e. it should focus on restoration of customer bill impacts). This approach would then protect customers from non-delivery of improvements and protects companies from a change in regulatory requirements.

16.2.3 For Davyhulme WwTW BOD, customers are protected from non-delivery through the following ODI:

- Discharge permit compliance - if we fail to deliver improvements to our discharges on time we would still expect the Environment Agency to issue the revised permit which we would be at high risk of failing to achieve. If we failed to achieve the new final effluent permit standards we will incur an underperformance payment through this ODI.

16.2.4 Additional consequences of non-delivery include:

- Prosecution and fines due to non-compliance with permits;
- Reputational impact of Environmental Performance Assessment;
- Loss of trust with customers and stakeholders; and,
- Loss of trust with the Environment Agency leading to less support for innovative approaches to delivering environmental improvement.

16.3 Managing change

16.3.1 It is reasonable to expect that customers should only pay for enhancement outcomes that are actually delivered. Due to rapidly evolving environmental legislation and supporting Environment Agency driver guidance, uncertainty is inherent in this submission and both customers and companies need a mechanism to manage this uncertainty.

16.3.2 It may be possible to make use of Ofwat's proposed Price Control Deliverables (PCD) mechanism, if appropriately specified, to help manage this uncertainty. We explore this further below.

16.3.3 Any changes to our programme will be made in agreement with the Environment Agency and Your Voice to ensure confidence that we are only working on improvements that are fully justified. As part of the AMP8 WINEP development we have submitted a letter to the Environment Agency and copied in Ofwat dated 31 August 2023. Included within this letter are details of discussions with the EA on our adaptive plan for Davyhulme detailing where the current WINEP does not align to the longer term adaptive plan

for the catchment. This letter has been submitted in lieu of the PR24 change control process which the EA has confirmed will not be available until the start of AMP8. A copy of this letter is available in Appendix B. On 22 September 2023 we received Environment Agency confirmation of driver expectation and regulatory dates for the facilities outlined on this document; Davyhulme, Wigan, Skelmersdale, Pennington Flash, Salford, Sale and Stockport. Our submission reflects variant A which is our core plan with outputs and totex aligned.

16.3.4 In reconciling performance at PR29, our 'Output in use certificate' (or equivalent documentation once formalised) would be used as appropriate evidence for the Price Control Deliverable that the scheme has been delivered. The delivery of schemes are also reported by the Environment Agency on the Defra SharePoint site that is used for WINEP development. If, at the time of submission for PR29, this documentation had not been received, we would provide the appropriate evidence and assurance that delivery would be achieved before 31 March 2030 or the Price Control Deliverable would take effect and return the allowance to customers.

16.3.5 We propose to apply the same level of assurance to this Price Control Deliverable as we propose for the AMP8 Outcome Delivery Incentives, which we also expect to be in line with our AMP7 assurance framework

16.4 Price Control Deliverable

16.4.1 Price Control Deliverables have been developed to protect customers from:

- Non-delivery of enhancement programmes; and,
- Late delivery, including any agreement between UUW and the regulators (such as the Environment Agency) that an output is no longer required.

16.4.2 In the context of managing changes to requirements or delivery dates, PCDs should be designed to compensate customers for any time value of money benefit arising for the company in the event that one or more schemes are deferred. Likewise, if any schemes are deemed not to be required, the PCD should (if designed appropriately) compensate customers fairly for the company's avoided costs.

16.4.3 We have set out more details regarding our approach to PCDs in *Chapter 8 – Delivering at efficient cost*, section 8.8.9.

16.4.4 Given the potential inter-AMP nature of these variants, it seems that it will be necessary to ensure that PCDs are either:

- established as multi AMP PCDs
- any PCD delivery payments (excluding time value/late delivery payments) due at the end of AMP8 are agreed to be transferred into AMP9 cost allowances to ensure AMP9 delivery is appropriately funded (this is equivalent to the shortfalling approach that Ofwat utilised up until it was removed at PR14).

16.4.5 As PCDs are still an emerging methodological approach, we will undoubtedly engage further with Ofwat to ensure that the PCDs set at final determinations both protect customers, whilst not being unduly punitive for companies in these such cases whereby the timing of requirements is not currently 100% certain.

