UUWR_22

PR24 Draft Determination: UUW Representation

Area of representation: Appendix Salford WwTW

August 2024

This document is a supporting appendix to accompany UUW DD representation document UUWR_11 – Gated mechanisms providing technical information on Salford WwTW.

Reference to draft determination documents PR24 draft determination: Expenditure Allowances, section 4.7.3 Approach to large schemes, pages 177 - 184

United Utilities

Water for the North West

1. Key points

- **Salford WwTW is a strategic site serving a thriving part of Greater Manchester:** The planned improvement of Salford WwTW is a key part of the Manchester Ship Canal partnership strategy, delivering environmental improvements to this vital waterbody.
- **We have applied adaptive planning principles for the Salford scheme development:** With awareness of the long-term drivers in the Environment Act we have included solutions for AMP8 that enable best overall value for our customers and the environment considering the AMP8 and AMP9 drivers**.**
- **We have done a full bottom-up estimate assessing site specific risks:** We understand the construction complexity of this scheme and have included phasing, temporary treatment and land purchase costs as necessary.
- **Site specific constructability challenges have added significant additional cost:** Mainly due to the constrained nature of the site and confirmed ground condition issues. We consider that these costs are not well represented in Ofwat’s cost assessment models.
- **We have a track history of intervening at the right time to replace existing secondary treatment assets when they are no longer fit for purpose:** We have built similar schemes at Blackburn, Oldham and Davyhulme in recent AMPs and this experience has informed our cost estimate for Salford.
- **Ofwat's modelled costs are significantly lower than that required to deliver the outcomes:** We do not consider that Ofwat’s cost assumption for Salford has appropriately accounted for the considerable works necessary to meet the challenging drivers in the WINEP for technically achievable limits (TAL) for BOD and ammonia on this site. We present the case that demonstrates our costs are an efficient representation of the challenges faced at Salford.

2. Introduction and overview

Our PR24 submission included a large wastewater project at Salford WwTW. The need is certain, being included in the WINEP throughout the Price Review process. However, Ofwat has challenged the costs we have put forward for this scheme.

The scheme at Salford is driven by improving the status of the Manchester Ship Canal as part of a long-term adaptive plan agreed with the Environment Agency (EA). The drivers are documented in the AMP8 WINEP. In addition, Salford will also have an Environment Act requirement in AMP9 for phosphorus, so to ensure there is no abortive short-term investment for customers our solution has been developed as an adaptive plan. We are working with the Environment Agency on a WINEP alteration form to bring the phosphorus driver forward into AMP8 and align it with the regulatory dates for BOD and ammonia to deliver all drivers together as a best value solution for customers.

We have developed the best value solution through a robust optioneering process, and we have challenged ourselves on the need to minimise significant construction and avoid rebuilding assets. However, this has proved challenging due to the stringent drivers we need to deliver, the existing asset base and site-specific characteristics. Our prior experience in this area has allowed us to identify a solution that meets our statutory requirements under the WINEP, deliver the environmental improvements and are best value for our customers over the course of multiple AMPs.

Ofwat has challenged the costs associated with the solution for the AMP8 drivers at Salford. The scale of the challenge is presented in Table 1. Figures presented are post-frontier shift and RPE.

Table 1: Comparison of UU Business Plan versus Ofwat Modelled Costs by Site

Site	Driver Basis	UU Business Plan	Allocated costs	Model	Challenge
Salford	Sanitary (AMP8)	£255m	£151m	Sanitary	-£104m

Source: UUW analysis

This document provides further supporting information around the technical and constructability challenges for the Salford scheme and presents further evidence to demonstrate that the proposed solution and costs relating to Salford have been challenged and, as such, are robust and accurate.

2.1 New requirements at Salford

The drivers for Salford are documented in the WINEP and summarised in Table 2. The red coding in the table shows where drivers include permit levels at the Technically Achievable Limit (TAL) for that driver. There will be examples of sites in the UK with permits lower than the TAL where water companies have agreed to take on more onerous targets due to the nature of the assets on site or for use in a flexible permitting environment. However, overall, the TAL limit indicates the tightest environmental standard expected for these determinands (BOD, ammonia and phosphorus).

Table 2: Drivers at Salford (red indicates that the new permit will be at technically achievable limit)

<table>
<tr><th rowspan="2">Site</th><th colspan="3">AMP 8 new drivers</th><th colspan="3">AMP9 new drivers</th><th rowspan="2">Growth to design horizon</th></tr>
<tr><th>BOD</th><th>Ammonia</th><th>Phosphorus</th><th>BOD</th><th>Ammonia</th><th>Phosphorus</th></tr>
<tr><td></td><td>mg/l 95%ile</td><td>mg/l 95%ie</td><td>Annual average</td><td>mg/l 95%ile</td><td>mg/l 95%ie</td><td>Annual average</td><td>As described</td></tr>
<tr><td>Salford</td><td>6</td><td>1</td><td></td><td></td><td></td><td>0.25*</td><td>28% population</td></tr>
</table>

**Alteration form with EA to align phosphorus driver with BOD and ammonia drivers in AMP8*

The TAL is not an absolute number, but it is an indication of on average the minimum level for that driver. Therefore, the TAL limit indicates the current minimum standard expected for these determinands (BOD, ammonia etc). The table above indicates the challenging limits to be achieved by the scheme at Salford WwTW.

Salford's AMP8 WINEP quality drivers for BOD and ammonia are at the technically achievable limits, 6 mg/l BOD and 1 mg/l ammonia, representing a significant step change from current permits. In developing the new solution, we were conscious of a future driver at the technically achievable limit (TAL) of 0.25mg/l phosphorus in AMP9. So, to avoid abortive costs, we were mindful that any assets installed to meet the AMP8 drivers would also have to facilitate phosphorus removal in the future, and we are working with the Environment Agency on an alteration to the WINEP to align the phosphorus driver with BOD and ammonia in AMP8. These drivers influence the need for significant rebuild at Salford, which is driving costs well in excess of Ofwat's ex ante assumption.

