Dŵr Cymru
Welsh Water

Event Duration Monitoring

Trigger Exceedance Notification

Document ID

Report type: Stage 2: Full Investigation Proposal

Permit Number: BP0236603

Receiving / Impacted waters: BW

Location: Knab Rock Sps, Mumbles, Swansea Bay, SA3 4EN

DCWW Asset ID: 53153

CAR References:

2024/06 - AR_NRW0044731 (Closed)

2024/11 - CAR_NRW0048888 (Open)

2025/07 - CAR_NRW0048888 (Open)

Document Control

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1	Stage 2: Full Investigation Proposal - Draft	04/11/2025	Mike Gillard	Initial Draft
1	Stage 2: Asset Manager Review	07/11/2025	Paul Buttle	Draft Report Review
2	Stage 2: Asset Manager Review	13/01/2026	Gareth Griffiths	Draft Report amendment
2	Stage 2: Client Manager Sign-off	23/01/2026	Helena Hopkins	Amendments and Sign Off
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1. Executive Summary

The Knab Rock Pumping Station, situated in the Mumbles area of Swansea, serves as a critical infrastructure component for managing wastewater flows from the south-western section of the Swansea Bay catchment. Originally constructed in the early 1900s and later modified in the late 1990s, the station now operates as a key pump-away facility, forwarding flows for treatment and stormwater management before discharge into Swansea Bay. The asset functions under strict permit and Event Duration Monitoring (EDM) requirements to ensure compliance with environmental standards, particularly regarding storage utilisation and minimum flow rates.

The root cause of operational challenges at the site primarily relates to the ageing infrastructure and the complexity of integrating legacy sewer networks with modern pumping and storage solutions. This has led to issues such as potential overflows and difficulties in consistently meeting consent conditions, especially during periods of high rainfall or storm events.

To address these concerns, the next steps include implementing a comprehensive Spill Reduction Plan, which involves enhancing stakeholder communication, optimising storage utilisation, and upgrading pumping and monitoring systems. These measures are designed to minimise environmental impact, improve system resilience, and ensure ongoing regulatory compliance.

2. Stage 2: Initial Investigation

2.1. Site Location

Knab Rock pumping station is in the Mumbles area of Swansea which lies at the Southern end of Swansea Bay on the Gower Peninsula. The original station structure was built into the cliff face rock at Mumbles in the early 1900's, where the original main brick egg trunk sewer (MTS) extended through Swansea Central and Northwards towards Morriston.

The pumping station now collects flow primarily from the South-Western section of the Swansea Bay Catchment and some bifurcated flows from the old Swansea Central historical MTS sewer network. The site was re-proposed from an old tidal discharge terminal station and turned into its current pump away design, back in the late 1990's (AMP2), when Swansea Bay bathing water trunk sewer and WwTW scheme were commissioned.

The pumped flows arrive at the bottom of Bryn Mill lane, where it picks up the new gravity trunk sewer that terminates at Langdon Road SPS and in turn discharges both foul flow for treatment and storm flows through the WwTW storm system, combining final effluent and storm water at the discharge point of the WwTW before this discharges out of the long sea outfall into the tidal waters of Swansea Bay.