16.4.6 The following PCD reflects our core plan (Variant A) and Variant B.

Table 25: PCD summary

Scheme delivery expectations	
Description of deliverable	Deliver enhancement to meet the needs of the AMP8 WINEP for 6mg/l BOD at Davyhulme WwTW
Output measurement and reporting	We have calculated the cumulative PCD deliverables based on delivery of the scheme in AMP8. As stated in the enhancement case delivery of this project is not achievable within the AMP8 period. We have proportioned the milestones as 20% for Contract Award, 40% Start on Site and 40% Project in Use. We propose the completion of site schemes will be reported through the APR process. Whilst these tables do not currently allow for project milestone delivery, this additional detail could be set out in table commentary. No delivery completion is forecast in year 1 this year will be spent in design and definition project phase, and tendering contracts.
Assurance	In line with EA guidance completion of an action will require the live WINEP/NEP to have been signed off by UUW with the relevant Output in Use evidence pack uploaded to the EA WINEP SharePoint. The EA will then also need to sign the live WINEP/NEP to confirm they are happy that the scheme has been completed. For schemes with a regulatory date of 31 March the EA has until 15 May in order to review the evidence and sign-off. EA sign-off provides third party assurance.
Conditions on scheme	None
Impact on PCs	We have assumed no impact, given our expectation of a deferral to the compliance date. If that is not the case, then delays to this scheme would impact the treatment works compliance PCL and hence lead to a penalty of against this measure.

16.4.7 In our PCD template *UUW32-PCD Excel Sheet* we have assumed a wholesale WACC of 3.23%, in line with Ofwat's guidance. We have assumed a 50% totex cost sharing rate, which is applied before calculating PCDs. We have applied a further 50% for Bioresources (where applicable), to ensure that only 25% of Bioresources totex is at risk from PCDs, given the lack of RCV guarantee, and general uncertainty in cost recovery from future Bioresources price controls. For late delivery we have applied a proportionate value of annual opex, and assumed 3.5% of capex, which provides a fair reflection of the time value of money of any related deferred capital spend.

Table 26: PCD delivery profile

	Unit	AMP8	2024	2025	2026	2027	2028	2029	2030	Ultimate delivery
Cumulative delivery target for PCD	**% delivered**		**0**	**0**	**0**	**20**	**60**	**60**	**100**	**100**
AMP8 Capex (22/23 pb)	£	784,250,529	-	-	58,035,935	76,099,319	196,087,679	309,017,981	145,009,615	
AMP8 Opex (22/23 pb)	£	0	-	-	-	-	-	-	-	
ODI impact per unit of PCD volume	£/% delivered	0.00								

Table 27: Price Control Allocation

Price Control	Unit	Price Control Allocation
Water resources	%	0.00%
Water network+	%	0.00%
Wastewater Network+	%	100.00%
Bioresources	%	0.00%

Table 28: PCD Incentive rates

	Unit	WR	WN+	WwN+	BR
Overall delivery	£/% delivered	0	0	3,921,253	0
Time value rate	£/% delivered	0	0	126,656,	0
Late delivery	£/% delivered	0	0	263,900	0

16.4.8 The following PCD outline reflects variants C and D.

16.4.9 These PCD inputs have been put together to reflect delivery of the alternative, lower cost, 8mg/l BOD scheme for Davyhulme.

16.4.10 We have provided an indicative delivery profile that could be used (following finalisation of the cost estimate) to develop a PCD, using the same approach as the full 6mg/l BOD Davyhulme scheme in Table 27 above, whereby we have proportioned the milestones as 20% for Contract Award, 40% Start on Site and 40% Project in Use.