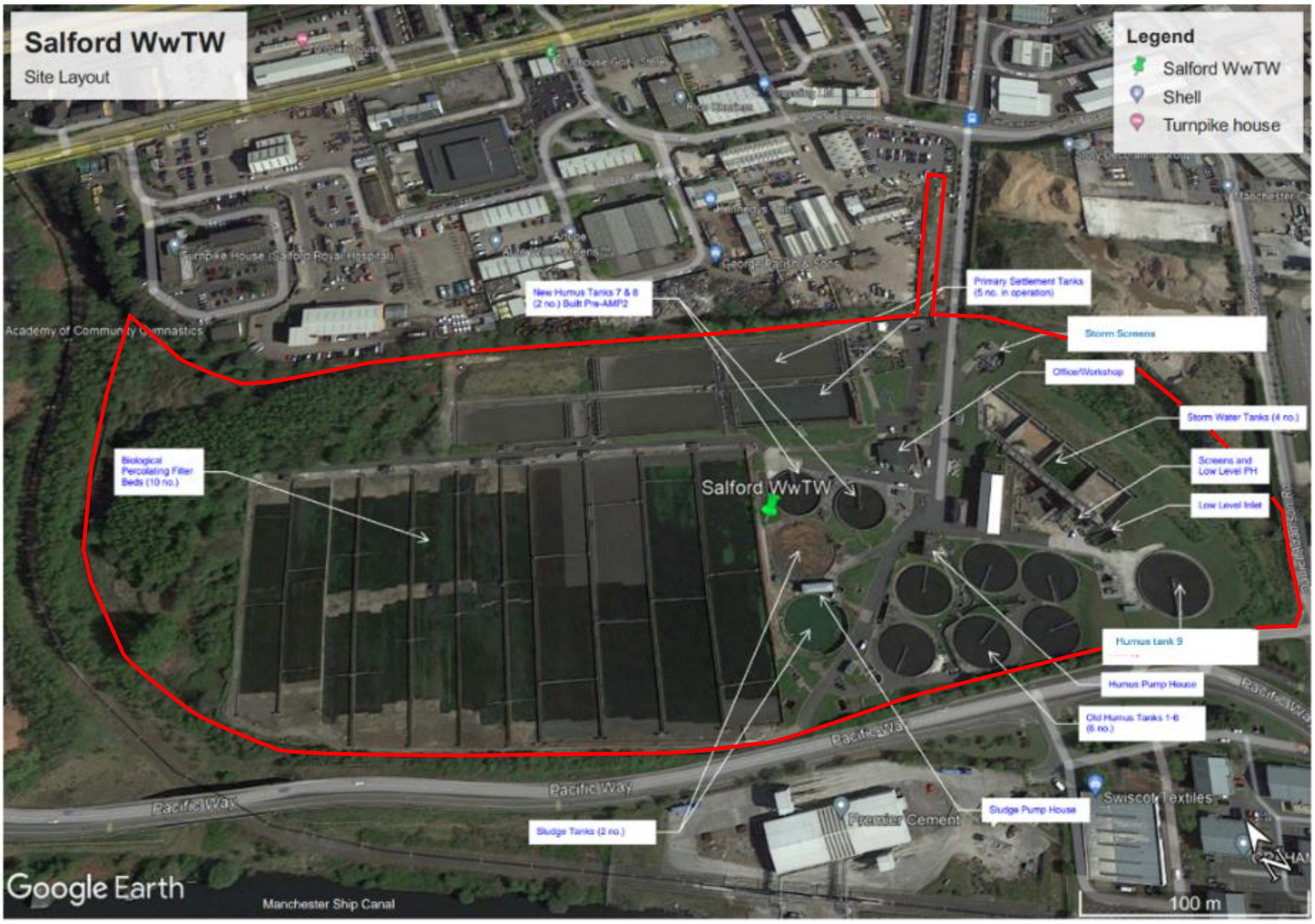
2.2 About Salford WwTW

Salford is one of the fastest growing cities in the UK, with a 15.4% increase in population between 2011 and 2021 according to ONS Census data. Based on current estimations the population served by Salford WwTW is likely to increase further by 28% over the next 25 years, resulting in further increase in flow and load to the wastewater treatment works.

In addition to the WINEP drivers, we also have a monitoring requirement for Cypermethrin, Nonylphenol, Cadmium (1.2 µg/l upper tier limit) and an operating technique agreement (OTA) to achieve a PFOS limit (0.0140523ug/l 95%ile basis).

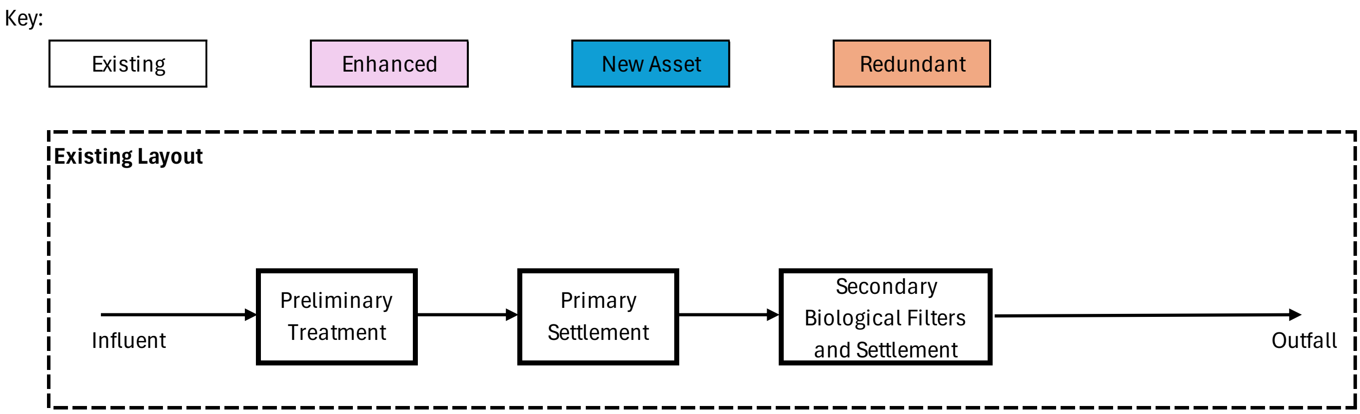
Salford WwTW is one of United Utilities' oldest treatment works, originally dating back to the early 1900s with additional assets added throughout the years to adapt to increases in population and tightening discharge permit requirements. It operates a traditional basic treatment process comprising of primary settlement tanks, trickling filters and humus settlement tanks.

