Drainage and Wastewater Management Plan

Pagham
Wastewater System Plan

from Southern Water

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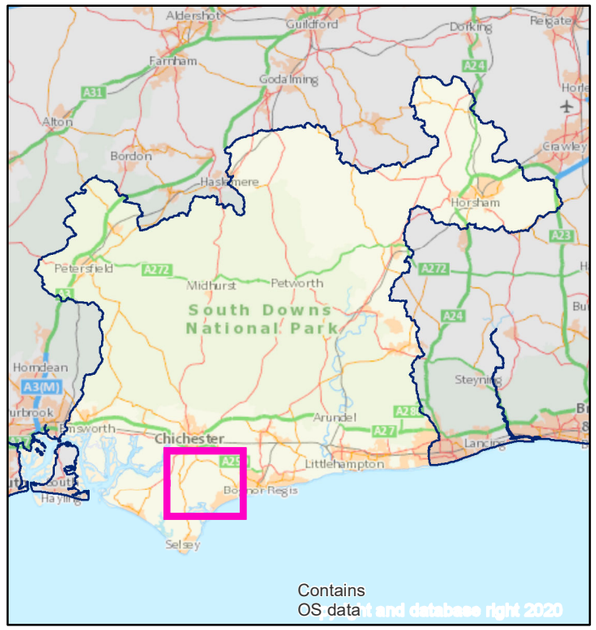
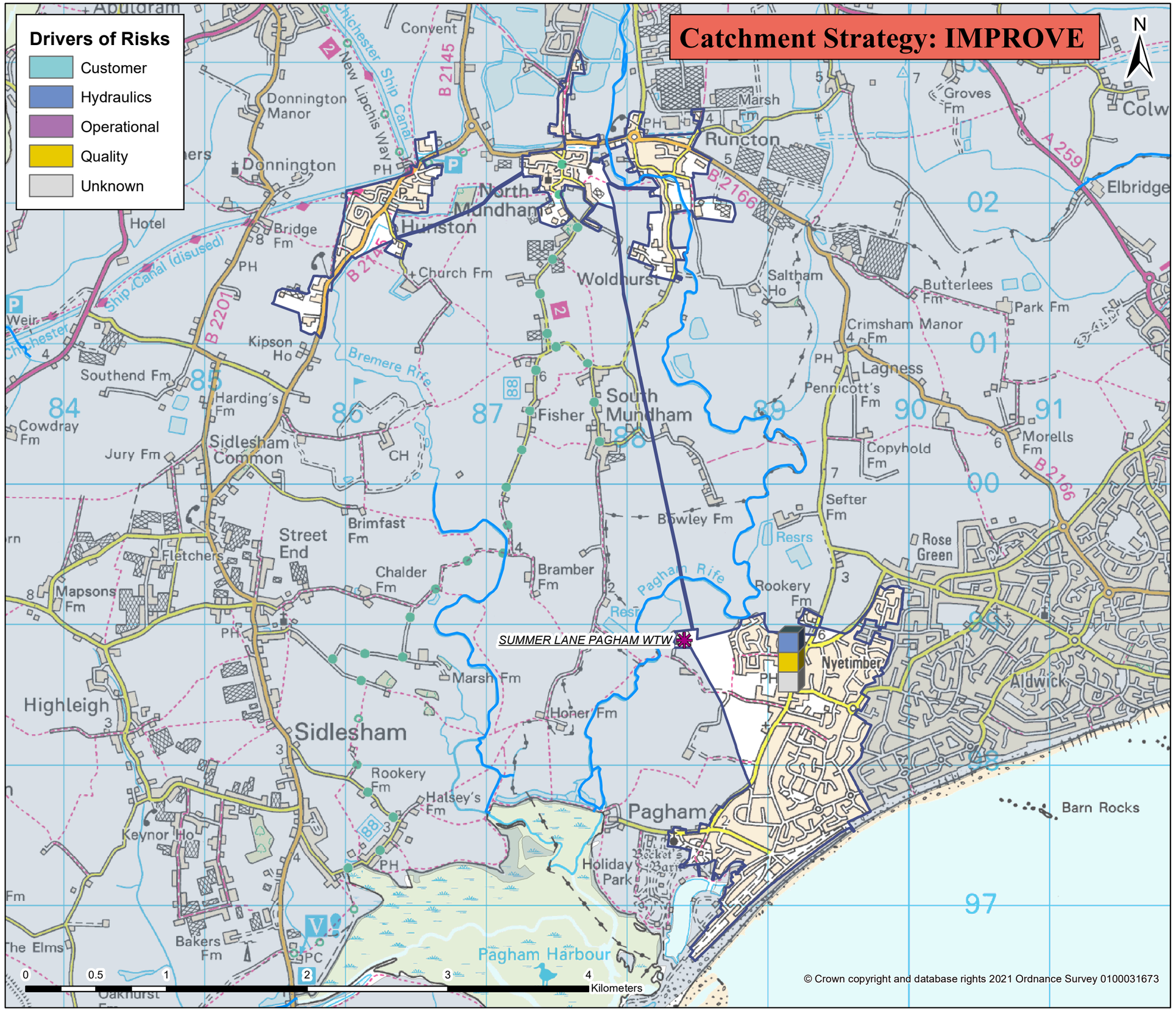
Pagham wastewater system: map and key facts