Figure 15: Davyhulme BOD PCD totex (£m) C and D

Requirement	2026	2027	2028	2029	2030	Total
Davyhulme WwTW 8mg/l BOD	3.115	2.643	9.448	26.955	10.600	52.761
Delivery %	20	20	60	60	100	100

Appendix A Pennington Flash overflows

Table 29 - Overflows within the Pennington Flash catchment included in the AMP8 WINEP

WINEP action ID	Scheme name	Primary driver	Scheme grouping
08UU101002a	Hindley PS SO WIG0255SO	EnvAct_IMP2	Pennington Flash
08UU101372a	Templeton Road PS WIG0095SO	EnvAct_IMP2	Pennington Flash
08UU102447a	Bickershaw Lane PS WIG0128	EnvAct_IMP4	Pennington Flash
08UU102448a	Crankwood Road PS WIG0129	EnvAct_IMP4	Pennington Flash
08UU102449a	Abram Hall PS WIG0130	EnvAct_IMP4	Pennington Flash
08UU102451a	Abram Hall CSO WIG0216	EnvAct_IMP4	Pennington Flash
08UU102450a	Strangeways CSO WIG0153	EnvAct_IMP4	Pennington Flash

Appendix B Copy of letter sent 31/08/23 Jo Harrison to Claire Bunter WINEP scope and delivery dates

United Utilities
Water for the North West

United Utilities Water Limited
Haweswater House
Lingley Mere Business Park
Lingley Green Avenue
Great Sankey
Warrington WA5 3LP

Telephone: 01925 237000

unitedutilities.com

Claire Bunter

Environment Agency

Via email: 31.08.23

Dear Claire

WINEP scope and delivery dates

Thank you for your recent clarification regarding the WINEP scope and your efforts to address phasing issues collaboratively with us.

We are concerned regarding the outcome of this clarification, which potentially adds a further £1 billion of expenditure into the AMP8 WINEP programme. This is investment that had previously been subject to an extensive adaptive planning process and scheduled to be delivered in AMP9. Accelerating this investment limits the opportunity for the delivery of more efficient and sustainable solutions and will inevitably lead to the delivery of grey, engineered solutions with a high carbon footprint. We are also concerned that the potential to discuss appropriate delivery dates for other schemes is also now on hold until after the Final Determination.

Delivery of complex schemes (see appendices 1 and 2)

As part of our WINEP options submission in January 2023 we highlighted a number of large, complex projects where there was a need to phase regulatory dates (see appendix 1). We subsequently engaged extensively and in good faith with regulators throughout 2023 to develop proposals and submit them through the various channels identified to us. A full timeline of the interactions is set out in appendix 2 to this letter.

As you will see from appendix 2 we have made significant efforts to engage with regulators on WINEP phasing needs and this culminated with the inclusion of phasing proposals for Davyhulme, Wigan & Skelmersdale and Pennington Flash, within our wider phasing submission of 19th July 2023.

In the meeting with all regulators ahead of the July submissions it was set out that companies should carefully consider phasing and if companies had concerns about deliverability, affordability and financeability they should be taking advantage of this opportunity. In addition to responding on the areas we were steered to look at, we again specifically raised the need for phasing for the three areas above and provided adaptive plans to support those proposals.

We are therefore concerned that the conclusion of this last process, which was communicated by the Environment Agency (EA) on the 17th August 2023, did not accept the phasing for Davyhulme, Wigan & Skelmersdale and Pennington Flash. It was stated that phasing decisions had been concluded and that the WINEP alteration process was not now available until after the Final Determination of PR24 plans.

As a consequence, the statutory WINEP now has dates for major schemes at Davyhulme, Wigan and Skelmersdale schemes in AMP8 and so costs must now be included in our AMP8 totex plan. We are concerned that this will both drive an additional £1bn (2021 prices) into our AMP8 WINEP programme and result in sub-optimal environmental improvements. Whilst our associated enhancement cases for these schemes will detail the need to enter into alteration processes to agree deliverable dates in AMP9 post Final Determination, our view is that these major scheme delivery dates should be agreed ahead of the business plan submission.

For Pennington Flash we have no deliverable solution developed and costed and so will not include costs in the PR24 plan at this time. We are working on a grey infrastructure solution and the cost, in the event that this is required, is potentially more than £150m (2021 prices). We will flag this need as part of our PR24 business plan with the expectation that, if such a scheme is required to be delivered within AMP8, a cost allowance will be added during the determination process.