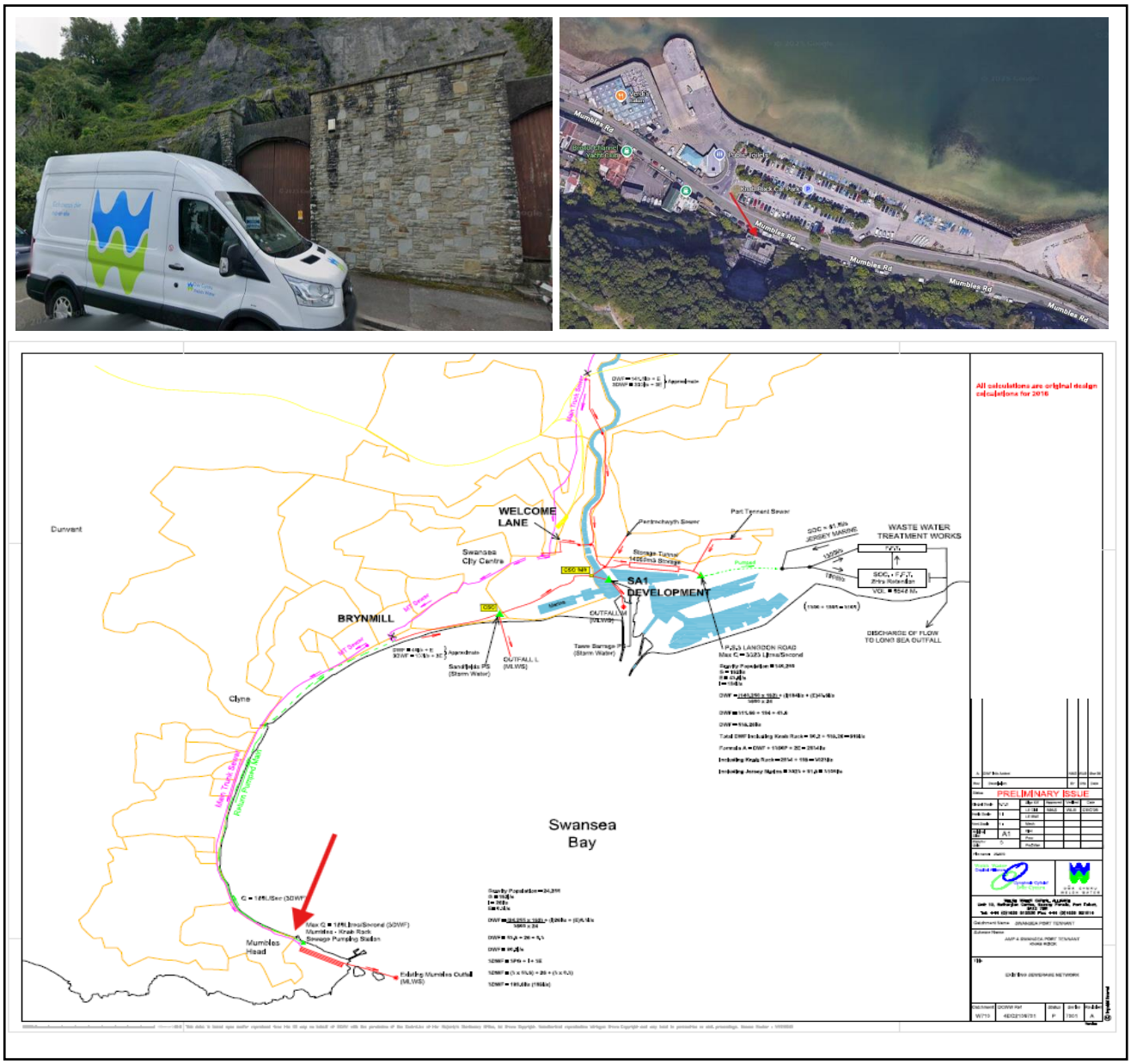

Figure 1: Location of Knab Rock SPS and Catchment Schematic. Photo snapshots from Google Earth and Catchment Schematic from AMP4 Review (Also found in Appendix "B")

2.2. Permit & EDM Requirements

The BP0236603 permit for 'Mumbles Sewage Pumping Station' allows this asset to discharge as a CSO via the tidal tanks. However, this is only permitted if all online storage within the network (415m^3) and the carpark box culvert tank (945m^3), a combined total of 1360m^3, has been used, and if the flow passed forward is at least 189 Liters per second.

The pumping station was upgraded during AMP3 via the bathing water (BW) driver U16 BATH13, so its EDM classification is BW, designed for up to 9 spills during the bathing season rather than 5. The DCWW permitting team has provided this information separately to NRW for resolution.

This asset would still have been in breach; however, the breach date would have been 5 July rather than 69 June 2025.

