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Exmouth Shellfish No Deterioration SW_ND AMP7 Projects

South West Water Technical Report June 2022

Affecting WINEP Deliverables:

Phear Park SPST_PSCSOEO_Exmouth (WINEP ID 7SW200871)

Maer Rd SPS_CSO_Exmouth (WINEP ID 7SW200711)

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EXECUTIVE SUMMARY

The Water Industry National Environment Programme (WINEP) output for this scheme is to deliver no more than 10 significant (>50m3) spills per annum from the aggregation of Maer Road Sewage Pumping Station (SPS) Combined Sewer Overflow (CSO) and Phear Park SPS CSO. This technical report accompanies the letter sent to the Environment Agency on 3rd May 2022 providing background and technical details of the key project development activities and the proposed strategy in support of the request for compliance date extension from 30th September 2022 to 31st December 2023.

Over the past 4 years we have developed a catchment strategy for Exmouth by exploring an extensive range of options particularly considering the use of sustainable, low-carbon approaches to urban drainage challenges. Following the evaluation of options, we have established that the limiting factor in the catchment is the treatment works capacity and any other catchment measures, such as surface water separation, non-foul flow removal and storage, are either insufficient in terms of reducing storm discharges or are impractical and constrained by treatment capacity. Our conclusion from this evaluation of options was that the fundamental constraint of maximum treatment capacity needed to be addressed in order to realise any significant reduction in storm discharges at the two overflows.

The most appropriate solution to meet the WINEP objectives is to increase pumped flow to the STW in conjunction with additional in-catchment measures. This will temporarily increase storm discharge volumes at the STW (Sewage Treatment Works) SSO (Settled Storm Overflow), until treatment capacity can be upgraded in a subsequent project. As a result of this increase a hydrodynamic coastal model has been built and calibrated using survey data collected by boat to establish whether the increased volume of discharge would have any detrimental impact on adjacent bathing waters. This work has demonstrated that no or negligible impact at designated waters (pre-May 2022) will be caused by the increased SSO discharge volumes and consequently there is no water quality need for additional stormwater treatment or disinfection at the STW SSO.

In 2020 it became evident that the preferred option required more flow to be discharged through the sewage treatment works (STW) Straight Point outfall and this has led to an extensive review of hydraulic capacity by building and analysing hydraulic models under varying flow conditions, undertaking offshore diver surveys on the outfall diffusers and completing CCTV investigations of the outfall tunnel and pipeline whilst causing minimal disruption to Sandy Bay holiday park during the tourist season.

Our presentation to the EA in September 2021 communicated some key messages including that the discovery that the theoretical capacity of the outfall had been reduced by some serviceability issue along the length of the pipe, primarily due to a section of sunken pipeline under the MOD rifle range earth bunding. The preferred and most appropriate long term solution is to replace the outfall from Sandy Bay car park out to sea.

This issue was introduced during the Sept 2021 presentation which referenced the potential that disinfection was unlikely to be necessary. The replacement of the outfall will facilitate the long-term solution for increased capacity at the STW, whilst having additional benefits including reducing the risk of pollution of Sandy Bay beach from the storm / emergency overflow at Sandy Bay pumping station, which could be redirected into the larger capacity outfall. Enhancement of treatment capacity will also generate headroom for development and provide an opportunity to consider a process change away from a biobead BAFF plant to an alternative.

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The coastal model was used to briefly assess the shellfish harvesting area off Sandy Bay, which was designated in May 2022, after our analysis. This has indicated that even the current final effluent discharge from the outfall would not meet the required Shellfish waters environmental quality design standards, which would lead to a WINEP improvement scheme in a future AMP. This scheme may involve extending the outfall rather than provide less sustainable and high carbon UV disinfection of storm flows. The coastal modelling is being expanded to assess the Sandy Bay shellfish area, in order to inform PR24 of improvements which could be carried out in AMP8. There may be an opportunity to extend the outfall early either through advancing spend into AMP7 or having an early view for AMP8.

Ancillary catchment works have continued to be progressed in support of the wider strategic solution;

- Surface Water Separation works at Seymour Road and Denning Court have been approved and are progressing with permissions and notices.
- Infiltration reduction works are ongoing within the catchment to reduce non-foul flows.
- Pumping Station upgrade works in preparation for increased passed forward flow have been approved and Phear Park will be delivered by the current compliance date.
- Rising main upgrade works for Maer Road pumping station are going for SWW budget approval in July 2022.
- STW outfall replacement is going for SWW budget approval in Sept 2022.

In summary the proposed strategy affords the following additional advantages, over simply meeting the WINEP storm discharge requirements alone.

- Facilitation of the longer-term strategy that considers the newly designated shellfish area at Sandy Bay in advance of an AMP8 investigation and subsequent AMP9 improvement action (if required).
- Potentially enables any improvement actions as a result of the new designation to be completed in either AMP7 or 8 (depending upon outfall extension) rather than AMP9.
- Significantly reduces pollution risk associated with inundation of the Sandy Bay pumping station along with reducing risk of rising main bursts from Maer Rd pumping station.
- Risk of micro-plastic release reduced in the long-term by potential replacement of the current treatment process at Maer Lane STW.

The outfall replacement requires substantial ground investigations to plan the directional drill and an MMO licence which is expected to take 8 months to agree. The directional drill is planned to start in February 2023, outside of the holiday park's season, but toward the end of the winter in order to be able to pull through the pipe during more favourable weather and sea states in April 2023. This will be followed by diffuser installation and pipe connections envisaged to be completed by June 2023. There has been an allowance on the end of this in case of complications including adverse weather / coastal conditions. Hence the request for the compliance date to be moved to December 2023.

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1 Objective / Purpose

The Water Industry National Environment Programme (WINEP) output for this scheme is to deliver no more than 10 significant (>50m3) spills per annum from the aggregation[1] of Maer Road Sewage Pumping Station (SPS) Combined Sewer Overflow (CSO) and Phear Park SPS CSO, subsequently referred to as "10 spills".

Unique ID	Scheme Name/Name of Investigation/Site Name/Licence name	Driver Code (Primary)	Current Completion Date (according to AGREED changes)	Abstraction Licence/ Permit, Obstruction ID or No Obstruction ID	Implementation Scope
7SW200711	Maer Rd SPS_CSO_Exmouth	SW_ND	30/09/2022	200125/CS/01	No more than 10 spills per annum shall be > 50m3 (aggregated for Maer Rd SPS CSO/EO, Phear Park SPST CSO/EO). A spill is as defined by EA guidance. Has benefit to the Outer Exe shellfish water as well as Exe Estuary. Must comply with EA pumping station emergency overflow policy requirements.
7SW200871	Phear Park SPST_PSCSOEO_Exmouth	SW_ND	30/09/2022	200124/PC/01	

Table 1: WINEP Extract

This technical report accompanies the letter sent to the EA on 3rd May 2022 to request a compliance date extension to Dec 2023. It is intended to provide background and technical details describing the project development and proposed strategy, in support of the request for compliance date extension from 30th September 2022 to 31st December 2023.

The report describes the work chronologically with more detailed sections on the outfall proposals and the coastal modelling. A timeline is available in Appendix D.

2 Previous Compliance Extension

2.1 SWW Request to EA 2018

In August 2018, a letter was sent to EA requesting an extension to the original June 2021 compliance date. This letter explained the technical infeasibility of delivering the PR19 storage solution and outlined 3 options for progressing the solution;

> Option 1 – Deliver PR19 storage solution irrespective of technical feasibility (and hence compliance with outputs). Construction start Sept 2020, proposed completion Sept 2021.

[1] https://www.gov.uk/government/publications/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows#counting-spills
Aggregation is to combine spills from each overflow which happen at the same time and count as one spill. Hence 10 aggregated spills will produce <10 spills at each overflow individually.

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Option 2 – Reduced Local Impact / Catchment Holistic Scenario. Construction start Sept 2020, proposed completion December 2021.

Option 3 – Stormwater Treatment alongside sustainable drainage solutions. Assuming the modelling data was favourable; construction start June 2021, completion Sept 2022.

This latter option was proposed but was dependent on the "*development of operable, maintainable, sustainable and environmentally beneficial solutions for the two assets which may be most appropriately achieved by stormwater treatment*". It was also written considering non-UV treatment, e.g. PFA (Performic Acid) dosing or other innovative methods.

2.2 EA Response 2018

EA reply dated 7th November 2018, agreed the extended compliance date of Sept 2022. The letter also states; "*as part of the mitigation, it is expected that the enhanced treatment (i.e. UV disinfection of the CSO discharges) will be completed by April 2022*". This was considered to be an aspiration, rather than a delivery requirement, to be developed through discussion with the EA and DEFRA, if the option were deemed feasible.

2.3 Temporary Disinfection of Catchment Overflows

The ultimate preferred solution achieves the "10 spills" output and hence UV disinfection is not required. Installing UV disinfection on a catchment overflow is physically extremely difficult and would involve an underground UV channel and associated above ground plant, standby generation and increased power supply. This is a larger footprint than a storm tank and is difficult to fit into the residential / park areas available. Hence installing UV as a temporary mitigation has a large abortive cost and a large carbon footprint. It is therefore not considered pragmatic or sustainable. Temporary disinfection has not been discussed at any EA liaison meetings detailed in section 8.2.

The preferred solution detailed below creates a temporary situation at the end of AMP7 delivery whereby more storm volume is discharged at the STW SSO off Straight Point. It was thought that this would need temporary disinfection, but detailed coastal modelling has shown that there is no detriment to existing designated Bathing or Shellfish Waters. The details are provided within this report.