Wider concerns on AMP8 delivery dates (see appendix 3)

More broadly we have continued to work hard on developing our delivery plans throughout 2023 so that wherever possible we plan to meet regulatory dates. With significant and welcome regulator support, through accelerated and transitional investment, we have started early on projects across £1.5bn of our AMP8 programme, bringing forward £200m of investment into AMP7. This has resolved a number of deliverability issues, but in addition to the issues raised above, there remain a further 16 WINEP schemes needing in-AMP8 date moves, which are set out in appendix 3.

Direct Procurement for Customers (DPC) – Salford, Sale and Stockport

As per our presentation to you on 4th July 2023, the Salford, Sale and Stockport bundle of schemes trigger thresholds as viable Direct Procurement for Customers (DPC) and we wish to explore that mode of delivery. The regulatory date for Salford already needs pushing back to Autumn 2031 to enable traditional delivery, but a further extension to that, and a likely less material delay to Sale and Stockport regulatory dates, would unlock DPC for this bundle. As strong DPC candidates only the running costs of the DPC process are included in our PR24 submission at this time for all 3 schemes, and not the full capital costs – which would be financed separately. In the event that the regulatory dates are not successfully moved, then we would need to include the in-house delivery cost requirement ahead of Final Determination, and we would still need to move the regulatory date for Salford. Equally, in the event that the DPC process does not result in a successful DPC contract award this bundle of schemes would require in-house delivery and associated cost allowances. This matter requires discussion with Ofwat and EA on the regulatory dates to resolve the approach to the regulatory processes and secure best value delivery of these schemes.

In summary, we understand that a mechanism for in-AMP scheme and date changes is proposed to be available through the WINEP alteration process after Final Determination, and we can use this for the in-AMP8 date changes identified in appendix 3, if the dates can't be changed ahead of that. Within that group we believe the Salford regulatory date requires more urgent discussion given the impact on the DPC bundle.

However, for the group of complex schemes in appendix 1, whilst we have appreciated the efforts made by regulators to explore the more significant phasing needs and opportunities, we remain of the view that any material and consequential scheme dates relating to deliverability must be agreed ahead of the Final Determination so the most representative costs and benefits flow through our delivery plan. We stand ready to discuss this further, and believe that it is important that we work together between the

PR24 submission and the Final Determination, to try and get the best outcomes from these drivers and greater certainty on what is a very large programme of investment for AMP8 and AMP9.

Please note that there is a separate matter on aligning WINEP drivers for Eccles WwTW and our overflow programme. I will write to you separately on Eccles with our proposals, given the legal considerations regarding compulsory purchase needs at the location.

Many thanks for your ongoing support on this matter.

Kind regards,

Jo Harrison
Asset Management Director

Cc:
Richard Hatch, Andy Judd and EA PR24 Mailbox, Environment Agency
Tim Griffiths, Ofwat

Appendix 1

Complex schemes requiring adaptive plans and AMP9 completion

Davyhulme WwTW - Throughout 2023 we have flagged the imperative for, and benefit from, phasing Davyhulme WINEP drivers differently. This culminated in us, as directed by the EA, formally submitting phasing proposals to the national WINEP panel (in March 2023) and then, after positive feedback, we were instructed to submit alteration requests to formalise those proposals, which we did (along with adaptive plans). Both EA North West and UUW understand that the 6 mg/l currently in the WINEP does not meet strict WFD needs in any event due to the physical nature of the ship canal waterbody. Our proposal for Davyhulme is for a low/no regrets interim solution at Davyhume – this would involve a BOD permit limit of 8mg/l in AMP8. This would also be deliverable within the AMP8 time period whilst it would take significantly longer to deliver the current WINEP requirement of 6mg/l BOD, if we are to keep the route to biological phosphorus removal open for the site (0.25mg/l phosphorus required in AMP9). If we are required to achieve 6mg/l BOD in AMP8 this could only be achieved with high levels of chemical dosing and a new tertiary solids removal plant that would compromise the available space for future biological phosphorus removal plant.