Population Equivalent (PE)	**9,664**
Discharge Waterbody	**Pagham Rife**
Number of Pumping Stations	**16**
Number of Overflows	**3**
Length of Sewer (km)	**112.0**
Catchment Reference	**PAGM**

BRAVA Results Table (PAGM)

	Planning Objective	2020	2050
1	Internal Sewer Flooding Risk	0	
2	Pollution Risk	0	
3	Sewer Collapse Risk	0	
4	Risk of Sewer Flooding in a 1 in 50 year storm	0	0
5	Storm Overflow performance	1	1
6	Risk of WTW Compliance Failure	0	0
7	Risk of flooding due to Hydraulic Overload	0	0
8	Dry Weather Flow Compliance	1	1
9	Good Ecological Status / Potential	0	
10	Surface Water Management	0	
11	Nutrient Neutrality	2	2
12	Groundwater Pollution	0	
13	Bathing Waters	0	
14	Shellfish Waters	NA	



Problem Characterisation

Pagham (PAGM)

This document describes the causes of the risks identified by the Baseline Risk and Vulnerability Assessment (BRAVA). The BRAVA results for this wastewater system are summarised in Table 1. The results indicate that pollution and water quality are the main concerns in this wastewater catchment. We have completed risk assessments for 2050 where we have the data and tools available to do so. For the other planning objectives, we will explore how we can predict future risks for the next cycle of DWMPs. All the risk assessment methods need to be reviewed after the first DWMPs have been produced with a view to improve the methods and data for future planning cycles.

Table 1: Results of the BRAVA for Pagham wastewater system

Planning Objectives		2020	Driver	2050
1	Internal Sewer Flooding Risk	0	-	
2	Pollution Risk	0	-	
3	Sewer Collapse Risk	0	-	
4	Sewer Flooding in a 1 in 50-year storm	0	-	0
5	Storm Overflow Performance	1	Hydraulic	1
6	WTW Water Quality Compliance	0	-	0
7	Flooding due to Hydraulic Overload	0	-	0
8	WTW Dry Weather Flow Compliance	1	Quality	1
9	Good Ecological Status / Good Ecological Potential	0	-	
10	Surface Water Management	0	-	
11	Nutrient Neutrality	2	Unknown	2
12	Groundwater Pollution	0	-	
13	Bathing Waters	0	-	
14	Shellfish Waters	NA	-	

Key

BRAVA Risk Band	
NA	Not Applicable*
0	Not Significant
1	Moderately Significant
2	Very Significant

*No issues relevant to planning objective within Wastewater System

Investment Strategy

The risks identified in this wastewater system mean that we have assigned the following investment strategy:

Improve

This means that we consider that the current performance of the drainage and wastewater system needs to be improved to reduce the impacts on our customers and/or the environment. We will plan investment to reduce the current risks by actively looking to invest capital funding in the short term to address current performance issues (and consider future risks when implementing improvements).