[The temporary disinfection of the STW SSO has been discussed at EA liaison meetings, in particular the potential for Performic Acid (PFA) dosing. These meetings included technical specialists and the EA WQ Senior Advisor, leading governance on Shellfish Waters. The outcome was that EA / DEFRA would only consider PFA dosing if it could be achieved within a blind tank. Designs were considered for such equipment, but it appeared infeasible. This discussion is now superseded as the outcome from the coastal modelling is favourable].

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2.4 Suggested Programme

The suggested high-level programme in the 2018 SWW letter for Option 3 is provided in Figure 1. This shows concept design completion in February 2021 and Delivery starting in June 2021 at the same time as detailed design commences.

As Option 3 (Stormwater Treatment) was being developed, the more sustainable and environmentally beneficial long-term strategy emerged which promotes treating more flow at Maer Lane STW. Therefore, rather than installing UV treatment on the Maer Road and Phear Park overflows the option to pump to and treat more at the STW became the preferred option, as detailed below. This then deviated from the high-level Option 3 programme presented in the August 2018 letter. The EA have been informed of progress at a number of meetings detailed in section 8.

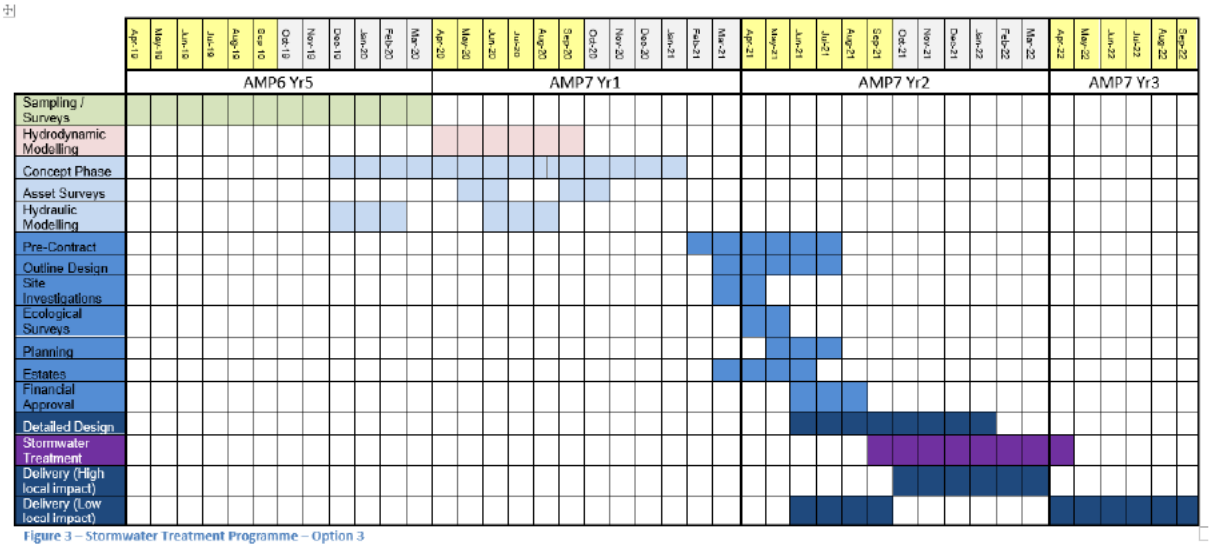

Figure 3 – Stormwater Treatment Programme – Option 3

Figure 1 – 2018 Suggested Original Programme for Stormwater Treatment (if feasible)

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3 Solution Development

The PR19 solution was based on the existing verified hydraulic model and consisted of additional storage at both Maer Road and Phear Park SPSs, as follows;

	Current Storage m^3	PR19 Additional Storage m^3
Maer Road SPS	430	8400
Phear Park SPS	1470	4725
Maer Lane STW	7000	0
TOTAL	**8900**	**13125**

Table 2 – Current and PR19 Storage Volumes

Note that the storage at the STW is used by pumping circa 650 l/s from Maer Road SPS and once the STW tanks are full the pump rate is ramped back to 109 l/s, thereby forcing the use of the Maer Road outfall as a point of storm discharge.

Further solution development was undertaken aimed to deliver the most sustainable and cost-effective solutions first, as follows;

1. Optimise use of existing assets
2. Remove non-foul flows from combined sewer network
3. Increase PFF
4. Attenuation storage solutions

3.1 Hydraulic Model Re-Calibration

Focus on the hydraulic model started in June 2019 which identified that the hydraulic model had been verified using a summer flow survey (for bathing water purposes). Models traditionally have been verified using CIWEM Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, however, this does not pick up variations in catchment behaviour in periods outside of the flow survey and hence the predicted annual spills were much less than the EDM data indicated.

Analysis of STW flow data indicated that the winter months needed 167% of the infiltration applied in the summer. The model was tagged as having low confidence in predictions at four overflows including Maer Road PSCSO and Phear Park PSCSO. This triggered work to better calibrate the model using SCADA data and EDM data. Long term flow monitors were deployed in the catchment and data from October 2019 to December 2019 was used to calibrate the slow response flows in the model.

The model was also updated with up-to-date information of effects of climate change on rainfall intensity. The increase in winter slow-response meant that the notional storage solutions developed for PR19 were not feasible because the storage volumes required would not drain down between winter storm events and consequently will not achieve the required “10 spills” output.

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3.2 Infiltration reduction

The obvious solution would be to remove the additional winter infiltration added into the model, via sewer rehabilitation, and build the PR19 sized tanks. The catchment was further examined via 'lift and look' surveys and CCTV but there were no areas of concentrated infiltration. The team had low confidence that full removal of the additional infiltration would be possible and hence achieving the required "10 spills" output would be significantly at risk.

However, infiltration reduction has been included as part of the preferred solution in order to reduce spill volumes, in addition to pumping and treatment costs. The target is to reduce the infiltration upstream of Phear Park by 50% of the additional infiltration added into the model which equates to approximately 16 l/s peak flow as observed the day after rainfall.

The Detectronic monitors that were installed to re-calibrate the hydraulic model were moved around to pinpoint infiltration. Lift and Look surveys and an initial CCTV survey started in January 2020 and has been progressing during appropriate weather conditions. Rehabilitation is programmed for Autumn 2022 in order to benefit the 2022/23 winter, with further CCTV and Phase 2 rehab programmed to be complete by Spring 2023.

3.3 Surface Water Separation

Surface Water Separation (SWS) in the catchment looked predominantly at road areas connected to the combined sewer upstream of both pumping stations. These areas are summarised in Appendix A and total 16.5 ha. The model was run removing all of these areas and the spills reduced as follows;

	Current (modelled)		Total SWS (16.5 ha) Predicted	
	Number of Spills per annum >50m3	Spill Volume (m^3)	Number of Spills per annum >50m3	Spill Volume (m^3)
Maer Road PS CSO	40.5	204,376	34.8	175,691
Phear Park PS CSO	22.5	70,072	21.0	65,249

Table 3 – Modelled Spill Statistics, Current and with 16.5 ha SWS

The work to separate each area was considered at very high level and a cost estimate based on pipe length was assigned to each area. The total cost was £8.5M (although based on design development of some of these areas, the costs should be somewhat increased to represent a delivery cost). Achieving more than 16.5 ha was therefore considered infeasible as a solution to achieve the "10 spills" output on its own.

However, the sites costing <£500k per ha were examined in more detail to form part of the preferred solution, recognising the long term sustainability benefits, including reduction in spill volume. Two areas have been promoted; Seymour Road (including Featherbed Lane / Road) and Denning Court. After further development these areas will reduce impermeable area connected to the combined sewer by approximately 1.67 ha. The very high level concepts for both areas have been developed by the Delivery Team. After surveys and

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outline design completion, Denning Court could not connect to the watercourse under the DCC bridge due to the condition of the bridge and hence the design has extended the surface water sewers further downstream. This also requires an EA EPR Permit for connecting the surface water to the watercourse.

Seymour Avenue requires multiple sequential road closures to be discussed with Devon County Highways. Both are programmed to start in October 2022 as shown in Figure 9 toward the end of this report.

3.4 Increased Pass Forward Flow

Exmouth has large amount of pre 1960s properties which discharge combined flows to the sewers. At the time there would have been crude outfalls and connecting surface water would be of benefit.

The issue within the Exmouth catchment is the relatively low permitted pass forward flow (PFF) at the terminal pumping stations and relatively low permitted Full Flow to Treatment (FFT) at the STW, compared to the population and the amount of property level impermeable area connected to the system.

For 2025 populations with an estimated infiltration rate, theoretical 3DWF is approximately 337 l/s, and the STW permitted FFT is only 273 l/s (81%). With dry weather flows generally peaking at 2DWF, even a small amount of rain can cause catchment storm storage to be engaged.

As property level SWS is extremely disruptive and invariably resisted by customers, expensive and very time-consuming, the only solution to reduce spills in the catchment is to increase the pass forward flow at the terminal pumping stations and ultimately increase the FFT at the STW. Hence the modelling moved on to this solution keeping parts of the SWS and infiltration reduction to promote sustainable improvements within the catchment and reduce overall spill volume.