Figure 1: Salford WwTW Existing Works Plan



Source: UUW analysis with Google Earth

Figure 2: Existing Treatment Processes at Salford WwTW



Source: UUW analysis

The step change from the current permit of 30 mg/l BOD and 5 mg/l ammonia to 6 mg/l BOD, 1 mg/l ammonia and 0.25mg/l phosphorus is beyond the capability of the existing technology on site at Salford and this will be evidenced in Section 4.

2.3 Constructability Challenges

As part of our approach to developing the solution at Salford we consulted with our external supply chain to ensure site specific constructability issues were identified and considered.

Two major constructability themes have been identified: constrained site conditions and the surrounding heavily urbanised built environment. Adapting to and resolving these challenges has resulted in site specific cost increases, when compared to a typical capital intervention. This may contribute to this project being viewed as an outlier.

2.3.1 Constrained Site Conditions

The footprint of Salford WwTW is near capacity, with no available land outside the site boundary to facilitate expansion. This results in the requirement to demolish and construct over existing assets, (that will be made redundant by the proposed solution), provide extensive temporary equipment to keep the site operational during the construction period and to build in a constrained area that has significant geotechnical, contamination and ecological challenges. These aspects dictate construction sequencing and prolong the programme. We have identified the need to rent land for the location of site compounds, plant storage and equipment laydown areas.

2.3.2 Surrounding Built Environment

Salford WwTW is located within the highly urbanised city of Salford, in Greater Manchester. This presents several challenges that drive increased construction costs and timescales:

- There is a high density of commercial and industrial premises immediately adjacent to the site boundaries and site access is though high traffic volume and congested areas. The choice and design of our solutions are influenced by the need to give due consideration to limiting construction, noise, vibration and odour emissions that may impact the neighbouring customers.
- Construction activities and plant access is required near to several strategic third-party transport assets such as the Manchester Ship Canal and railway infrastructure. There will be programme and cost impacts due the need to liaise with third parties to obtain specific permissions, undertake monitoring works during construction and the need to employ specialist low impact construction techniques.
- There is a known risk of the presence of historical unexploded ordnance at the site due to the proximity to Trafford Park, which is an industrial area targeted by air attack during World War Two. This requires specialist measures such as advanced probing of construction areas, watching briefs and emergency response plans. These measures add additional steps to the construction process, which adds cost.

3. Our solution minimises costs over multiple AMPs

3.1 The proposed solution

We carried out an options appraisals process which looked at do nothing, enhancement of existing assets and new build solutions. The do nothing and enhance existing assets approaches were not feasible as they would not achieve the BOD or ammonia drivers, as evidenced in section 3.2 below. The existing process of tricking filters is not capable of meeting the AMP8 WINEP drivers, nor does it have the capacity for treating increased flow and load as a result of population increase. We therefore need to deliver a best available technology (BAT) solution, that will deliver the environmental improvements for Salford WwTW to the regulatory date and the best value solution for customers.

Following the options appraisal process, a new secondary treatment process was selected as the preferred option. This preferred option is also in line with the future Environment Act driver of 0.25mg/l phosphorus due for AMP9, which are in discussion with the Environment Agency to bring forward into AMP8. We consider that the solution avoids abortive works and cost.

Our proposed solution to meet the drivers, set out in Section 3, is a new biological phosphorus removal activated sludge process (Bio P ASP). This intervention is part of our adaptive plan to achieving the future stringent phosphorus permit as well as the overall plan to improve the quality of the Manchester Ship Canal. As a result, we are currently working with the Environment Agency to align the phosphorus driver with BOD and ammonia in AMP8.

The following sections will describe in more detail why we are confident this is the only solution for Salford WwTW to meet the AMP8 drivers, maintain our excellent environmental performance and deliver best value for customers.

3.2 Challenging permit conditions compared to the existing asset base

As previously referenced, the population in the catchment of Salford WwTW has grown significantly over the last decade and is predicted to continue to increase to the design horizon of 2050. This, combined with the AMP8 WINEP drivers for Salford WwTW for BOD and ammonia, and future phosphorus driver, at the technically achievable limits, means the existing site assets will be incapable of meeting the new drivers.

Population Increase

The treatment works at Salford is currently operating at the limit of capacity, and with the pace of development in the catchment, and the resulting population increase, we are increasingly employing operational interventions to ensure we are compliant with our existing permit conditions. Since the site improvements in AMP2 the domestic population has increased by 26% to 2022.

The existing assets will be pushed beyond their design limits and capacity with the predicted further growth in population and the subsequent increase in flow and load, which would cause further deterioration in performance for the current permit conditions.

6mg/l BOD driver – beyond the capability of the existing assets

The driver for 6mg/l BOD is a significant challenge to deliver at any wastewater treatment works, as it is the technically achievable limit. We challenged ourselves to incorporate the use of the existing assets; we assessed the current performance, the optimisation potential and the potential to add on tertiary treatment to meet the requirement for 6mg/l BOD, despite the challenges of the population growth.

Achieving 6mg/l BOD permits with a fixed film trickling filter process is highly challenging and is widely considered impractical due to several inherent limitations of the technology, which are summarised below:

- **Diffusion Limitation**: The biology attached to trickling filter media is often referred to as a fixed film or biofilm. Performance of biofilm processes is diffusion-limited, i.e. pollutant mass must travel across a concentration gradient from the bulk to the biofilm where the mass is metabolised by the biology/microorganisms. However, the rate at which these pollutants diffuse into the biofilm can be limited by a number of factors including biofilm thickness, oxygen gradient and available substrate. Trickling filters therefore have limited BOD treatment performance of up to 90% BOD removal (Metcalf and Eddy 2002, Table 9-1, p. 893).