Pennington Flash overflows - In June 2023, the EA concluded that additional overflows in the Pennington Flash drainage area required improvement to 10 spills per annum to address phosphorus loading in Pennington Flash and would include these in the AMP8 WINEP as there was no time to discuss an alternative at that stage. This was added to our WINEP by the EA within the 3rd July 2023 WINEP version. We have previously flagged that resolution of these to a 10 spills per annum standard is technically challenging and not deliverable within AMP8. Our proposal is to instead pursue a rainwater management approach in AMP8 before committing to significant grey infrastructure. We would, however also propose to retain in the plan the solutions to meet the local WFD issues in Hey Brook (Hindley PS and Templeton Road) as we believe these deliver significant benefit (25% reduction in phosphorus loading to Pennington Flash).

Wigan & Skelmersdale WwTWs - On 3rd July 2023 the EA issued a version of the WINEP to reflect the latest position and, whist this reflected many of the changes we were expecting, it also included in AMP8 a large drivers for Wigan and Skelmersdale WwTWs that had previously been in AMP9. Our proposal for this location is to deliver the AMP8 and AMP9 environmental requirements as a combined solution. The proposal joins flows from both treatment facilities through a transfer of Skelmersdale flows to Wigan WwTW and utilising a new biological phosphorous removal activated sludge plant. The approach has been assessed against alternative chemical dosing options and treatment at the respective works individually. Since the overflows at Pennington Flash are upstream of Wigan WwTW we have produced one adaptive plan (as per our phasing submission of 19th July 2023). Our proposed delivery date for the combined solution for Wigan & Skelmersdale and Pennington Flash overflows is 31st March 2035, but with the WFD improvements for Hey Brook and 25% reduction in load to Pennington Flash by 31st March 2030.

The drivers and our alternative proposal/dates are summarised below.

WINEP action ID	Scheme name	Primary driver	Scheme grouping	Proposed change to WINEP
08UU102339a	Davyhulme WwTW	WFD_IMPg	Davyhulme 6 BOD	Change requirement from 6 to 8mg/l BOD by 31st March 2030 (with 6mg/l in AMP9)
09UU100060a	WIGAN (HOSCAR) WwTW	EnvAct_IMP1	Wigan/ Skelmersdale	Change delivery date to 31st March 2035
09UU100060b	SKELMERSDALE WwTW	EnvAct_IMP1	Wigan/ Skelmersdale	Change delivery date to 31st March 2035
08UU101002a	Hindley PS SO WIG0255SO	EnvAct_IMP2	Pennington Flash	WFD improvements for Hey Brook and 25% reduction in load to Pennington Flash by 31st March 2030. Completion of all SODRP requirements (including improvements to Pennington Flash) by 31st March 2035
08UU101372a	Templeton Road PS WIG0095SO	EnvAct_IMP2	Pennington Flash	WFD improvements for Hey Brook and 25% reduction in load to Pennington Flash by 31st March 2030. Completion of all SODRP requirements (including improvements to Pennington Flash) by 31st March 2035
08UU102447a	Bickershaw Lane PS WIG0128	EnvAct_IMP4	Pennington Flash	Change delivery date to 31st March 2035
08UU102448a	Crankwood Road PS WIG0129	EnvAct_IMP4	Pennington Flash	Change delivery date to 31st March 2035
08UU102449a	Abram Hall PS WIG0130	EnvAct_IMP4	Pennington Flash	Change delivery date to 31st March 2035
08UU102451a	Abram Hall CSO WIG0216	EnvAct_IMP4	Pennington Flash	Change delivery date to 31st March 2035
08UU102450a	Strangeways CSO WIG0153	EnvAct_IMP4	Pennington Flash	Change delivery date to 31st March 2035

Appendix 2

EA / UUW interactions of phasing and deliverabilty

24th Jan 2023 – The UUW WINEP submission two covering letter flags concerns about deliverability and an option for an alternative at Davyhulme to reduce the scale of expenditure (this is the 8mg/l BOD proposal), improve the sustainability and future site flexibility.

9th Feb 2023 – UUW presented the proposed 8mg/l BOD AMP8 option for Davyhulme to the EA in the North West.

17th March 2023 – UUW wrote to the EA highlighting that we had 39 WINEP actions where at that time we believed it may be necessary to request regulatory date changes. This letter requested guidance on the process for agreeing such changes.

24th Mar 2023 – The EA confirmed they had identified the established route for our proposals for Davyhulme WwTW to be reviewed which was through a national WINEP assessment panel. Responses to EA queries were provided on 30th Mar 2023 to inform the panel.