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4 Preferred Strategy – AMP7 Interventions

4.1 Scope Summary

With the benefit of surveys, detailed scoping and buildability reviews the implications and constraints of the general PFF increase are now better understood. The preferred strategy involves increasing pumped flow from Maer Road and Phear Park SPSs to the STW. This fills the storm tanks at the STW, as is currently the situation, only filling them a little faster. However, the pumps at Maer Road SPS are no longer ramped back to 109 l/s when the STW tanks are full and they continue to deliver storm flows to the STW. The storm tanks at the STW then spill through the STW settled storm overflow (SSO) which discharges with the treated final effluent through the long sea outfall off Straight Point.

The scope of the AMP7 intervention consists of the following elements of work;

Project Element	Details	Current Cost Estimate £k
Infiltration removal upstream of Phear Park	Targeting 16 l/s as measured a day after rainfall	£253k
SWS at Denning Court	0.6 ha	£216k
SWS at Seymour Road	1.07 ha	£732k
Increase Phear Park pump rate	From 120 l/s to 200 l/s	£3,372k
Increase Maer Road pump rate	From 600 / 109 l/s to 700 l/s even when STW tanks are full	Inc above
Maer Road Rising Main Replacement	375m length towards STW which has historically failed	£1,400k
Increase STW Outfall Capacity	Short dual pipe lengths plus directional drill to sea	£6,500k
Scoping and Modelling	Consultant and internal resource to build solution	£323k
TOTAL		**£12,796k**

Table 4 – AMP7 Elements of Preferred Strategy being delivered

With more flow being pumped to the STW the Straight Point outfall needs to be able to discharge the additional flow rates. The requirements of the outfall and proposed works are detailed in section 7.

The Phear Park and Maer Road rising mains will receive more flow than they have previously and for Maer Road this will be for a longer duration (as pumps are not ramped down when STW storm tanks are full). Pressure increases in the mains will be negligible. Previous bursts have been caused by pitting in the invert of the main where sand has abased the pipe. It is recognised that rising mains have been a significant source of pollutions in recent years and investment should be targeted proactively to reduce risk. Phear Park has largely already been refurbished or rerouted due to development and is considered low risk. The last 375m of the Maer Road main is where previous bursts have

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occurred and hence replacement of this section is included to avoid future pollution incidents.

The PR19 Final Determination was estimated at £12,413k[2] based on the PR19 solution of additional storage at Phear Park and Maer Road. Hence we are achieving the output at a similar cost but with the additional benefits associated with the preferred strategy, as summarised in section 9.

4.2 Overflow Performance

The scope above achieves the required AMP7 WINEP annual spill targets at Phear Park and Maer Road but increases spill volume at the STW SSO. The spills have effectively been moved from the outfalls affecting the Shellfish Waters to the long sea outfall remote from these.

	Baseline Model		AMP7 Post Shellfish Project		AMP8 Post STW Upgrade (FFT = 546 l/s)	
	Number of Spills per annum (12/24)	Annual Spill Volume (m^3)	Number of Spills per annum (12/24)	Annual Spill Volume (m^3)	Number of Spills per annum (12/24)	Annual Spill Volume (m^3)
Maer Road PS CSO	40.5	204,376	7.5	18,779	7.5	18,779
Phear Park PS CSO	22.5	70,072	7.5	17,831	7.5	17,831
Maer Lane STW SSO	44.5	89,778	39.5	333,822	7	38,511
Total Volume		**364,226**		**370,432**		**75,121**

Table 5 – Modelled Spill Statistics for Proposed Strategy

Normally an improvement scheme would not cause detriment at other overflows so the water quality impact of this has been assessed via coastal modelling and is presented in section 6. This work has demonstrated that no or negligible impact at designated waters (pre-May 2022) will be caused by the increased SSO discharge volumes and consequently there is no water quality need for additional stormwater treatment or disinfection at the STW SSO.

The end of AMP7 position is a temporary situation and future AMP8 improvements will create an overall more advantageous catchment.

[2] Inflating the 2019 price of £10,646k

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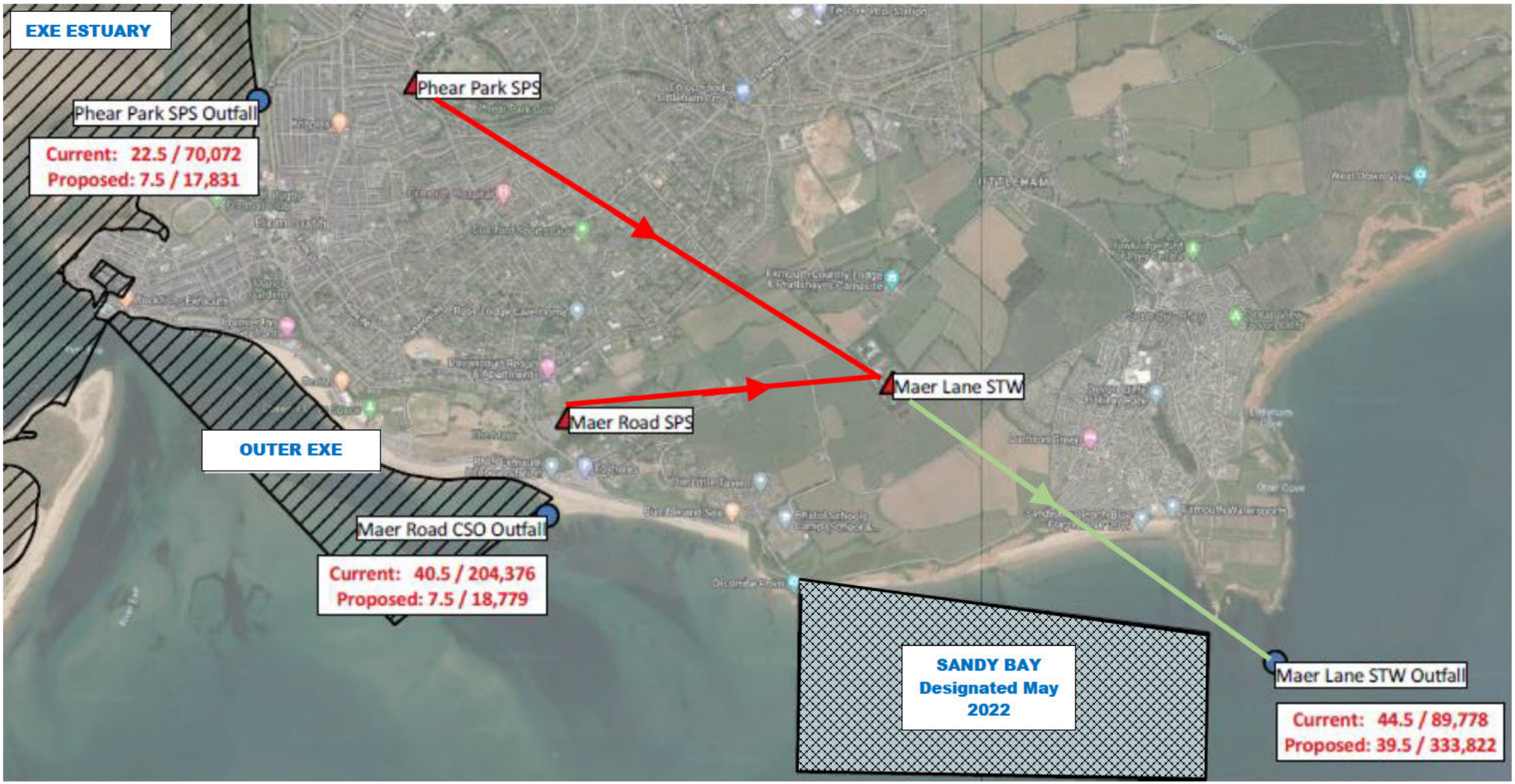

Figure 2 – Annual Predicted Spill Frequency / Volume from AMP7 Only Interventions

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5 Preferred Strategy - AMP8 Improvements

5.1 STW Upgrade

On the basis of the increased storm discharge volumes from the Straight Point outfall, the preferred long-term strategy also includes for increased FFT at the STW, approximately doubling the FFT from 273 to 546 l/s. The spill reduction predicted at the STW SSO can be seen above in Table 5.

The Team have looked in more detail and initially suggest that FFT might be ultimately increased to 800 l/s in order to provide 6DWF treatment at a design horizon of 2050. The scope of the AMP8 upgrade would be designed for approximately 546 l/s with additional primary and final settlement to be built at a later date. Treating more than 3DWF is particularly advantageous in catchments with historic surface water in flows in order to reduce storm overflow discharges.