- **Oxygen Limitation**: Oxygen is required for all aerobic treatment processes, including trickling filters, which employ natural ventilation. The rate of airflow is a function of the temperature difference between the ambient air and the air inside the pores, which is approximately at sewage temperature. During some periods of the year no nett air flow occurs through the trickling filters because temperature differential is negligible (Metcalf and Eddy 2002, Figure 9-6, p. 902). This limits the biological process and reduces the effectiveness of the treatment process.
- **Low Hydraulic Retention Time:** The hydraulic retention time of effluent while it is being treated in trickling filters is short, therefore the effective contact time needed for thorough BOD removal, such as that to 6mg/l BOD and beyond, is not sufficient.
- **Lack of Process Control:** Trickling filters offer limited process control opportunities, which makes it hard to optimise the process for low BOD levels. The fixed media bed restricts adjustments to biofilm thickness and hydraulic loading in real-time. Ensuring adequate oxygen transfer, especially in deeper biofilm layers, is also problematic. So, optimisation of Trickling Filters to achieve low BOD drivers is seldom possible.

BOD is the sum of the particulate BOD and the soluble filtered BOD. Total BOD can be reduced by the addition of tertiary solids removal downstream of trickling filters; however, the soluble filtered fraction would not be improved by this process.

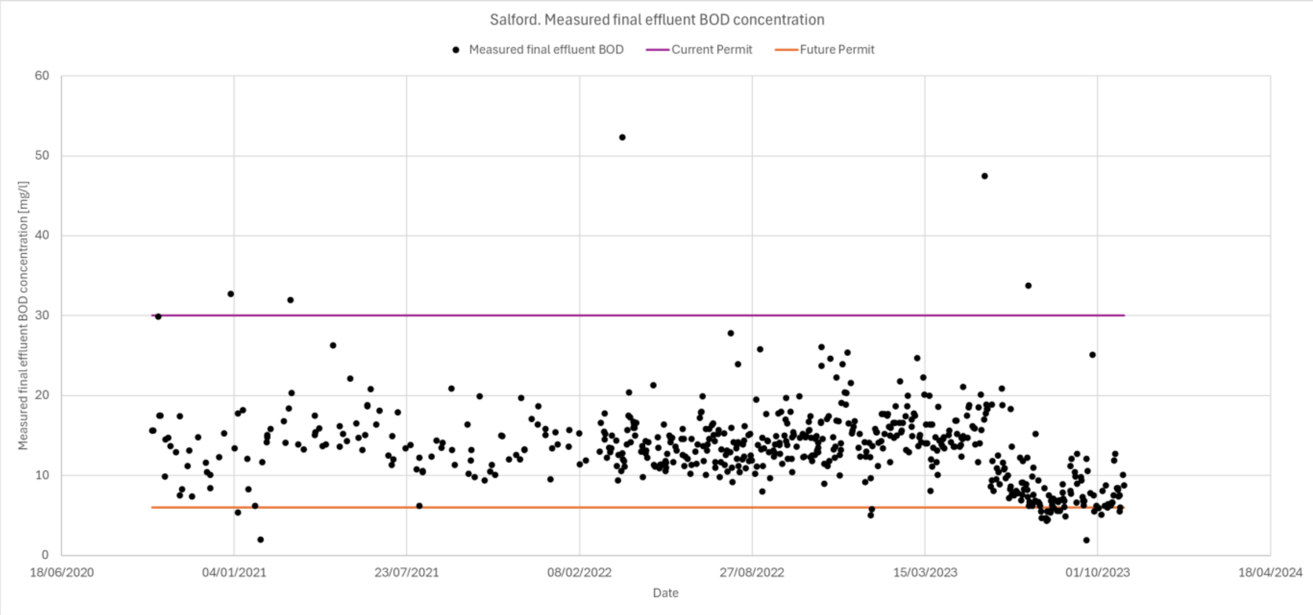
Trickling filters designed for maximum BOD removal capability will be sized for both BOD and ammonia removal. The effluent quality that can be achieved is 10 mg/l BOD and 3 mg/l ammonia (Metcalf and Eddy 2002, Table 9-5, p. 909). Consequently, the industry view on designing trickling filter performance for a technically achievable limit of 6 mg/l BOD is not possible.

BOD Performance at Salford WwTW

The conclusion drawn from the technical theory of the treatment capability of trickling filters is that they are unable to achieve 6mg/l BOD performance. To validate the theory, we also reviewed the performance data of the assets at Salford to identify any opportunities to retain them in our solution for the AMP8 WINEP drivers.

Figure 3 shows all the final effluent data for Salford and demonstrates that it consistently meets the current 30mg/l BOD permit, but it is not capable of achieving the 6mg/l BOD driver, indicated by the red horizontal line. Recent improvements in performance are associated with operational interventions to meet the current permit conditions as a result of the population growth in the catchment.