29th Mar 2023 – EA advise that date changes should be managed through the "Data Handling and Changes Tracking after Options Development".

14th April 2023 – Following feedback from the national assessment panel UUW was advised to submit an alteration form for Davyhulme to request the 8mg/l BOD proposal is included in the WINEP.

5th May 2023 – EA write to companies asking them to set out which parts of the WINEP and WRMP they have concerns about and *'if so, which parts of the programmes would you choose to phase beyond AMP8 if you could and why'*. The letter also offered a chance of a meeting with the regulators that we took and where we presented our proposals.

16th May 2023 – UUW respond to the letter of 5th May. One of our proposals here is to deliver a solution at Davyhulme to meet 8mg/l BOD rather than 6mg/l BOD as this would be significantly lower cost, be more sustainable, deliver the majority of the intended benefit and keep open the option of us being able to use more sustainable treatment processes in the future for phosphorus removal. This is a proposal we first floated in our WINEP options submission in Jan 2023.

25th May 2023 – meeting with EA, Ofwat and Defra to discuss our proposals. There was positive feedback from the session about an informative and constructive dialogue was. There was subsequently no further decisions or actions from the regulators specific to our proposals.

3rd July 2023 – EA issue a revised WINEP to reflect the outcome of their review of water company's WINEP submissions made in January 2023. This reflected many changes we were expecting, but also included a major scheme for Wigan and Skelmersdale WwTWs which had not been previously specified by the EA. Following queries from UUW it transpired the EA in the North West were not aware of this change and it had been made by their national team. This version of the WINEP also included 5 additional overflows which impact Pennington Flash and changes to requirements for two existing ones.

5th July 2023 – EA write to water companies asking them to set out if their WINEP is deliverable, affordable and financeable and if not we were to propose options to phase investment. In the pre-meet with regulators it was made clear that if companies have concerns about deliverability, affordability and financeability they should be taking advantage of this opportunity.

19th July 2023 – UUW submit completed EA phasing spreadsheet with proposals for their review. This included Davyhulme, Wigan/Skelmersdale and Pennington Flash schemes as well as the boreholes, septic tanks and emergency overflow monitoring.

21st July 2023 – EA email to inform UUW that the WINEP change process is not live for AMP8 schemes until after the Final Determination. UUW had been verbally informed of this on 19th July so we included Davyhulme, Wigan/Skelmersdale and Pennington Flash in the phasing submission.

27th July 2023 – Further data provided by UUW to support the phasing submission (costs for phasing options for Davyhulme, Wigan/Skem and Pennington Flash were uploaded).

18th Aug 2023 – EA provide a short email setting out their position on emergency overflow monitoring and septic tanks (common to all companies) as well as pointing companies to their decisions on phasing which were on the EA SharePoint. The feedback was very high level, but rejected phasing for Davyhulme, Wigan/Skem and Pennington Flash within the spreadsheet.

Pennington Flash specific timeline

8th June 2023 - EA agree that a 250kg/yr phosphorus load reduction target is needed for Pennington Flash in AMP8. This equates to 10 spills per annum for 7 overflows in the Hindley area.

14th June 2023 – UUW email EA with proposal to phase solutions for the 7 overflows with a focus on rainwater management in AMP8 and completion of solutions in AMP9. This would allow us to maximise the opportunity for partnership with the Wigan Greenheart project.

3rd July 2023 – EA issue a revised WINEP to reflect the outcome of their review of water company's WINEP submissions made in Jan 2023. This version of the WINEP also included 5 additional overflows which impact Pennington Flash and changes to requirements for two existing ones.

5th July 2023 – EA write to water companies asking them to set out if their WINEP was deliverable, affordable and financeable and if not we were to propose options to phase investment. In the pre-meet with regulators it was made clear that if companies have concerns about deliverability, affordability and financeability they should be taking advantage of this opportunity.

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27th July 2023 – Further data provided to support phasing submission (costs for phasing options for Davyhulme, Wigan/Skem and Pennington Flash were uploaded).