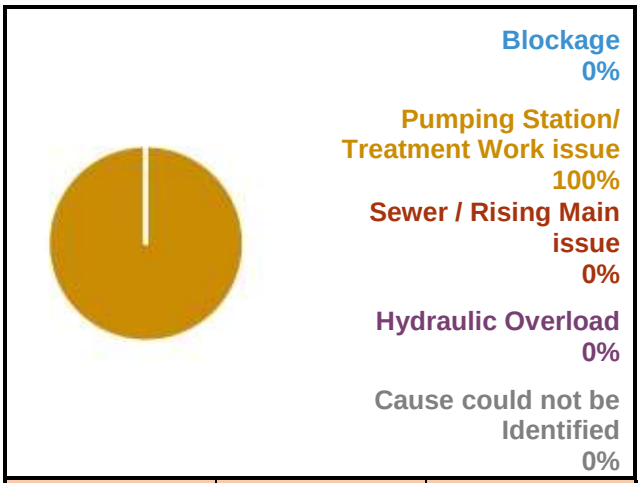
Planning Objective 1: Internal Sewer Flooding Risk

There have been zero (or less than 3) internal flooding incidents reported during the three year period considered by the risk assessment, so the risk is in the 'not significant' band.

Planning Objective 2: Pollution Risk

The number of pollution incidents reported during the three years considered by the risk assessment are shown in Figure 1. The length of sewer in this wastewater system means there have been less than 24.51 incidents per 10,000km per year (a threshold set by Ofwat) so the risk is in the 'not significant' band.

Figure 1: Number of pollution incidents per annum and causes



2017	2018	2019
0	0	1

Planning Objective 3: Sewer Collapse Risk

The number of sewer collapses reported during the three years considered by the risk assessment are shown in Table 2. The length of sewer in this wastewater system means there have been less than 5.72 incidents per 1,000km per year (a threshold set by Ofwat) so the risk is in the 'not significant' band.

Table 2: Sewer collapses and rising main bursts

Sewer Collapse	**2017/18**	1
	2018/19	1
	2019/20	0
Rising Main Bursts	**2017/18**	0
	2018/19	0
	2019/20	0

Planning Objective 4: Sewer Flooding in a 1 in 50 Year Storm

The risk of flooding in a 1 in 50 year storm is not significant in 2020 or 2050. This is because our computer model of the sewer network indicate for 2020 that approximately 10 - 20 properties within this wastewater system are in areas that could flood by water escaping from sewers.

Our wastewater networks are generally designed with capacity for up to a 1 in 30 year storm, hence flooding is expected to occur during more severe storms such as a 1 in 50 year event. Flooding will occur due to insufficient capacity of the drainage system either on the surface before it enters the drainage system, and/or from manholes, in people's homes or at a low point elsewhere in the system.

Planning Objective 5: Storm Overflow Performance

The storm overflow performance risk has been assessed as moderately significant in 2020 and 2050. Table 3 shows the overflows that discharge above the low threshold set for storm overflow discharges to Shellfish Water, Bathing Water and inland rivers.

The primary driver for the Storm Overflow Performance is 'Hydraulic.'

Table 3: Overflows exceeding discharge frequency threshold per annum

	Number of overflows		Threshold for number of discharges per annum		
	2020	2050	Low	Medium	High
Shellfish Waters	0 Medium	0 Medium	Less than 8	Between 8-10	10 or more
Bathing Waters	0 Medium	1 Medium	Less than 3	Between 3-10	10 or more
Freshwater	1 Medium	1 Medium	Less than 20	Between 20-40	40 or more

Planning Objective 6: Wastewater Treatment Works Water Quality Compliance

The risk of non-compliance with our wastewater quality permit has been assessed as not significant for both 2020 and 2050. This is because the wastewater treatment works has no record of compliance failure during the last three years (2018-2020).