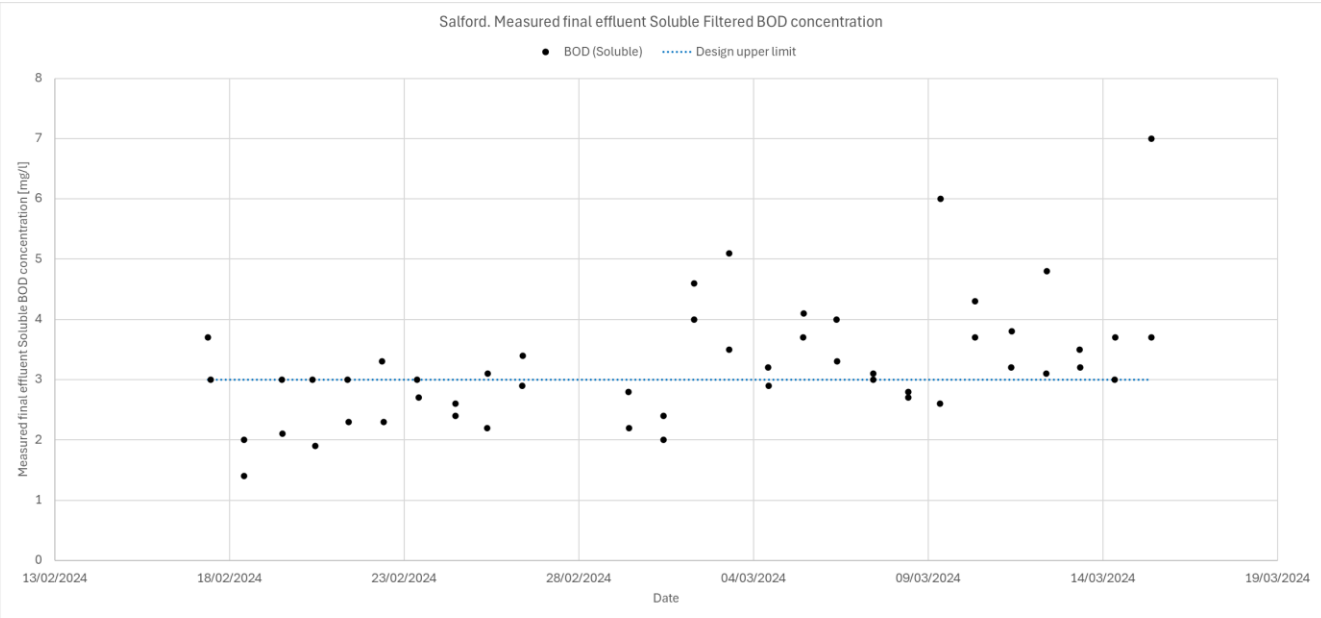
Figure 3: Salford WwTW BOD performance



Source: UUW analysis of sample data 1/10/20 to 31/10/23

Building on this analysis, Figure 4 shows the soluble filtered BOD indicates that even if particulate BOD was removed effectively by tertiary solids removal the filtered soluble BOD (which cannot be treated in a tertiary bolt-on process) would be consistently higher than 6mg/l.

Figure 4: Salford WwTW – Soluble filtered BOD



Source: UUW analysis of sample data 17/2/24 to 15/3/24

This demonstrates that the existing trickling filter process is not capable of meeting the stringent future BOD driver and cannot be enhanced any further.

1mg/l Ammonia driver– a challenge for the existing assets

Meeting a stringent 1mg/l ammonia permit with trickling filters poses significant challenges:

- **Biological nitrification inefficiency**: trickling filters primarily focus on organic carbon removal and can nitrify ammonia to nitrate under certain conditions. However, they often lack the consistent nitrification efficiency needed to achieve ammonia levels as low as 1mg/l, especially under varying loading conditions
- **Temperature sensitivity**: biological nitrification in trickling filters is highly temperature dependent. At lower temperatures, the activity of nitrifying bacteria diminishes, making it difficult to maintain low ammonia concentrations year-round
- **Hydraulic Loading Rates**: High hydraulic loading rates can lead to insufficient contact time between the wastewater and the biofilm, reducing nitrification efficiency. Trickling filters may struggle to balance high hydraulic loads with the need for thorough nitrification.

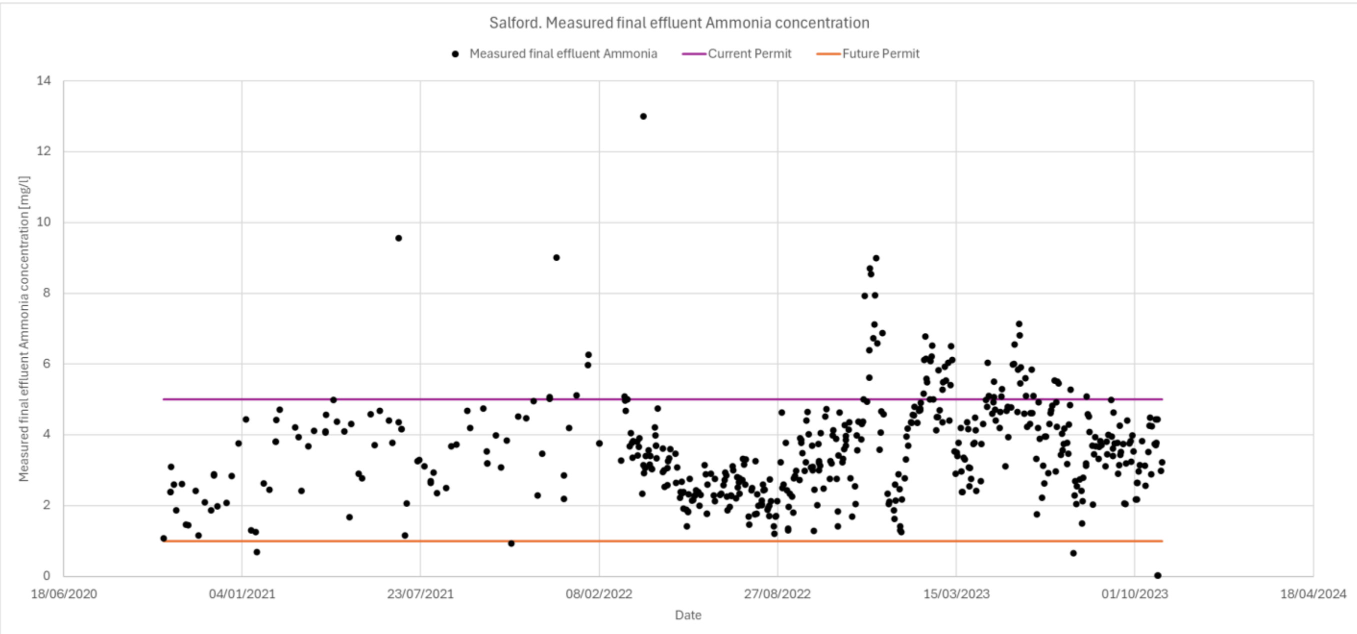
As stated previously, trickling filters are designed for maximum BOD removal capability and can be sized for both BOD and ammonia removal. The effluent quality that can be robustly achieved is 10 mg/l BOD and 3 mg/l ammonia (Metcalf and Eddy, Table 9-5, p. 909).