18th Aug 2023 – EA provide a short email setting out their position on emergency overflow monitoring and septic tanks (common to all companies) as well as pointing companies to their decisions on phasing which were on the EA SharePoint. The feedback was very high level, but rejected phasing for Davyhulme, Wigan/Skem and Pennington Flash within the spreadsheet.

Appendix 3

AMP8 in-period regulatory dates changes

In March 2023 we wrote to you to highlight the 39 instances where, at that time, regulatory dates were in misalignment with forecast achievable programme dates and we were sign-posted to raise these through the WINEP change process. However, subsequently in July 2023 we were advised that this process was not live for AMP8 schemes until after the Final Determination.

Following receipt of the WINEP dated 3rd July 2023 and the subsequent finalisation of our totex programme for AMP8 we now have a final view of where we still have residual issues with achieving regulatory dates. The benefit of transitional spend and some further programme optimisation has reduced the instances where in-AMP programme dates extend beyond regulatory dates to 15.

The drivers and our alternative proposal/dates are summarised below. We will bring details of what drives the deliverable dates for these schemes to the discussion with EA North West.

WINEP Action ID	Scheme Name	Primary driver	Regulatory Date	UUW Proposed Delivery date
08UU102423	Lytham PS FYL0003SO - BW IMP	BW_IMP1	31/03/2026	19/03/2029
08UU102422	Lamaleach CSO FYL0002SO - BW IMP	BW_IMP1	31/03/2026	19/03/2029
08UU102420	Lancaster (Stodday) WwTW - BW IMP	BW_IMP1	31/03/2026	19/03/2029
08UU102421	Askam-in-Furness WwTW ST 0174701365T - BW IMP	BW_IMP1	31/03/2026	19/03/2029
08UU102419	Southport (Bank End) WwTW - EnvAct IMP3	BW_IMP1	31/03/2026	05/08/2029
08UU100878	Davyhulme WwTW - phosphorus	WFD_ND	31/03/2026	31/03/2030
08UU100971	No Det - Warrington South WwTW	WFD_ND	31/03/2026	05/03/2029
08UU100961	No Det - Crewe WwTW	WFD_ND	31/03/2026	13/11/2028
08UU100113	Dufton WwTW - Habitats	WFD_ND	31/03/2026	30/09/2026
08UU100935	Milburn WwTW WINEP Habitats	WFD_ND	31/03/2026	31/01/2027
08UU100936	Morland WwTW - WINEP Habitats	WFD_ND	31/03/2026	31/01/2027
08UU100932	Long Marton East WwTW	WFD_ND	31/03/2026	30/11/2026
08UU100926	Great Asby WwTW	WFD_ND	31/03/2026	30/11/2026
08UU100953	Partington -0169401485T	WFD_ND	31/03/2026	01/12/2028
08UU100882	Salford WwTW - BOD	WFD_IMPg	31/03/2030	15/09/2033[1]

Appendix C Copy of letter from EA confirming its position following a meeting of Defra, EA and Ofwat

creating a better place
for people and wildlife

Environment Agency

By Email only

Ref: UU/WINEP/220923
Date: 22 September 2023

Jo Harrison
Asset Management Director
United Utilities

Dear Jo,

Re: Water Industry National Environment Programme (WINEP) scope and delivery dates

Thank you for your letter to Claire Bunter dated 31 August 2023, regarding the "WINEP scope and delivery dates". After careful consideration of your concerns and following your meeting with Richard Hatch, the EA's National Price Review Manager, and colleagues from Defra and Ofwat on 20 September, I am writing to confirm our position.

Davyhulme
You have proposed an 8 mg/l BOD interim low/no regrets solution for Davyhulme WwTW within AMP8, followed by a 6 mg/l BOD solution in AMP9 together with biological phosphorus removal (0.25 mg/l phosphorus limit) to meet the Technically Achievable Limit as required by the Environment Act.

I appreciate we previously confirmed that we are unable to consider proposed alterations to the PR24 WINEP before Ofwat's Final Determination of your Business Plan. We were, therefore, unable to consider your formal alteration submission of 29 June 2023 requesting an alteration to PR24 WINEP action 08UU102339 for Davyhulme WwTW.

This principle is still correct. However, while we would not normally consider an alteration request before the Final Determination, due to the unique nature of the Davyhulme scheme we are willing to consider your request at this stage. To facilitate this and to provide a formal record of the proposal and our ultimate decision please submit a further WINEP major alteration request.