Table S3.3 Storm sewage discharge settings					
Effluent and discharge point	**Description of discharge**	**Overflow setting l/s**	**Maximum size of solid matter**	**Screen aperture size**	**Minimum storage capacity m³ (online)**
A1 Storm sewage via Point of Discharge	Storm sewage	189	No greater than 6 mm in more than 1 dimension	6 mm x 6 mm	1360

Permit number:
BP0236603

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Figure 2: Snapshot out of the Asset Permit with relevant information.

2.3. Asset and Telemetry Description

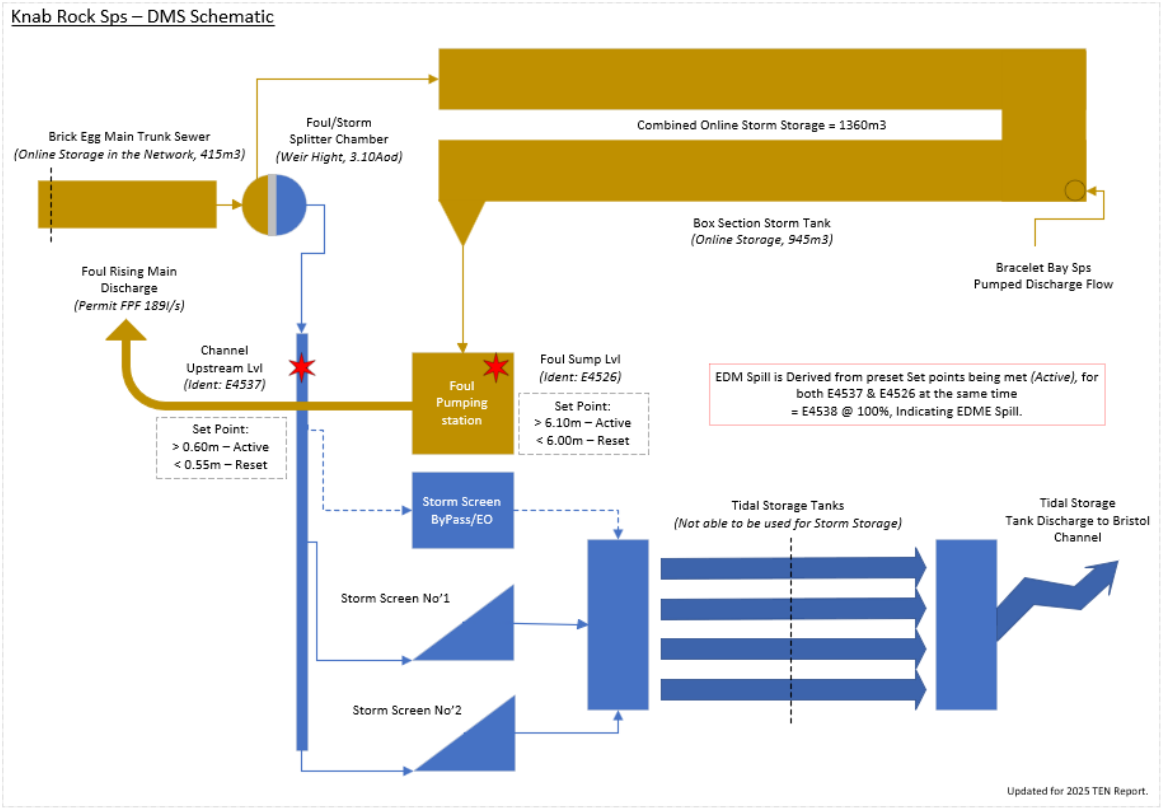

Figure 3: Image of the Discharge Mechanism Summary (DMS) schematic of site layout and EDM locations. Full size detail can be found in Appendix "C" below.

Description of how discharge occurs:

If the foul pumps are beaten or fail, the storage tank starts to fill. Once it is full, the incoming line surcharges and excess flows spill over the weir, through the escalator screens and into the tidal storage tanks underneath Knab Rock. The tanks are emptied at high tide using a penstock controlled by a tidal clock.