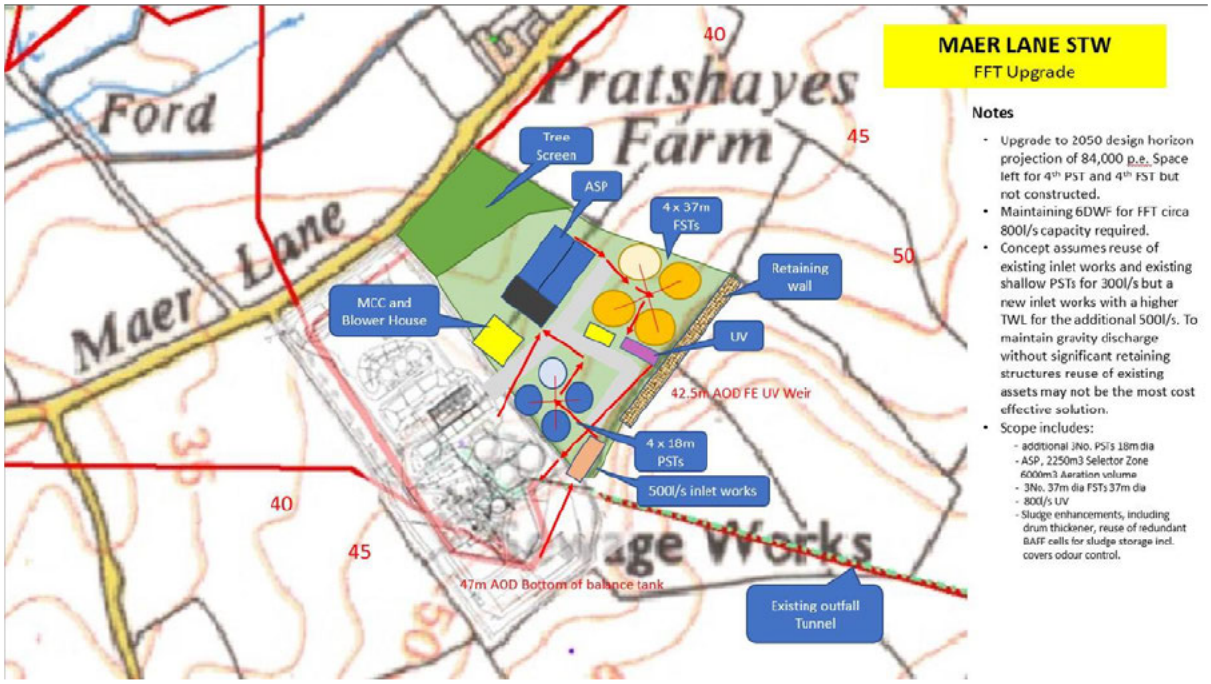

Figure 3 – STW Upgrade High Level Concept

Some elements of the existing STW process would be retained but the BAFF units and the final effluent UV would be decommissioned and replaced. The BAFF units currently require chemical dosing and they contain plastic media and a filter. In line with SWW's historic pledge to phase out all biobead plants at the end of their asset life, these BAFF units require replacement to reduce potential for the discharge of micro-plastics to the environment.

The cost has been estimated at circa £25M. It is proposed that this is included in PR24 and delivered in AMP8, possibly under a Shellfish SW_IMP1 driver, after the new designation of the Sandy Bay Shellfish beds. Normally after a new designation, there would be a Shellfish Water investigation in AMP8 followed by the improvement works in AMP9. However, the coastal modelling is currently being extended to examine the impact of the Straight Point outfall storm discharges on the Sandy Bay Shellfish Waters. This will allow an improvement to be included in PR24, thereby delivering the benefit an AMP early.

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5.2 Outfall Extension

The coastal modelling in section 6 predicts there is likely improvement needed due to the final effluent discharge from the Straight Point outfall. It is anticipated this can be achieved via an outfall extension. It is currently being assessed as to whether this can be delivered concurrently with the outfall works in AMP7, which depends on marginal cost. This would deliver the improvement two AMPs early.

5.3 Further Catchment Improvements

The other surface water separation areas are currently being considered whilst working alongside Devon County Council to address flood risk. There could be joint benefit in deliver of these improvements.

Under the Waterfit initiative Hartopp Road PS overflow is being considered for improvement within AMP7. This overflows discharges from the same outfall as Phear Park PS Overflow but was not included on the WINEP and spills on average 40 times per annum. A conceptual surface water separation scheme has been produced and this will be developed under Waterfit with the intention to deliver this AMP if costs allow.

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6 No Detriment and Coastal Modelling

The preferred strategy increases spill volume at the STW SSO until the STW can be upgraded in AMP8. The effect of this has been analysed to show no detriment at designated Waters (as defined prior to May 2022).

A Vessel Mounted Acoustic Doppler Current Profiler survey was carried out offshore which captured current profiles in off Straight Point and in the main estuary channel off the marina, over a full tidal cycle. The diffusers on the Straight Point outfall were scanned and mapped to add to previous information collected from diver surveys.

This information was used to construct a full MIKE21 coastal model of the Exe Estuary and surrounding coastline in order to evidence the benefits and potential deterioration arising from the preferred strategy's temporary discharge conditions. The full report is available in Appendix B. It should be noted that the spill frequencies vary slightly from those given above as the hydraulic model is continuously being improved with regard to infiltration with data from long term monitors.

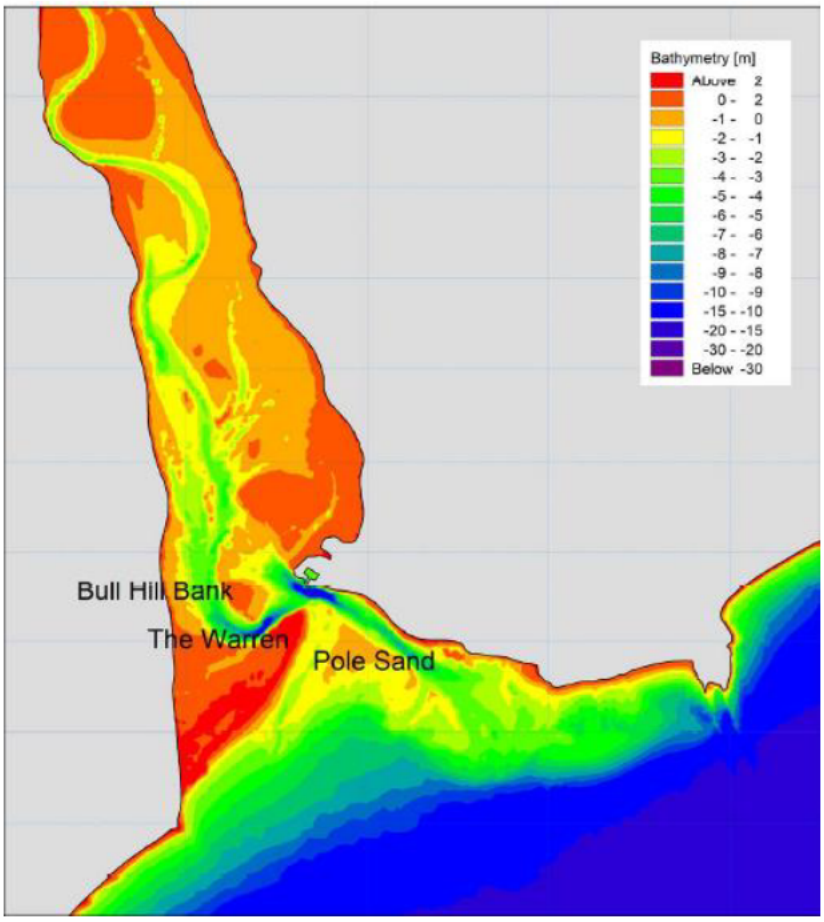

Figure 4 – Bathymetric Survey of Exe Estuary

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6.1 Designated Bathing Waters

Model predictions indicated no impact at the Dawlish Town, Dawlish Warren, Exmouth or Sandy Bay designated Bathing Waters associated with effluent from the Straight Point SSO, under any of the modelled wind conditions (including No Wind) under continuous discharge conditions. A simulation with easterly wind conditions, to check for impact from the Straight Point outfall on Dawlish Warren and Dawlish Town bathing waters was also undertaken. No impact is predicted by the model.

A statistical check was required to evidence no deterioration at Budleigh Salterton given the increase in storm volumes and the fact the modelled plume was shown to impact the bathing water under certain conditions. It was concluded that statistically the increase in storm volumes coming from the Straight Point outfall will have a negligible impact on bathing water quality at Budleigh Salterton Bathing Water.

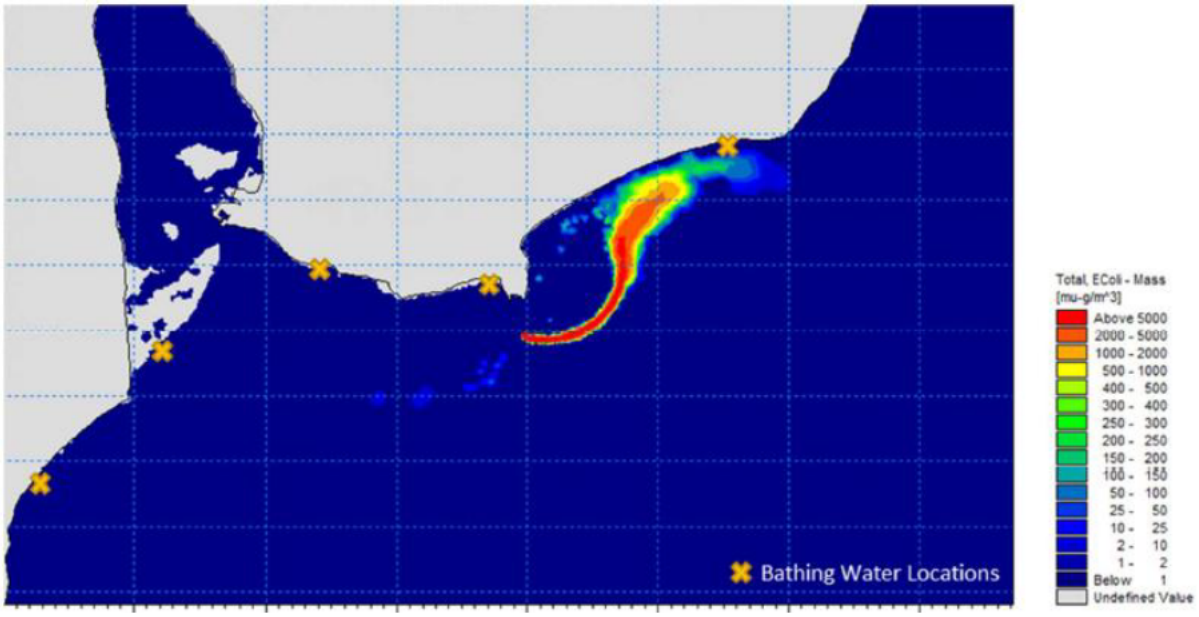

Figure 5 - E.coli plume moving toward Budleigh Salterton Bathing Waters (no wind HW+3h)

6.2 Shellfish Waters

The proposed AMP7 solution benefits the target designated Shellfish Waters in the Exe Estuary and Outer Exe.