Planning Objective 7: Flooding due to Hydraulic Overload

Our initial assessment is that flooding from hydraulic overload is not significant in this wastewater catchment for both 2020 and 2050. Our network modelling indicates that the risk of flooding due to hydraulic overload is not significant in this wastewater system. This is because there are a small proportion of properties in areas at risk from flooding as shown in Table 4.

Table 4: Annualised number of properties at risk per 10,000 connections.

Rainfall Return Period (yr)	Number of Properties at Risk		Annualised per 10,000 connections	
	2020	2050	2020	2050
1 in 1	0	0	0	0
1 in 2	0	1	0	0
1 in 5	1	9	0	2
1 in 10	9	9	1	1
1 in 20	9	17	0	1
1 in 30	9	17	0	1
Total Annualised			**2**	**4**

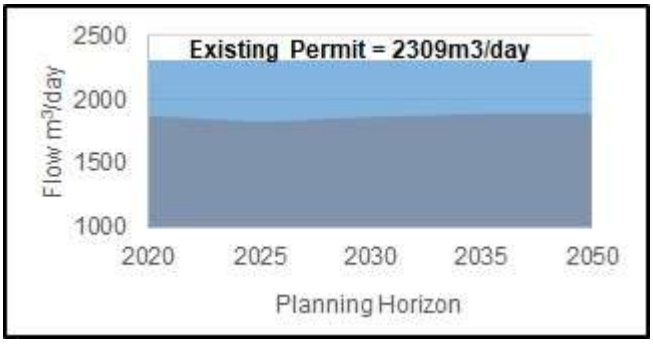
This indicates that the wastewater network currently has capacity for storm events for which the system was designed and the capacity is unlikely to be exceeded in the future.

Planning Objective 8: Wastewater Treatment Works Dry Weather Flow Compliance

The risk of Wastewater Treatment Works Dry Weather Flow Compliance is moderately significant for both 2020 and 2050. This is because the average annual dry weather flow for 2017, 2018 and 2019 has been between 80% and 100% of the current permit, shown in Figure 2. The predicted DWF in 2050 is also expected to remain below 100% of the current permit.

The primary driver is 'Quality' due to the permit and capacity at the treatment work.

Figure 3: Recorded and predicted dry weather flow with existing permit



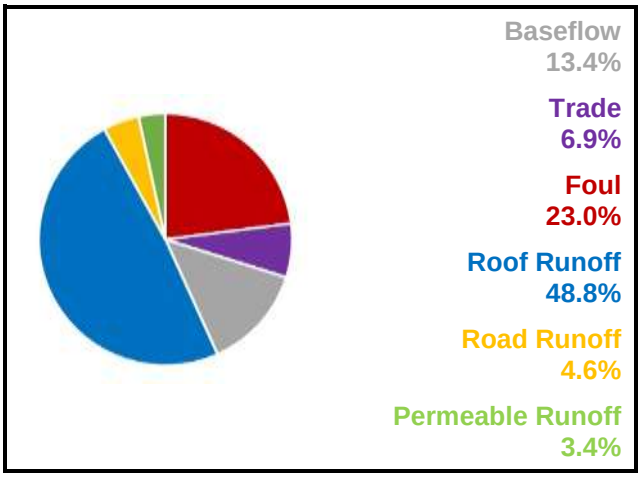
Planning Objective 9: Good Ecological Status / Good Ecological Potential

This wastewater system is not hydraulically linked to a waterbody where wastewater operations are contributing to not achieving GES/GEP, therefore the risk is not significant.

Planning Objective 10: Surface Water Management

Figure 3 illustrates the sources of water flowing in the wastewater system during a 1 in 20 year storm. It shows that surface water runoff from roofs, road and permeable surfaces constitutes more than 56.8% of the flow in the sewers. The total contribution of foul water from homes is 23.0% with business contributing 6.9%. The baseflow is infiltration from water in the ground and makes up 13.4% of the flow in the system.

Figure 3: Sources of water flowing in sewers during a 1 in 20 year storm



Planning Objective 11: Nutrient Neutrality

The risk to internationally designated habitat sites from this wastewater system is very significant in 2020 and 2050. This is because Natural England have advised that there is a risk to condition for the habitat sites that are hydraulically linked to our wastewater system, listed in Table 5.