How the discharges are monitored:

Using an multi scenario derived spill signal, which is based on following logic: When 'CHANNEL UPSTREAM LEVEL' (E4537) Is Greater Than 0.60m Then Set Variable 1, Variable 1 Will Only Clear Once The Level Has Fallen To 0.55m.

When 'FOUL SUMP' (E4526) Is Greater Than 6.10m Then Set Variable 2, Variable 2 will Only Clear Once The Level Has Fallen To 6.00m.

If Variable 1 and Variable 2 Then 100% Spill (2E4538)

2.4. Telemetry Data Analysis

Spill block data

Spill Number	SpillBlockStart	SpillBlockEnd	ReadingsOverLimit	MaxReading	SuspectReadin	SpillRangeType
1	26/05/2025 22:45:00	27/05/2025 10:45:00	10	100	0	Initial 12 Hour Block
2	27/05/2025 10:45:00	28/05/2025 10:45:00	23	100	0	Subsequent 24 Hour Block
3	03/06/2025 05:30:00	03/06/2025 17:30:00	24	100	0	Initial 12 Hour Block
4	05/06/2025 09:00:00	05/06/2025 21:00:00	16	100	0	Initial 12 Hour Block
5	12/06/2025 11:00:00	12/06/2025 23:00:00	48	100	0	Initial 12 Hour Block
6	12/06/2025 23:00:00	13/06/2025 23:00:00	38	100	0	Subsequent 24 Hour Block
7	13/06/2025 23:00:00	14/06/2025 23:00:00	55	100	0	Subsequent 24 Hour Block
8	24/06/2025 04:45:00	24/06/2025 16:45:00	13	100	0	Initial 12 Hour Block
9	05/07/2025 10:45:00	05/07/2025 22:45:00	9	100	0	Initial 12 Hour Block

Total Spills No	9	Input No of ReadingsOverLimit below
Significant Spills No	9	
Single Spill Events No	0	
Total Spill Duration (hours)	59	236
Significant Spill Duration (hours)	59	236

Figure 4: EDM Telemetry verified Data in Block count, as issues in Stage 1.

2.5. Catchment Review

A review during the TEN Stage 2 process identified an AMP4 hydraulic assessment and recommendations report with proposals to reduce BW spills, but these were not implemented due to their high estimated cost of £17.42 million. In May 2016, works at Mumbles Knab Rock SPS were completed to prevent saline intrusion, leading to a 50% reduction in spills during the 2016 bathing season. Despite improvements, some saline and surface water ingress remains due to the network and pumping station configuration, with new problem areas under assessment for AMP8 modelling.

A £2.5 million capital scheme began in 2023/24 to refurbish the SPS and ensure FPF compliance, but ongoing BW spillage risks required further root cause analysis. While annual maintenance has kept pumps compliant, continued repairs are no longer viable. In late 2024, four new pumps were installed, each capable of handling 189 l/s, but friction losses in the ageing pipeline have reduced flows below target levels. Since site constraints prevent larger pumps, this remains a challenge. A sustainable drainage plan referenced is available from AMP6.

2.6. Root Cause Statement

The root cause of operational challenges at the site primarily relates to the ageing infrastructure and the complexity of integrating legacy sewer networks with modern pumping and storage solutions. This has led to issues such as potential overflows and difficulties in consistently meeting consent conditions, especially during periods of high rainfall or storm events.

The Pumped flow:

A full ME&I refurbishment or installation of a larger pump is required to meet the 189 l/s permit flow or any increased FPF flow, ensuring the rising main operates at maximum duty point to minimise BW spills.

The Rising Main:

The rising main's hydraulic condition meets the permit specification of FPF 189 l/s based on aged pipework calculations. Additional assessments would be required if flow rates exceed this limit.

The Catchment:

Comprehensive and ongoing network investigations have identified several hotspots that may be susceptible to saline intrusion and hydraulic overloading within the gravity network supplying Knab Rock SPS. The impact of these issues appears significant relative to the shortfall in FPF from the SPS. Consequently, further detailed survey work and updated modelling are necessary in these hotspot areas to determine strategies for mitigating inflow and infiltration, prior to considering interventions at the SPS itself.