Your request must be supported by compelling evidence and justification. This should include full details of why the scheme cannot be completed within AMP8 and why the BOD solution is so intricately linked to the phosphorus removal/recovery.

customer service line 03708 506 506
gov.uk/environment-agency

You need to show us that you are delivering the dissolved oxygen improvements as quickly as possible and you should provide details of any actions you are taking now, or propose to take in advance of AMP8, to achieve this. You should set out clearly the consequences, if any, that the phasing of the BOD reductions would have on achieving the environmental outcome.

We would expect you to demonstrate and give your firm commitment to achieving the 6mg/l BOD standard and the biological phosphorus removal/recovery as early as possible within AMP9.

You should also provide any other supporting information which you believe is relevant to the delivery of the scheme.

The current requirements for BOD and phosphorus through the WINEP are:

Action ID	PR24 driver	Permit requirement	Completion date
08UU102339a	WFD_IMPg	6 mg/l BOD 95%ile	31/03/2030
08UU100878	WFD_ND	3 mg/l phosphorus annual average	31/03/2026
09UU100039	EnvAct_IMP1	0.25 mg/l phosphorus annual average	TBC

Wigan and Skelmersdale
The AMP8 actions for Wigan and Skelmersdale are statutory requirements; the completion date will therefore remain as 31 March 2030.

Action ID	PR24 driver	Permit requirement	Completion date
09UU100060 a (Wigan (Hoscar) WwTW)	EnvAct IMP1, WFD_IMP(m)	0.25 mg/l P (Annual Average)* 1 mg/l Ammonia (95%ile)	31/03/2030
09UU100060b (Skelmersdale WwTW)	EnvAct IMP1, WFD_IMP(m)	0.25 mg/l P (Annual Average)*	31/03/2030

* Plus associated iron 95%-ile and UTL

Pennington Flash
The 7 overflow schemes for Pennington Flash are statutory requirements; the completion date will therefore remain as 31 March 2030.

Action ID	PR24 driver	Completion date
08UU101002a Hindley PS SO WIG0255SO	EnvAct_IMP2, EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU101372a Templeton Road PS WIG0095SO	EnvAct_IMP2, EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU102447a Bickershaw Lane PS WIG0128	EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU102448a Crankwood Road PS WIG0129	EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU102449a Abram Hall PS WIG0130	EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU102450a Strangeways CSO WIG0153	EnvAct_IMP4, WFD_IMPg	31/03/2030
08UU102451a Abram Hall CSO WIG0216	EnvAct_IMP4, EnvAct_IMP5, WFD_IMPg	31/03/2030

For Pennington Flash you have confirmed you are working on a grey infrastructure solution. You note that you expect a cost allowance to be added during the determination process for the Pennington Flash AMP8 scheme. Your AMP7 investigation should have provided you with the information you need to deliver a solution in AMP8.

Direct Procurement for Customers (DPC) – Salford, Sale and Stockport

You note that the Salford, Sale and Stockport bundle of schemes trigger thresholds as viable Direct Procurement for Customers (DPC). These are statutory requirements and therefore the completion dates in the WINEP remain.

Action ID	PR24 driver	Permit requirement	Completion date
08UU100882a Salford WwTW	WFD_IMPg	6 mg/l BOD 95%ile 1 mg/l Ammonia 95%ile	31/03/2030
08UU101382a Sale WwTW	WFD_IMPg	10 mg/l BOD 95%ile	31/03/2030
08UU101381a Stockport WwTW	WFD_IMPg	15 mg/l BOD 95%ile	31/03/2030

I will be writing separately to you next week to confirm the outcome of the Environment Agency's assessment of your PR24 phasing proposals.

I look forward to continuing to work closely with you as you finalise your business plans.

Yours sincerely

Anne Dacey
Deputy Director, Operations Catchment Services
Cc
Amira Amzour - Deputy Director, Water Quality Policy, Defra
Harry Armstrong - Director, Regulatory Policy, Ofwat
Claire Bunter - Claire Bunter Account Manager UU

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United Utilities

Water for the North West