Table 5: Habitat Sites hydraulically linked to wastewater system

Habitat Sites	
Pagham Harbour	Phosphate and Nitrate permit review required Overflow Spills
Solent and Dorset Coast	Phosphate and Nitrate permit review required Overflow Spills

Planning Objective 12: Groundwater Pollution

The risk of Groundwater Pollution is not significant. This is because the wastewater network in this wastewater system does not overlap with any groundwater Source Protection Zones (SPZ) used for water supply.

Planning Objective 13: Bathing Waters

The designated bathing waters that could be affected by discharges from this wastewater system are shown in Table 6, along with the current classification from the Environment Agency. The risks from this wastewater system on these bathing waters is not significant. This is because all the designated bathing waters affected by this wastewater system have passed annual inspections..

Table 6: Bathing Water annual results

Bathing Waters	Annual Results		
	2017	2018	2019
Pagham	Good	Excellent	Excellent

Planning Objective 14: Shellfish Waters

The discharges from this wastewater system do not impact on any designated shellfish waters.

Generic Options Assessment for: Pagham (PAGM)

Planning Objectives		2020	Driver	2050
PO1	Internal Flooding	0	-	-
PO2	Pollution Risk	0	-	-
PO3	Sewer Collapse	0	-	-
PO4	Risk of Sewer Flooding in 1 in 50 yr	0	-	0
PO5	Storm Overflow Performance	1	Hydraulic	1
PO6	Risk of WTW Compliance Failure	0	-	0
PO7	Annualised Flood Risk/Hydraulic Overload	0	-	0
PO8	DWF Compliance	1	Quality	1
PO9	Achieve Good Ecological Status	0	-	-
PO10	Improve Surface Water Management	0	-	-
PO11	Secure Nutrient Neutrality	2	Unknown	2
PO12	Reduce Groundwater Pollution	0	-	-
PO13	Improve Bathing Water Quality	0	-	-
PO14	Improve Shellfish Water Quality	NA	-	-

Type of Measures	Generic Option Categories	Icon	Take Forward?	Reasons	Examples of Generic Options
Source (Demand) Measures (to reduce likelihood)	Control / Reduce surface water run-off		Y	-	Natural Flood Management; rural land management and catchment management; SuDS including blue and green infrastructure; storm management
	Reduce groundwater levels		N	Reducing groundwater levels would reduce the risks from infiltration into the network. However, in practice, reducing groundwater levels will be detrimental to the environment, ground conditions and is prohibitively too costly to implement. For these reasons, this generic option has been discounted.	Reduce leakage from water supply pipes; pump away schemes to locally lower groundwater near sewer network
	Improve **quality** of wastewater		N	None of the significant risks are caused by the quality of wastewater entering the wastewater system.	Domestic and business customer education; incentives and behaviour change (reduce Fats, Oils & Grease, wet wipes etc.); monitoring trade waste at source; on-site black water and/or greywater pre-treatment
	Reduce the **quantity** / demand		Y	-	Water efficient appliances; water efficient measures; blackwater and/or greywater re-use; treatment at source
Pathway (Supply) Measures (to reduce likelihood)	Network Improvements		Y	-	Asset optimisation; additional network capacity; storage; separate flows; structural repairs; re-line sewer pipe and manholes; smart networks.
	Improve Treatment Quality		Y	-	Increase treatment capacity; rationalisation of treatment works (centralisation / de-centralisation); install tertiary plant; UV plant or disinfection facilities; innovation; improve Technical Achievable Limits; new WTWs
	Wastewater Transfer to treatment elsewhere		N	The causes of risk are not due to where our systems discharge to the environment or our ability to increase the capacity to connect more homes. Transferring wastewater for treatment elsewhere will not reduce any of the significant risks in this catchment.	Transfer flow to other network or treatment sites; transport sewage by tanker to other sites
Receptor Measures (to reduce consequences)	Mitigate impacts on Air Quality		N/A	Not included in first round of DWMPs	Carbon offsetting; noise suppression /filtering; odour control and treatments
	Improve Land and Soils		N/A	Not included in first round of DWMPs	Sludge soil enhancement
	Mitigate impacts on receiving waters		Y	-	River enhancement, aeration
	Reduce impact on properties		N	There are no properties affected by the significant risks in this catchment, hence reducing impacts at property level will not mitigate any significant risks.	Property flood resilience; non-return valves; flood guards / doors; air brick covers
Other	Study / Investigation		N	No further studies are required at this stage	Additional data required; hydraulic model development; WQ monitoring and modelling