It is possible to install tertiary treatment downstream of trickling filters to achieve more stringent ammonia drivers. Our view for Salford was that an add-on tertiary ammonia solution would only achieve the ammonia driver only, and therefore does not represent the best value solution at Salford.

Ammonia Performance at Salford WwTW
As with the BOD driver, the conclusion drawn from the technical theory of the treatment capability of trickling filters is that they are also unable to achieve 1mg/l ammonia performance. However, we again reviewed the performance data of the assets at Salford to identify any opportunities to retain them in our solution for the AMP8 WINEP drivers.

As shown in Figure 5 the recent ammonia performance at Salford would not achieve the future driver of 1mg/l with the existing trickling filters. The growth in population experienced in recent years has challenged the limits of the process at Salford and operational interventions have been necessary to ensure performance meets the existing permit requirements, and we continue to liaise with the EA on this challenge.

Figure 5: Salford WwTW – Ammonia performance



Source: UUW analysis of sample data 8/10/20 to 31/10/23

As described, the current ammonia permit of 5mg/l is a challenge for Salford, due to the population growth experienced in the catchment pushing the treatment process beyond its design limits. A separate side-stream to treat the excess flow and load due to the population growth would only address that portion of the incoming flow, with the existing process still not able to achieve the future AMP8 drivers. This approach was therefore not pursued as more robust integrated solutions could be explored.

Other drivers

In addition to the stringent WINEP drivers for BOD and ammonia, Salford also has monitoring requirements for Cypermethrin, Nonylphenol, Cadmium and an operating technique agreement (OTA) to achieve a PFOS limit of 0.0140523ug/l on a 95%ile basis. We anticipate that the monitoring for Cypermethrin and Nonylphenol will lead to future permits for these determinands, which would also require an activated sludge-based process. Therefore, our solution for the AMP8 drivers is adaptive to ensure that there are no abortive costs to address any future chemical drivers.

3.3 Creating a sustainable adaptive plan which represents best value for customers

We have demonstrated above, based on technical theory and on performance data from the existing assets at Salford, that the new AMP8 WINEP drivers of 6mg/l BOD and 1mg/l ammonia, are not possible to achieve with the existing secondary treatment trickling filters. We have also discussed that a new bolt-on tertiary nitrification process downstream of the trickling filters would only achieve the 1mg/l ammonia driver and not the BOD driver.

In addition to the WINEP drivers, there is a predicted 28% increase in population equivalent within the Salford catchment by the design horizon of 2050. This growth is not possible to accommodate through existing assets.

We therefore concluded that our best value option to meet the AMP8 WINEP drivers at Salford was to replace the existing trickling filters with a modern activated sludge-based process, which will meet the drivers for BOD, ammonia and phosphorus, and will be designed for the 2050 design horizon. Activated sludge-based technology is the best available technique (BAT) for achieving the stringent drivers described above.

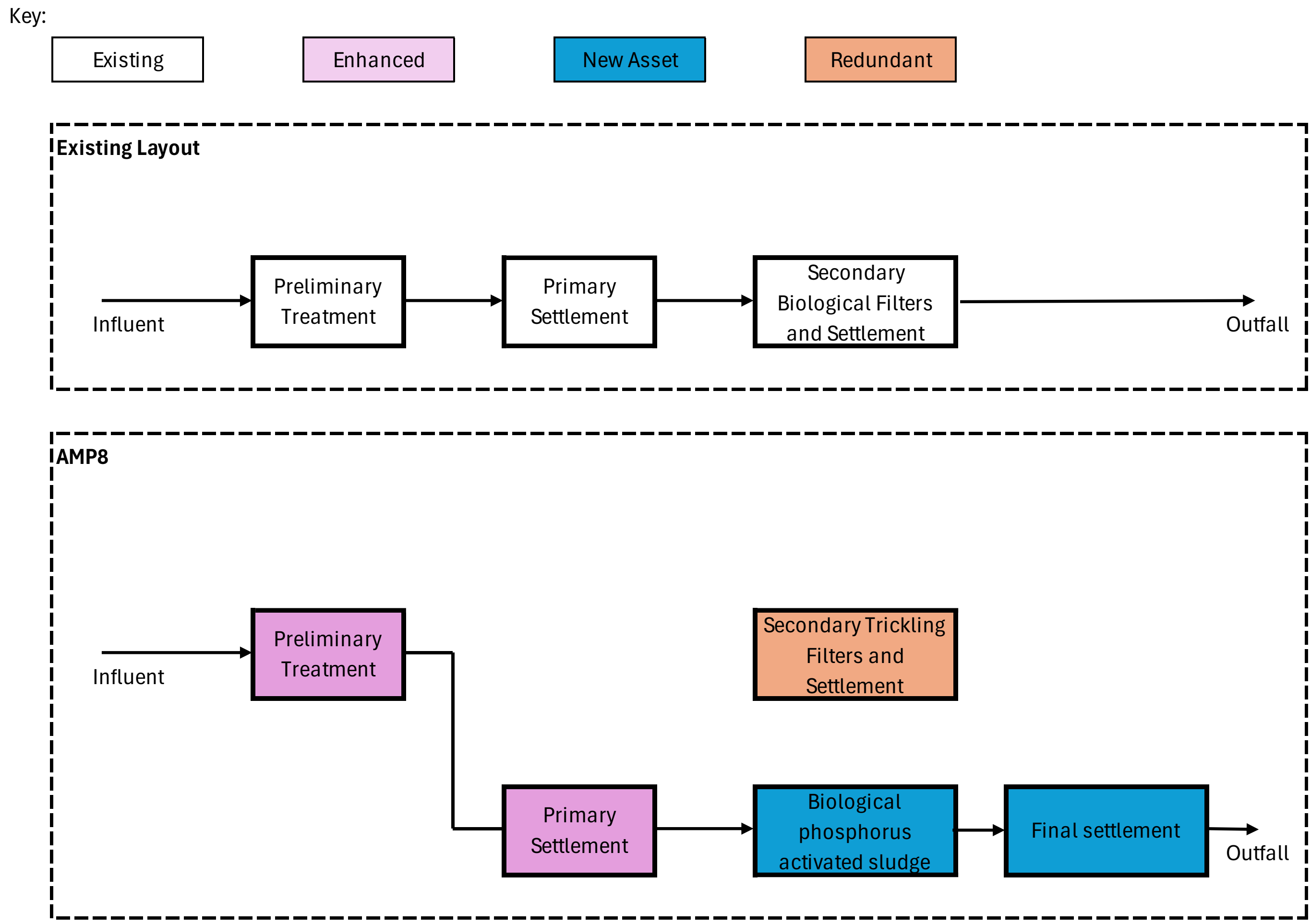
While we were developing the solution for Salford for submission of our Business Plan in October 2023, we knew that the site would have a future tightening of the phosphorus permit to 0.25mg/l from the Environment Act in AMP9 and we are working with the Environment Agency to align the phosphorus driver with BOD and ammonia in AMP8. As discussed in our representation for our phosphorus programme (*UUWR_33_P removal*), when a new suspended growth (e.g. ASP) secondary treatment process is part of the solution for sanitary drivers, the best value sustainable solution is to deliver biological phosphorus removal at the same time where there are phosphorus drivers.