At the time of analysis, the Sandy Bay shellfish site was a Classified Shellfish Water Production / Harvesting Area, classified and managed by the Food Standards Agency; it was not designated under the Shellfish Water Directive until May 2022.

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The modelling considered the E.coli geomeans at points around the edge of the Sandy Bay shellfish site. There is guidance given on the .gov website[3] around what geomeans are required for designing solutions such as this, discharging from a long sea outfall.

The guidance says

> *You can use marine impact modelling to design a solution to meet a geomean of 110 E. coli/100ml. To make sure shellfish flesh samples comply with the WFD shellfish flesh standard the Environment Agency may require a geomean design standard of 5 E. coli/100ml*

The geomean E.Coli was predicted to be 32 E.coli / 100ml at the SE corner based solely on the existing continuous final effluent discharge from Straight Point outfall (i.e. no storm flows). Extending the outfall by 250m reduced the geomeans below 5 when considering continuous final effluent only. Further modelling would be needed to consider the increased SSO discharge volumes and any future increased continuous final effluent discharge. This was not carried out as the beds were not designated at the time.

There are another four Classified Shellfish Water Production / Harvesting Areas in and around the estuary and another two off the coast of Budleigh Salterton which are not designated. Modelling found no impact at these sites.

7 Straight Point Outfall

7.1 Capacity

The Straight Point outfall takes final effluent and settled storm flows from the STW. It leaves the STW site via a 1.35m diameter tunnel under the hillside to Sandy Bay holiday park and then a 600mm diameter sewer through the holiday park, into the MOD Rifle Range land and discharging via a diffuser arrangement off Straight Point.

Under normally circumstances the outfall currently discharges 273 l/s of final effluent plus storm flows in the region of 60 l/s (when Maer Road SPS has ramped down).

Surveys, modelling and physical testing have been undertaken which estimate the current outfall capacity to be around 650-700 l/s. However, when it takes these flows it will be significantly surcharged through the holiday park which risks pollutions in the event of pipe failure / burst. Of significance the section under the Rifle Range was found to have a bellied section, thought to be due to the over-loading of soil from the 8m high earth bund that has been constructed on top of the pipes.

Under the preferred strategy the outfall would need to take 991 l/s consisting of 273 l/s final effluent and 718 l/s storm flows. After the STW upgrade in AMP8 this would then change to 546 l/s final effluent and 445 l/s storm flows. The pumped flows from the terminal SPSs are proposed as follows;

[3] https://www.gov.uk/government/publications/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows

[redacted]

- Sandy Bay 60 l/s
- Lime Kilns (Budleigh Salterton) 31 l/s
- Maer Road (proposed) 700 l/s
- Phear Park (proposed) 200 l/s

As 991 l/s exceeds the 700 l/s current capacity, the outfall capacity needs increasing. Initially this was modelled via dualling sections through the holiday park, but continued surveys then found the damaged section under the rifle range and hydraulic modelling showed this downstream area to be the most problematic in terms of capacity. The preferred method of increasing capacity is therefore to directional drill from the Sandy Bay car park out to sea, with a new diffuser arrangement on the discharge point set approx. 30m west of the existing discharge point. The existing outfall under the Rifle Range would then be abandoned due to its condition.