August 2021
Version 1

Pahgam Wastewater System - Outline Options Appraisal

Generic Option	Location of Risk	Planning Objective and Description of Risk	Option Reference	Description	Further Description	Unconstrained Option?	Constrained Option?	Feasible Option?	Net Benefits	Estimated Cost	Preferred Option	Best value / Least cost or Reasons for Rejection
Control/ Reduce surface water entering the sewers												
Control / Reduce groundwater infiltration												
Improve quality of wastewater entering sewers (inc reducing FOG, RAG, pre-treatment, trade waste)												
Control / Reduce the quantity / flow of wastewater entering sewer system	SUMMER LANE PAGHAM WTW	PO8 (2050)- Dry Weather Flow	PAGM.SC04.1	Water Efficient Appliance / Measures	Southern Water aims to reduce water consumption to 100 l/h/d by 2040.	No						Deliver the required outcome
Network Improvements (eg increase capacity, storage, conveyance)	Catchment Wide	PO8 (2050)- Dry Weather Flow	PAGM.PW01.1	Pipe Rehabilitation Programme	Relining/improving structural grades of sewers across the catchment.	No						Cost Effective and Deliver the required outcome
Improve treatment (capacity and quality at existing works or develop new WTWs)	SUMMER LANE PAGHAM WTW	PO8 (2050)- Dry Weather Flow	PAGM.PW02.1	Permit Review	Proposed permit-2425m3.	Yes	Yes	Yes	Minor Positive +	£2,635K	Yes	Best Value
Wastewater Transfer	SUMMER LANE PAGHAM WTW	PO8 (2050)- Dry Weather Flow	PAGM.PW03.1	Construct New WPS & Rising Main	Within 10km radius of PAGM is LAVA which in 2050 will have approximately 903m3day of headroom (until it is above 80% of its DWF permit).	No						Cost Effective
Mitigate impacts on Air Quality (e.g. Carbon neutrality, noise, odour)												Not included in the first round of DWMPs
Improve Land and Soils												Not included in the first round of DWMPs
Mitigate impacts on Water Quality												
Reduce consequences Properties (e.g. Property Flood Resilience)												
Study/ investigation to gather more data	Catchment Wide	PO8 (2050)- Dry Weather Flow	PAGM.OT01.1	Infiltration Reduction Plan	Relining/improving structural grades of sewers across the catchment.	No						Risk and uncertainty - future resilience
Study/ investigation to gather more data	Pagham Harbour Solent and Dorset Coast	PO11 - Nutrient Neutrality	PAGM.OT01.2	Nutrient Budget	Catchment is Hydraulically linked to; Pagham Harbour (Threat/Remedy Identified or Anticipated) Solent and Dorset Coast (Threat/Remedy Identified or Anticipated).	Yes	Yes	Yes	Major Positive +++	£75K	Yes	Best Value
Study/ investigation to gather more data	Catchment Wide	PO5- Storm Overflow	PAGM.OT01.3	Storage	Storage.	Yes	Yes	Yes	Minor Positive +	£1,000K	Yes	Best Value
Study/ investigation to gather more data	Catchment Wide	PO5- Storm Overflow	PAGM.OT01.4	Improve Hydraulic Model	Improve Hydraulic Model.	Yes	Yes	Yes	Minor Positive +	£225K	Yes	Best Value
Study/ investigation to gather more data	Catchment Wide	PO4 PO7 PO10 Flooding & Drainage, Water Resources, Infiltration	PAGM.OT01.5	Rainwater Harvesting	Study: Use of rainwater harvesting to be considered within routine planning objectives.	Yes	Yes	Yes	Minor Positive +	£TBC - With Partners	No	Best Value
Study/ investigation to gather more data	Summer land Pagham WTW	PO8 PO11	PAGM.OT01.6	DWF at WTWs	Study: Explore the option of transferring wastewater for treatment elsewhere due to predicted growth in the system and the environmental constraints on expansion of the works discharging into designated waters.	Yes	Yes	Yes	Minor Positive +	£TBC - With Partners	No	Best Value