There is an option to deliver a traditional ASP in AMP8 which delivers the BOD and ammonia drivers. To then follow up with an AMP9 retrofit intervention that upgrades the ASP to a biological P removal ASP. By testing this option through our adaptive plan, we are confident that this is not good use of customer money and defers environmental improvements. Site mobilisation for a significant scheme adds substantial costs to a project and we consider a retrofit to what would be a relatively new asset in this case is not good value for money.

Therefore, we have developed a preferred adaptive plan that will deliver biological phosphorus removal as part of the AMP8 solution in anticipation of the future driver, therefore ensuring no abortive investment for AMP9. We are working with the Environment Agency to bring forward the P driver to fully align to our adaptive plan.

The simplified process flow below shows the existing process stages and what is proposed for delivery in AMP8.

Figure 6: Process Flow Diagram showing existing treatment process stages and proposed AMP8 solution



Source: UUW analysis

4. Constructability challenges and influence on cost

Our review of the construction plan for the Salford WwTW solution identified a number of unique site-specific challenges which are extremely unlikely to be appropriately reflected within a benchmarking model. These unique site-specific constructability challenges have led to an impact on the total project cost for the scheme.

The footprint of Salford WwTW is sandwiched between a live railway line, the Manchester Ship Canal and industrial units. Investigations have identified a significant risk that the little land that is available on-site contains substantial contamination from legacy industrial use and unexploded ordnance. It will also need extensive dewatering and will require more complicated and specialist excavation techniques due to extensive groundwater infiltration. This results in onerous constructability requirements including the need to demolish redundant assets and deal with challenging ground conditions, both of which impact programme sequencing.

The largest impact on the construction cost is the cost of demolition and decommissioning of the existing trickling filters and the need to construct in challenging ground conditions. The table below outlines additional costs from the identified constructability challenges that are over and above the cost of new assets to meet the new requirements. We consider that these costs are those that are not reflected within Ofwat's DD allowance.

Table 3: Key site constructability challenges not reflected in Ofwat's benchmark

	Additional cost beyond Ofwat's assessment (£m)
Demolition & decommissioning of existing assets	41.1
Ground conditions (including piling and contaminated land)	35.8
New HV power supply / upgrade	12.7
Site access roads	2.8
Landscaping, reprofiling and ecology	3.6
Extended programme due to site constraints limiting concurrent working (12 months additional)	7.5
Total	**103.4**

Source: UU project data

4.1 Demolition

Given the limited space available for development at Salford, demolition of five of the existing trickling filters will be required to free up land for construction of some of the new assets which will incur significant cost. Demolition includes the need to remediate the existing trickling filter media, dispose and then demolish the remaining structure (scale of these filters is 154 metres by 87 metres) including all associated mechanical and electrical equipment. This will incur significant additional costs due to the need to keep the site operational and compliant while this work is carried out within a limited site footprint. We consider this is represents activity that is atypical for a sanitary parameters scheme and as such, the associated costs are not reflected within Ofwat's benchmark

Figure 7: Salford WwTW existing plan with new solution overlayed

Source: UUW analysis with Google Maps

4.2 Ground conditions

The only undeveloped land available for use on site is an area which is confirmed to have contamination. Recent boreholes and ground sampling works (2024) have identified industrial waste and the presence of hydrocarbon contamination, which is highly toxic and requires specialist techniques to remove.

The ground has low load-bearing capacity and therefore piling will be required for all new structures in this area. Driven piles will not be suitable due to the risk to a deep aquifer running under the site, instead more costly non-driven piling methods will be required. The area is also uneven with steep slopes to the north and west and will require significant reprofiling including the construction of a retaining wall to prepare the site for construction.

The site lies within a high-risk area for unexploded ordnance requiring a watching brief and advanced probing of the area prior to and during excavation and piling activities which will add time to the delivery schedule and impact cost.

High groundwater levels are present due to the proximity to the Manchester Ship Canal and a historic watercourse that flowed through the southwestern part of the site. As a result, extensive dewatering activity will be required during construction activities near to the existing filter beds. More expensive excavation techniques will also be required. These factors combine to create a particularly challenging mix of site-specific ground conditions, where the effect of each compounds the effect of the others. We do not consider that this will be reflected within Ofwat's benchmark.

4.3 Land and planning constraints

Land purchase for the proposed works extension is not possible because of the constrained nature of the Salford site. This means that there is no option other than utilising the land known to be contaminated. Additionally, there is insufficient on-site land available for a site compound and welfare facilities, meaning land/property close to the site will need to be leased for a working compound.

The existing power supply at Salford WwTW is insufficient to meet the demands of the new assets. The site's current Authorised Supply Capacity is 690kVA and the power demand of the new assets proposed is expected to be circa 6,200kVA, which is an almost ten-fold increase. This will require a major power upgrade, including supply enhancement by the Distribution Network Operator (DNO) to support the process improvement solution.