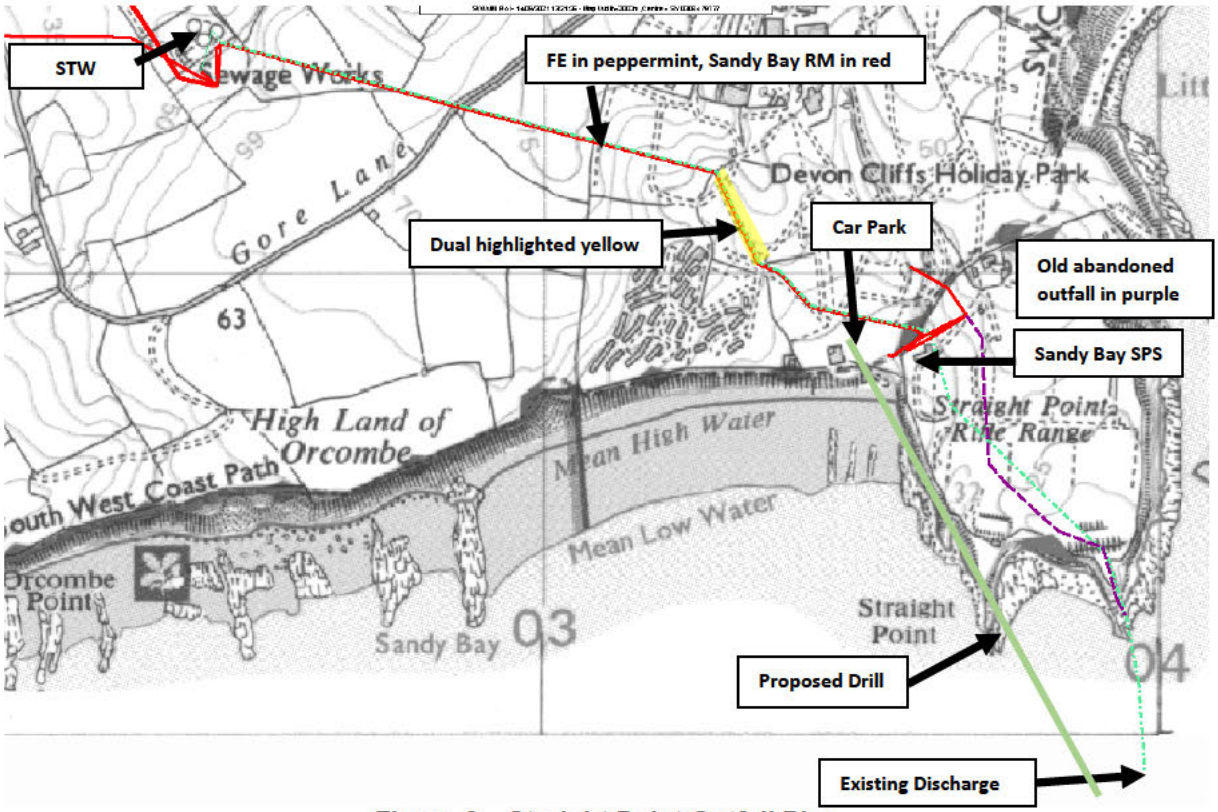

Figure 6 – Straight Point Outfall Plan

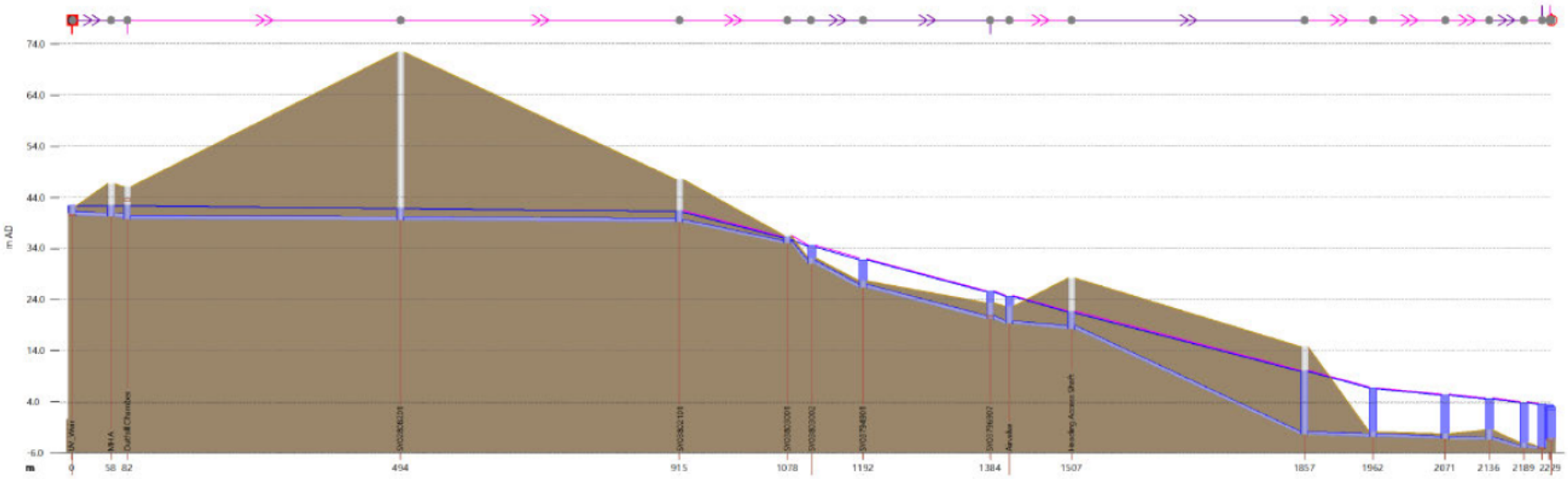

Figure 7 – Existing Outfall Long Section showing flooding at STW at 650 l/s

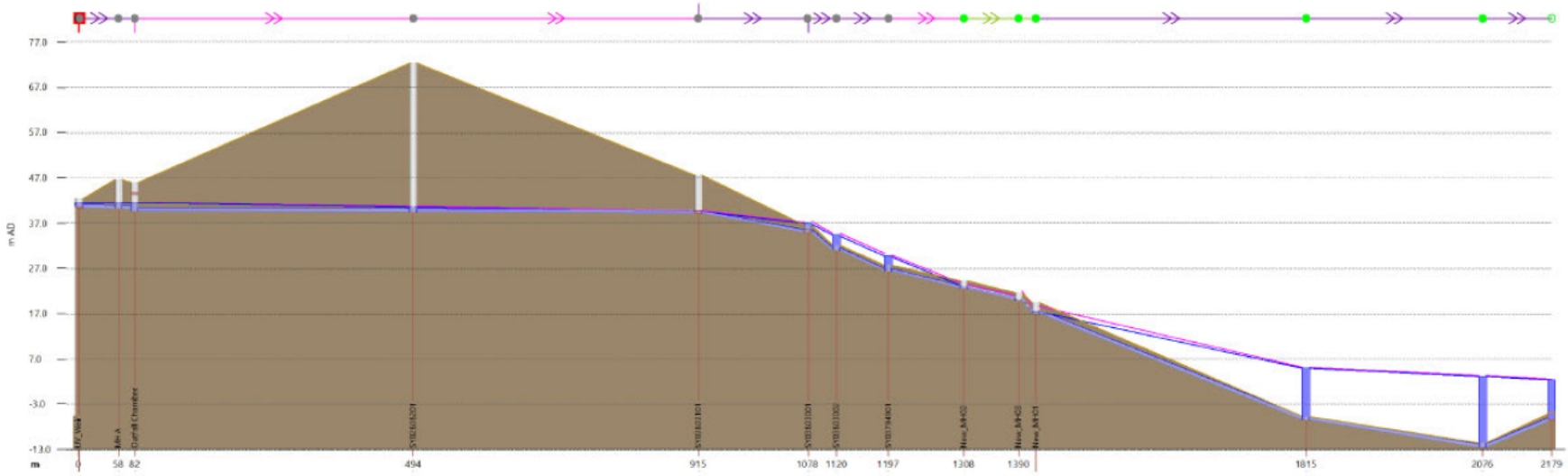

Figure 8 – Proposed Outfall Long Section showing sufficient capacity at 991 l/s

[redacted]

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7.2 Sandy Bay PSCSOEO Opportunity

Sandy Bay SPS was originally designed as a foul only pumping station to deliver 13 l/s to Maer Lane STW, as the holiday park discharge was foul only. Whilst being constructed it was found that surface water discharged to the network making it combined. The pump rate was increased to 60 l/s to account for this and a letter was written to the holiday park legally obliging them to remove the surface water elements and this has been the basis of the ongoing communications between them and SWW.

Sandy Bay does not have a gravity overflow and such an overflow could not discharge to the FE outfall because it is pressurised at this point. When storm flows exceed the 60 l/s pump capacity, flooding occurs from the covers in the car park and discharges onto the beach. This has been responsible for a Cat 2 pollution incident on 01/05/2017 when the storm pump failed. The station has now been upgraded to foul duty, storm duty, storm standby pump regime but a risk still remains.

Drilling a new FE / storm outfall from the car park out to sea will give opportunity for the outfall not to be pressurised in the vicinity of the Sandy Bay PS in the car park. This then gives opportunity for SWW to agree a PSCSOEO permit with the EA and to construct a gravity overflow from Sandy Bay wet well / storm tank to the FE outfall. This takes any discharge out to sea rather than flooding and discharging on to the beach, reducing risk of Bathing Water failure. The risk of Pollution Incidents here is also greatly reduced. It is understood that the EA would be supportive of this proposal.

7.3 Outfall Timescales and programme

The following dates can be seen more visually on the summary programme provide in section 8.

Outfall surveys started on 22nd May 2020 when it became apparent that the preferred solution relied on outfall capacity. This started with an initial CCTV survey down to the outfall from a chamber on the combined sewer in the Rifle Range. The water level in the outfall was higher than expected raising concerns. The diffusers were then checked for condition and blockages by divers in September 2020, which was somewhat delayed due to weather. This found no hydraulic issues.

On 6th April 2021, after estates organisation and agreeing a process risk assessment for stopping flows, the outfall was traced and mapped through Sandy Bay. A CCTV survey was completed where access was available via a chamber at the tunnel exit. This gave estimates of roughness values.

An ICM hydraulic model was built of the outfall using the roughness estimated but the higher water levels were still not explained. Initial model runs suggested dualling sections through the holiday park would provide the required capacity.

On 3rd September 2021 an exercise was undertaken to remove an air valve and CCTV the section of outfall under the Rifle Range. This section was found to have a high level of roughness with a belly in the pipe thought to have been caused by overloading of the above 8m high earth bund. The hydraulic model was adjusted accordingly and the lack of capacity in this section was worsened.

[redacted]

[redacted]

The option to drill a new outfall from the Sandy Bay car park then became the preferred option in order to be able to abandon the section under the Rifle Range. Some dualling in the holiday park is still required but was much reduced. Under this option the outfall in the holiday park would be under significantly less pressure reducing risk of burst and the section in the car park would not be pressurised. This option also provides more certainty when considering roughness assumptions in the modelling. After outline design and cost estimation, this approach was formally agreed by SWW on 3rd March 2022.

Work to tender surveys started in February 2022, with surveyors then programmed for June to August 2022, including boreholes, bathymetric survey and divers ecological seabed survey. The MMO licence is due to be submitted in July and allowing a 6 month consultation period (as has been experience with recent applications) this is expected to be granted January 2023.

The construction works has been programmed to minimise the impact on the holiday camp as well and target the earliest opportunity for the marine works when a suitable weather window including sea state can be expected. The directional drill involves drilling from the car park and exiting the drill on the sea-bed. Benonite slurry and arisings will increase vehicle movements during this time. The pipe will be floated round from Norway and pulled back up through the drilled hole from the sea end.

The drilling activity is programmed to start after the MMO licence is granted and toward the end of the winter period in February 2023, so that the hole is not left open for a long duration before the pipe can be pulled back through, which is envisaged to be April 2023 with a steadier sea state. This will then be followed by installation of the diffusers and the onshore connections, taking the completion to June 2023. The programme in Figure 9 also shows a 2-month buffer period in case of complications including adverse weather / coastal conditions.

7.4 Outfall Extension

The coastal modelling described in section 6 predicts no detriment at any of the currently designated waters at the time of writing. Hence the current outfall discharge location is deemed sufficient for this project and the directional drill is looking to create a discharge approximately 30m to the west of the existing discharge location.

However, in May 2022 Sandy Bay Shellfish Waters was designated under the Shellfish Waters Directive. The modelling predicted that the existing final effluent (only) from the existing Straight Point outfall could cause the E.coli geomean to exceed 5 at the SE corner of the Sandy Bay Shellfish Waters. The effect of storm discharges has not yet been modelled but can easily be completed for both the AMP7 temporary position and the proposed AMP8 STW upgrade. The conclusion is likely to be that the outfall requires extending maybe 250m or 500m further offshore.

The extension may be done via extending the drill during this project, although the topography and technical feasibility may be restrictive. The alternative would be an extension laid on the seabed. Both methods would require additional pipe to be floated round from Norway, and hence it seems sensible to achieve this during AMP7, although this will depend on the marginal cost.

[redacted]

[redacted] [redacted]

8 Overall Programme

8.1 Delivery Dates and Mitigation

In order to mitigate the impact of current discharge levels on the Shellfish beds, the Phear Park SPS upgrade is programmed to be completed by the original compliance date of September 2022, which involves hiring pumps, whilst the permanent ones are procured. This will allow 200 l/s to be pumped up to the STW and will reduce the significant spills at Phear Park PS CSO to 7.5 per annum and is envisaged to achieve the Phear Park WINEP driver (WINEP ID 7SW200871).

The spill volume at Phear Park will be further reduced by the completion of the surface water separation and infiltration removal projects later in winter 2022/23.

As can be seen from Figure 2, Phear Park overflow outfall is within the estuary potentially effecting the Exe Estuary Shellfish Beds and the Outer Exe beds. Hence its timely delivery will reduce impact on these beds.

The Straight Point outfall currently has the capacity to accept additional flow rates from Phear Park, but does not have the capacity for the Maer Road additional flows. Hence the Maer Road SPS Upgrade cannot be completed until the outfall capacity is increased via the directional drill. The Maer Road overflow outfall is on the east boundary of the Outer Exe beds and its delayed delivery (WINEP ID 7SW200711) will have much less of an impact.

8.2 EA Liaison Meetings

The following meetings have taken place whereby SWW have updated colleagues at the EA on progress with Exmouth and have discussed issues and potential resolutions. More details as to the content of these meetings is available on request.