DWMP Investment Needs

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

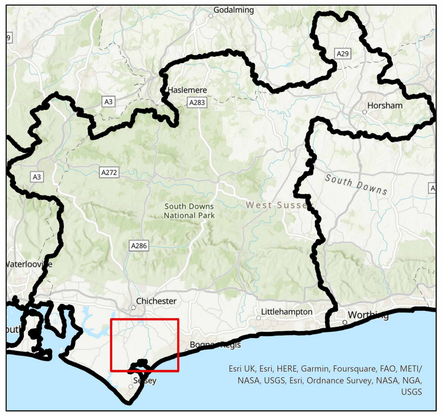
7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2023
Version : 1.0

Reference	River Basin (L2)	Wastewater System (L3)	Location	Option	Indicative Cost	Indicative Timescales	Potential Partners	Applicable Planning Objectives
Arun and Western Streams								
Pagham								
PAGM.CONS01.1	Arun and Western Streams	Pagham	Pagham	Growth scheme from our Drainage Area Plan (DAP): Upsizing or separation	£TBC	AMP10	West Sussex County Council	PO5 PO8 PO11
PAGM.PW02.1	Arun and Western Streams	Pagham	Summer land Pagham WTW	Increase capacity to allow for planned new development	£4,000K	AMP8	-	PO8
PAGM.OT01.4	Arun and Western Streams	Pagham	System Wide	Improve the Hydraulic Model: Surveys and reverification of model to improve confidence and accuracy	£225K	AMP8	-	PO5
PAGM.OT01.6	Arun and Western Streams	Pagham	Summer land Pagham WTW	Study: Explore the option of transferring wastewater for treatment elsewhere due to predicted growth in the system and the environmental constraints on expansion of the works discharging into designated waters.	£TBC	AMP8	-	PO8 PO11
PAGM.WINEP01.1	Arun and Western Streams	Pagham	SUMMER LANE PAGHAM SSO	Reduce the number of storm discharges from SUMMER LANE PAGHAM SSO by a combination of SuDS and storage options	£1,895K	AMP8	-	PO4 PO5 PO7
PAGM.WINEP01.2	Arun and Western Streams	Pagham	MAIN ROAD HUNSTON CEO	New or improved screen to reduce aesthetics impacts from storm discharges at MAIN ROAD HUNSTON CEO	£130K	AMP12	-	PO5
PAGM.WINEP.PO2.1	Arun and Western Streams	Pagham	Pagham WTW	Action to reduce total phosphorus and/or total nitrogen levels from discharges which drain to internationally designated sites where there is a risk from nutrients	£6,545K	AMP10	-	PO9 PO11

Drainage and Wastewater Management Plan: Location of Potential Options PAGHAM Wastewater system in Arun and Western Streams River Basin Catchment

(i) This map should be read in conjunction with the list of Investment Needs for this wastewater system
(ii) The areas shown on this map are the potential locations for the options. The location of the risk may be elsewhere in the system.
(iii) Labels for each location are the option references in the list of Investment Needs
(iv) Drainage Area Plan (DAP) options on flooding and growth are not shown.



- Customer Education
- Pipe Rehabilitation
- Asset Resilience
- Wastewater Treatment
- WINEP Nutient Neutrality
- WINEP Storm Overflows

PAGM.WINEP01.2
PAGM.WINEP01.1
PAGM.PW02.1
PAGM.WINEP.PO2.1

N

0 0.28 0.55 1.1 1.65 2.2 Kilometers