Ecology surveys undertaken for the project have identified several environmental and ecological challenges. Specifically, the historic tip area to the west of the site is currently a wooded scrubland with nesting birds and a potential bat habitat. The area also has widespread presence of Japanese Knotweed, an invasive species that will require significant additional measures to contain and treat the invasive species by licenced specialists to prevent it spreading. A pond is located within the proposed construction footprint with the risk for Great Crested Newt habitation.

4.4 Programme sequencing

The works will have to be constructed in two phases; phase one on the contaminated land area which, once commissioned, will provide sufficient process capacity to release an element of the exiting tricking filter beds for construction. This approach significantly extends the overall programme. Limited space for storage of materials and the single-track limited access routes across site present a logistical challenge and added cost. Temporary works to widen some of the site access roads will be needed as part of the enabling works along with the import of large quantities of hardcore material for piling mats and temporary access road improvements.

The new final effluent pipe across site will require use of easement powers to construct within the boundary of the adjacent railway. It will also require temporary decommissioning of the sludge transfer rising main between Salford and Eccles which will incur additional tankering costs and require complex coordination of sludge tanker movements in and out of site to maintain operations during this period.

4.5 Surrounding Built Environment

The site is a constrained by the existing industrial park adjacent to the site boundary on the North and Eastern sides. There is a live railway line to the West and the Manchester Ship Canal to the South. Access to the site is a single road through the industrial park, there is very limited access across the site with narrow single-track roads between existing process units. These will need to be widened and reinforced – the close presence of live assets and neighbouring businesses significantly increases the costs beyond that expected in a typical scheme.

5. Challenging our own costs

Following the development of the solutions to meet the original drivers we internally challenged ourselves, to ensure we were submitting efficient solutions. In the case of Salford efficiencies were adopted, including removal of the tertiary solids removal process (which had been included to ensure robust delivery of the 6mg/l BOD driver), rationalisation of sludge handling equipment and refurbishment of the existing primary settlement tanks instead of replacement.

This challenge generated a significant efficiency for the Salford scheme, which was removed from our submitted costs in our business plan. Since submission we have continued to validate and refine the scheme, which is described in the following section.

5.1 Work undertaken since submission

As part of the development of the scope and cost for the Salford scheme we have carried out a methodological approach to estimating and assurance. A summary of our approach is as follows: -

Cost Estimating
To develop robust and efficient costs we have used an estimating approach based on data collected over several AMPs (AMP3 to AMP7) updated to reflect present market conditions under which we and the UK water industry are operating. We have partnered with Mott Macdonald who provide us and other UK water and sewerage companies with an estimating service, which allows them to provide a benchmarked approach to our PR24 capital cost estimates.

Our Investment Programme Estimating System (referred to as the PR24 Estimating Database / IPES) is an in-house estimating tool which is used to provide costs for the Price Review and scheme development. The system is a robust repository for data from previous AMP periods, which sits along-side estimated data, to allow us to develop project and programme estimating.

Cost Assurance
Mott MacDonald has provided us a specialist estimating function utilising costing data derived from our construction data which supports our scheme estimates. Post business plan submission, to give us additional confidence that our cost estimates produced by Mott MacDonald were accurate, we undertook a self-assurance exercise by appointing ChandlerKBS. We asked ChandlerKBS to price up a selection of our projects using their Cost Intelligence database (CID). ChandlerKBS are an international commercial company who have provided estimating services to a number of UK infrastructure businesses, including a number of water companies. Their CID contains data derived from their clients over 20 years including tens of thousands of cost curves and capital projects.

The outcome of this review was that an overall variance of 3% against the Mott MacDonald estimate shows a close level of correlation and gives us confidence in the costs we have developed for our schemes. This was backed up by the output report: "The overall ChandlerKBS estimate total for the fourteen projects is 3% lower than the UU PR24 estimates. ChandlerKBS consider the UU PR24 estimates to be comparable with our industry cost data" (ChandlerKBS 2024).

We consider that the estimate which has been developed bottom up is robust, and we have tested this with third party input. The scheme for Salford has many site-specific challenges and the solution is a biological P removal plant, which we observe is an intervention that is not specifically assessed through econometric models. For these factors we propose a separate cost assessment approach, beyond a model assessment.

Following our business plan submission in October 2023, we have continued to develop the Salford solution through our Transitional Investment funding. We appointed Jacobs as our Strategic Solution partner in February 2024. Since then, we have continued to work with their global experts to develop the adaptive plan for a new suspended growth (ASP) secondary treatment process solution capable of delivering biological phosphorus removal, therefore ensuring no abortive investment for AMP9. Through early engagement with our Enterprise construction delivery partners, we have reviewed and refined the construction phasing and sequencing plan to avoid the need for temporary treatment which would add significant cost and challenge the programme delivery. We have also continued to develop the scope of work to upgrade the existing primary settlement tanks to secure the lowest cost solution.

6. Conclusion

The WINEP drivers for Salford WwTW are not achievable with the existing treatment process on site as described in section 4. Therefore, replacement with a new treatment process is required. We have followed our adaptive plan to develop the solution in a way that is designed specifically to meet these stringent quality drivers in AMP8, as well as being aware of future drivers to avoid abortive cost.

We consider that the evidence presented within this representation demonstrates that we have chosen the right technical solution for Salford and that we have optimised a solution that considers the constructability of the solution and that our estimating and optioneering process has confirmed this as the best value solution.

As described in section 5 there are significant constructability issues that through our bottom-up solution development have been confirmed and itemised for the Salford scheme. Notably the presence of contaminated land, the high-risk of unexploded ordnance, site boundary constraints that lead to construction sequencing add significant cost to the scheme. But we have explored these and understand the impact on the cost and delivery of this scheme ahead of project initiation.

As such, we are confident that the site-specific requirements mean the cost to deliver this scheme, which we have estimated to be £255million, is in excess of the Ofwat's assumed cost of £151million. Figures are post-frontier shift and RPE.

Our DD representation requests that Ofwat recognises our business plan costs for £255m in full.