- **24/07/19 – PR19 Exe SFW Project – Progress Update (Pell Frischmann Offices)**
  EA Attendees: [redacted],
  SWW / Consultant attendees: [redacted]

- **05/06/20 – AMP7 Bathing and Shellfish Waters – Initial Options Discussion (Webex)**
  EA Attendees: [redacted]
  SWW attendees: [redacted]

- **03/02/21 – Pre Permitting Meeting – Shellfish (Teams)**
  EA Attendees: [redacted],
  SWW attendees: [redacted]

- **24/09/21 Exmouth Shellfish – EA Update (Teams)**
  EA attendees: [redacted]
  SWW / Consultant attendees: [redacted]

[redacted]

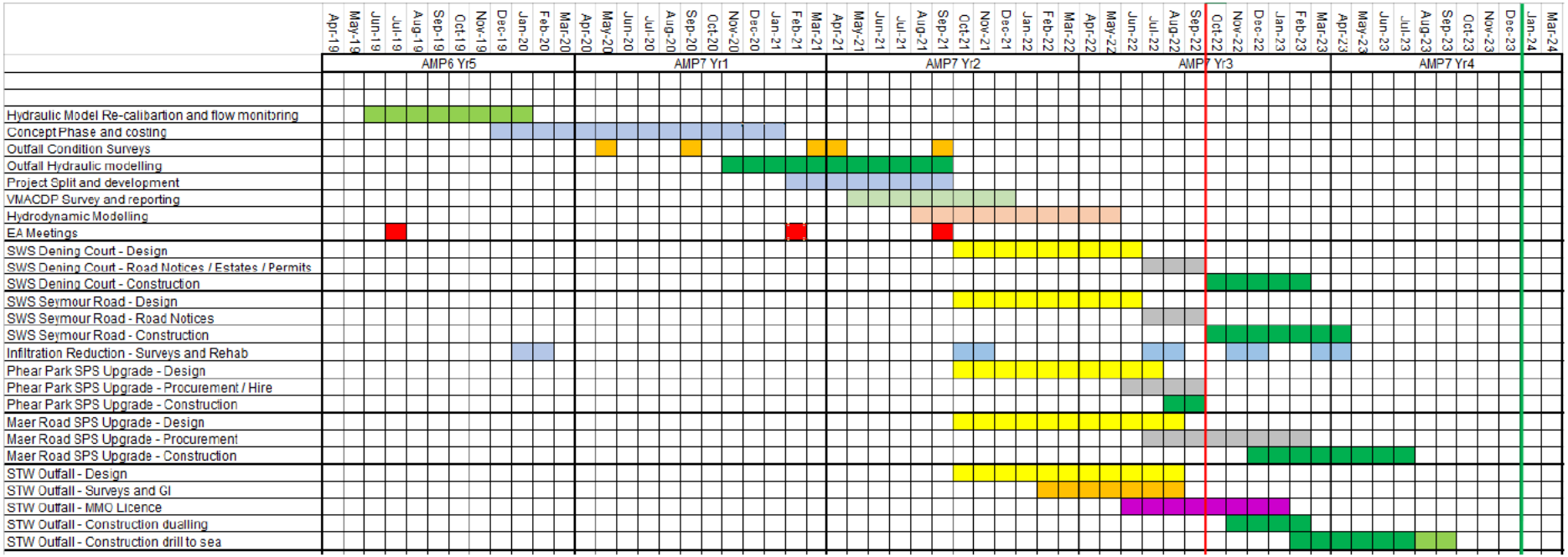

Figure 9 – Overall Summary Programme – Current Estimation

[redacted]

[redacted]

9 Long Term Benefits of Preferred Strategy

To achieve the AMP7 outputs, the extensive development work has analysed the catchment holistically and considered impact on all designated waters, rather than just the target ones. This identified the fundamental 'bottle neck' in the STW treatment capacity and hence the strategy to increase this in future. The work in this AMP fits into this strategy and facilitates its delivery.

9.1 AMP7 benefits

- Target Shellfish Waters improved
- Increased pump rates to allow future increase in treatment
- Coastal Modelling to inform PR24 on improvements for the newly designated Sandy Bay Shellfish Waters
- Reduction in non-foul flows
- Replacement of outfall asset found to be in poor condition
- Reduction of outfall surcharge and associated risk of pollution from burst
- Potential utilisation of the new outfall to reduce risk of pollution adjacent to beach from Sandy Bay PS during extreme storm events or failure
- Reduced risk of pollution from pipe defects and subsequent burst of Maer Road rising main

9.2 AMP8 benefits

- Sandy Bay Shellfish Waters improved an AMP early
- Increased treatment of flows; tertiary treatment of flows that would otherwise discharge as storm or UV treated storm
- Reduction in risk of micro-plastic release by replacement of the current BAFF treatment process
- Accommodation of catchment growth and allowance for future catchment growth

[redacted]

[redacted]

APPENDICES

[redacted]

[redacted]

APPENDIX A – SWS Areas Considered

Note that based on design development of some of these areas, the costs in the below table should be somewhat increased.

The Salterton Road area needs more modelling and surveys to determine where the surface water could discharge and has not been included in this project.

Area / Location	Ha	Indicative cost (£k)	Cost/Ha
Denning Court	0.62	£115	£185
Salterton Rd Area	3.50	£1,088	£311
Potential Featherbed Lane	0.50	£200	£400
Seymour Rd/ Featherstone Rd	0.67	£276	£412
Lyndhurst Rd	0.60	£275	£458
Cyprus Rd & Maer Vale	1.20	£588	£490
Marina Court	0.11	£57	£523
Foxhill	1.78	£979	£550
Victoria Rd/ St. Andrews Rd/ Mamhead View/Morton Rd/ Imperial Rd	5.00	£2,800	£560
East Drive	0.13	£85	£654
Esplanade/Pavilion Area	1.00	£680	£680
Seafield Ave	0.28	£200	£714
Maristow Ave	0.22	£165	£750
Isca Rd	0.10	£85	£850
Springfield Rd	0.22	£191	£868
Masey Rd/Newland Ave	0.50	£614	£1,228
Long Lane Garage Area	0.06	£104	£1,825
TOTAL	**16.49**	**£8,502**	

[redacted]

[redacted]

APPENDIX C – Responses to EA letter dated 10th June 2022

1. EA modelling shows that the Exe Shellfish Waters have been deteriorating, with a high degree of certainty. Has SWW put in place the enhanced treatment (UV disinfection of the CSO discharges), which was required by April 2022 as part of the delayed scheme mitigation? If not, please explain why.

Reference section 2.3.

2. Whilst we support sustainable, long-term solutions, legislative requirements must be met. In our letter of 7 November 2018, we were clear that 'The revised deadlines must be met due to legal obligations. However, because of remaining infraction risk, steps should be taken to deliver the measures within the shortest time possible and definitely no later than September 2022'. Further delays to 2023 will be in breach of regulations to prevent deterioration at shellfish waters. Please set out how you plan to mitigate for any impacts on the local shellfish economy.

Reference section 8

The long term trend for the Beacon Point monitoring point suggest an improvement in the E.Coli levels. There has been improvement in the C gigas and Exe Mytilus spp Classification from 2018 to 2021. The area from River Kenn to Starcross has improved from Prohibited to Class B, which may be due to the installation of final effluent UV at Kenn and Kennford STW. The area from Starcross to Dawlish Warren has improved to Long Term B.

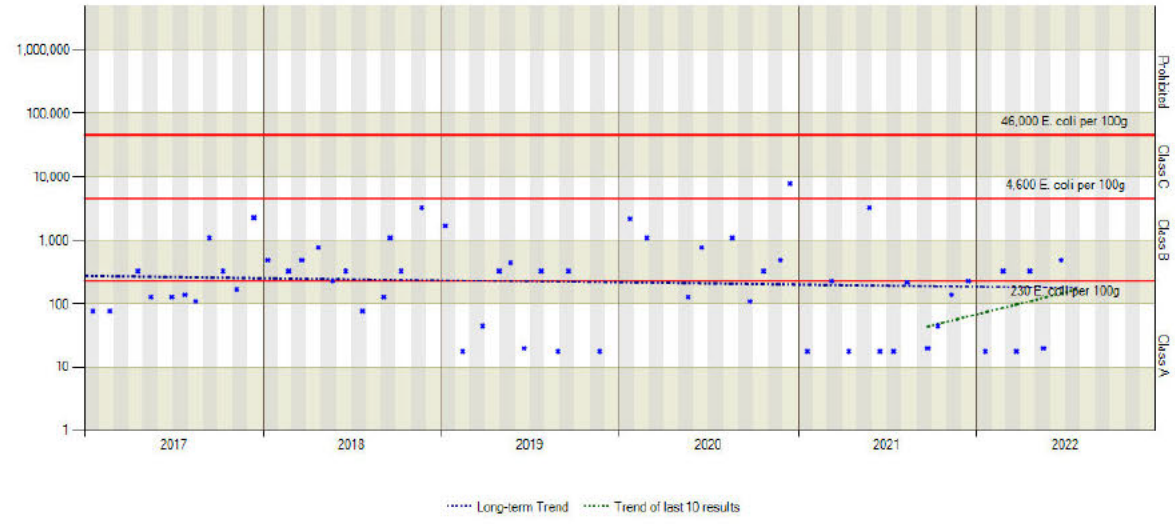

Figure 10 – Beacon Point E.Coli monitoring results[4]

[4] https://www.cefas.co.uk/data-and-publications/shellfish-classification-and-microbiological-monitoring/england-and-wales/shellfish-monitoring-results/details/?species=MUS&connection=SHS&PointID=B26AT