The Storage:

The lack of adequate storm storage is clear from the amount of time the site spends spilling, as the tidal tank's large volume currently doesn't act as an environmental buffer for the asset. Once flows enter these holding tanks, they cannot be sent back, so the stored volume continues to extend the spill's impact even after the rain has stopped. However, for moderate storms and spills afterwards, it may be possible to return water for treatment if tidal tanks are adapted to boost storm storage and add pumps that send stormwater back.

2.7. Stage 2: Next Steps

Full Investigation Proposal:

Below are key FIP actions needed to develop a long-term, resilient BW spill investment plan for this asset.

2.8. Stage 2 Full Investigation Plan

Table 1: Full Investigation Plan

Action Ref.	Action Required	Action Due Date	Comments	Complete (Y/N)	Completion Date
1	Gravity network survey work for identified hot spots.	30/06/2026	Conduct a survey of designated network targets in the upstream catchment.		
2a	Catchment modelling.	31/12/2026	Rebuild upstream gravity catchment modelling with new information.		
2b	Catchment modelling.	30/06/2027	Run modelling with remedial optioneering.		
3	Recommendations from modelling outcomes.	30/09/2027	Review recommended outcomes and agreed prioritised action plan.		
4	MVS and OVA		Calculate the costs of the agreed action plan to		

		31/12/2027	present to NRW and discuss its affordability in relation to the meet permit and BW spill drivers.		
5	Capital Design	31/12/2028	Deliverable commitment programme.		

3. Stage 3: Trigger Exceedance Reason Report (TERR)

Carry out the work described in the FIP to produce TERR as an outcome and present as next steps.

4. Stage 4: Spill Reduction Plan

4.1. Spill Reduction Proposal

Increase FPF as a mitigation trial. Sufficient power supply and panel Kw head room already assessed and is available for this trial to be investigated. Outcomes from this trial will allow for a more informed rising main detail to be calculated in any future design.

Table 2: Spill Reduction Plan

Action Ref.	Action Required	Action Due Date	Comments	Complete (Y/N)	Completion Date
1	Mitigation to increase FPF: Change foul pump duty **From:** Duty/Assist1/ Assit2/Standby and convert as a test period **To:** Duty/Assist1/ Assist2/Assit3, with spare standby pump on site at SPS, ready to replace on failure alarm of any one of the 4 duty pumps.	04/05/2026	This aims to meet the permit FPF requirement and determine if higher flow velocity can clear debris from the rising main, thus reducing frictional losses, system head loss, and improving FPF flows.		

5. Stage 5: Implement Solutions

5.1. Stakeholder Communication

As per below guidance, the above mitigation in the SRP and FIP will need to be circulated and agreed with NRW.

1. Appendices

1.1. Appendix A: Acronyms/Abbreviations

Acronym/Abbreviation	Meaning
AMP	Asset Management Plan
CSO	Combined Sewer Overflow
DMS	Discharge Mechanism Summary
DWF	Dry Weather Flow
DCWW	Dwr Cymru Welsh Water
EDM	Event and Duration Monitoring
FIP	Full Investigation Plan
FFT	Flow to Full Treatment
MVS	Minimum Viable Solution
NGR	National Grid Reference
OVA	Options Value Analysis
PFF	Pass Forward Flow
FPF	Flow Pass Forward
SAS	Surplus Activated Sludge
SOAF	Sewer Overflow Assessment Framework
SPS	Sewage Pumping Station
SRP	Spill Reduction Plan
STMF	Storm Tank Flow
STMRF	Storm Tank Return Flow
TEN	Trigger Event Notification
WWTW	Wastewater Treatment Works
BW	Bathing Water

1.2. Appendix B: Attachment, AMP4 Sub-Catchment Schematic Drawing

W710-4DC2109701-P07001 Layout1.pdf

1.3. Appendix C: Attachment, EDM – DMS Schematic layout

Knab Rock Sps - DMS Schematic2025