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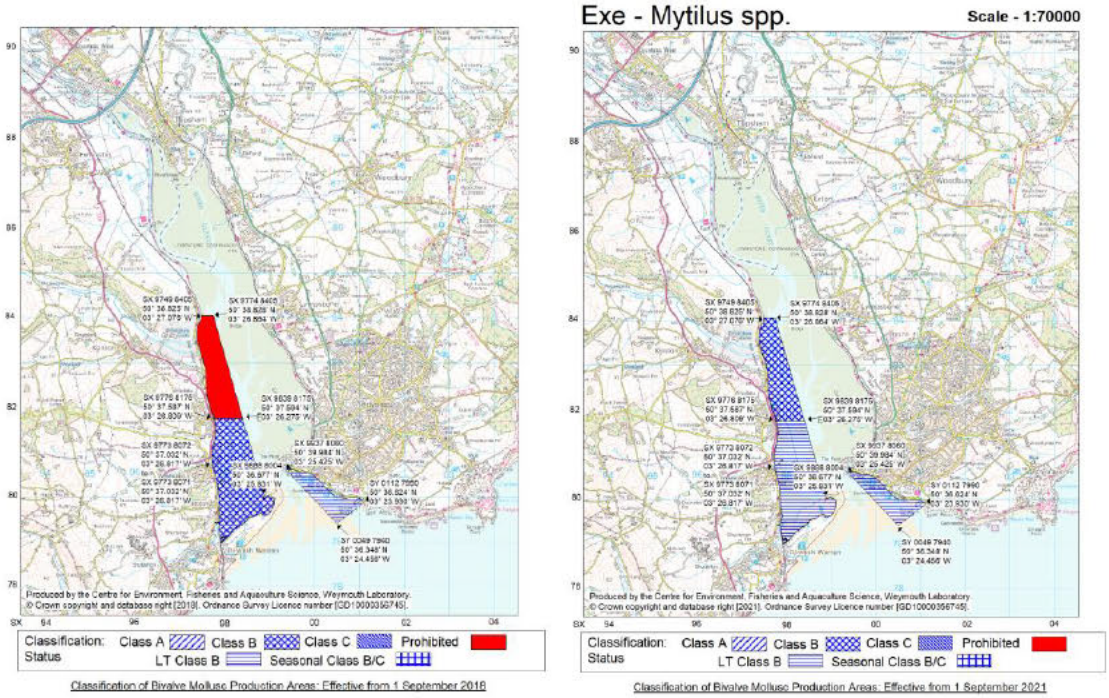

Fishery	Bed	Species	2018	2017	2016	2015	2014
Exe Estuary	Dawlish to Starcross	Mytilus spp	B	B	B	B	B-LT
Exe Estuary	Starcross to Powderham	Mytilus spp	P	P	P	P	B
Exe Estuary	Exe Approaches	Mytilus spp	B-LT	B-LT	B-LT	B-LT	B-LT

Figure 11 – Mytilus Classifications Sept 2018 and Sept 2021

With the general improving trends shown above, it is not anticipated that the addition 15 month delay in delivering the Maer Road PS CSO element of the works with cause the shellfish waters to deteriorate, and hence there will be no impact on the shellfish economy.

Live data from both overflows is available via Beachlive, hosted by Surfers Against Sewage, which will soon be available direct from SWW.

3. The latest AMP7 proposals suggest extending delivery to 31 December 2023. This is said to be because work on the new outfall is restricted by Sandy Bay holiday park. This seems to be a very long period. Please can an explanation be provided to show why it could not be completed in a single winter season.

Reference section 7.3. Sections of the outfall require dualling through the holiday park; the detail of this was confirmed in Sept 2021 and at that time, it was unable to be coordinated with the holiday park's own planned out of season work in order to deliver in winter 2021/22. In addition, a new outfall needs directional drilling from Sandy Bay car park to the sea. This requires significant planning, surveys and an MMO licence. This has been scheduled after the potential adverse weather / sea states in winter months, but still outside of the holiday park's season, and has therefore been planned to commence in January 2023.

[redacted]

4. Please share your detailed programme of work, setting out what needs to happen and when and outlining environmental risks and mitigation. Please share associated cost benefit information, to show the appropriateness of solutions proposed. What is the fall-back option to protect the environment if these proposals can't be delivered earlier, e.g. increasing the outfall capacity (can this be undertaken sooner?), UV disinfection of the storm discharge, and transferring flows from Phear Park and Maer Lane pumping stations.

Reference sections 7.3 and 8 and full programme in Appendix C

5. Your letter says that SWW has looked at alternative solutions over the last 18 months. Please provide further evidence to explain why options analysis did not take place sooner (after our November 2018 letter).

We apologise if any confusion has been caused by our previous letter. Various stages of design development have taken place after your November 2018 letter, as detailed above and shown in Figure 9. The last 18 months have more heavily involved the Engineering Delivery teams as opposed to Asset Management / Programme Development Teams.

6. There are other pressures from SWW assets on the Exe Estuary and the Outer Exe shellfish waters, e.g. there have been recent permit exceedances at Countess Wear STW and the site is at high risk of permit failure; it would be helpful to include an assessment of in-combination impacts from SWW assets and associated mitigation.

Issues effecting the final effluent discharge at Countess Wear STW, have been measured on SS, BOD and ammonia. The discharge passes through final effluent UV to remove E.Coli and there have been no UV failures. E.Coli is the only measurable parameter with regard to Shellfish Waters hence the issues are believed to have had no effect on shellfish.

The storm UV at Countess Wear is still awaiting its permit to determine parameters on which to report. Agreeing this permit before 30th September 2022 would provide some mitigation to ensuring the agreed E.Coli reductions are met. This needs joint resource between the EA and SWW.

There are other assets in Exmouth which could be impacting the Shellfish Waters, which were not included in the AMP7 WINEP, for example Hartopp Road PSCSOEO which discharges from the same outfall as Phear Park PSCSOEO. We have a conceptual surface water separation scheme in this area which we are hoping to development and deliver in AMP7 under Waterfit.

Assessing impacts from multiple assets within these Shellfish Waters is a large piece of work, essentially a Shellfish Water investigation, which would normally take a year to deliver with various surveys and sampling.

[redacted]

[redacted]

7. We require assurance on the modelling approach and outputs. What confidence do you have in the marine modelling undertaken, and the prediction of no deterioration to the bathing water or shellfish waters at the new proposed outfall location?

The hydrodynamic coastal modelling is described in section 6 with the full assessment and model build / calibration report included in Appendix B. In particular, section 4 of the model calibration report in Appendix B gives the confidence in the model predictions.

8. The surface water separation work is the only item we might consider is a sustainable, low carbon solution to avoid deterioration. From your letter, it appears that this is now unlikely to make a significant contribution, given the proposal to pump to storage and then treat, or discharge, excess via an increased capacity and extended outfall. Are there other low carbon solutions that are being considered?

Reference section 3.3 for details of surface water separation. Infiltration reduction is also included within this project as a sustainable low carbon solution, although it is understood that currently the EA do not consider this improvement works, rather capital maintenance.

The location of the overflows in a built-up residential area makes other low carbon solutions infeasible. For example, stormwater treatment via reed beds or wetlands.

[redacted]

[redacted]

APPENDIX D – Timeline
(Note dates in the future are indicative of when activities are likely to take place).

Nov 17 – PR19 submission

Feb 18 – Hydraulic Modelling continued and found winter infiltration not modelled. Re-calibration needed

Aug 18 – SWW letter requesting extension to Sept 2021 compliance date

Nov 18 – EA response letter accepting extension

Jun 19 – Hydraulic Model re-calibration and flow monitoring
Jul 19 – EA meeting on 24th "PR19 Exe SFW Project – Progress update"

Dec 19 – OFWAT Final Determination confirmed
Dec 19 – Start of Concept Design and costing

START OF AMP 7
May 20 – STW Outfall Mapping survey and start of CCTV planning
Jun 20 – EA meeting on 5th "AMP7 Bathing and Shellfish Waters – Initial Options Discussion"

Sep 20 – STW Outfall CCTV Surveys

Nov 20 – Start of STW Outfall detailed hydraulic modelling

Feb 21 – Strategy feasibility confirmed, project split and development of elements started
Feb 21 – EA meeting on 3rd "Per Permitting Meeting – Shellfish"
Mar 21 – STW Outfall CCTV Surveys

May 21 – Coastal surveys, reporting and start of hydrodynamic modelling

Sep 21 – STW outfall CCTV under Rifle Range bund. Confirmation of condition and need for directional drill
Sep 21 – EA meeting on 9th "Exmouth Shellfish – EA Update"
Oct 21 – Technical Approval of Elements and hand over to Delivery Teams / Start of outline design

Feb 22 – Outfall survey specs and programme for GI started

Jun 22 – MMO licence submission for outfall directional drill
Jul 22 – Road Notices and permit applications for surface water separation schemes submitted

Sept 22 – Upgrade of Phear Park complete with temporary pumps, to pass uprated flows to STW
Oct 22 – Start on site for surface water separation schemes
Nov 22 – Start on site for outfall dualling in holiday park

Feb 23 – Start of Directional Drill at Sandy Bay

Apr 23 – Start of pull through of outfall pipe avoiding adverse weather and poor sea states

Jul 23 – Completion of Maer Road SPS Upgrade
Aug 23 – Anticipated completion of outfall and diffusers (subject to weather conditions – 4-month buffer until December in case of complications / adverse weather / coastal conditions)

Dec 23 – Proposed Compliance Date allowing buffer for delays on directional drill and associated sea working

[redacted]