Appendix 7 – Minimising sewer flooding: Response to IAP

Wessex Water

March 2019

Wessex Water
YTL GROUP

Summary

This appendix sets out the changes we have made to our investment programme and provides additional evidence in relation to Ofwat's cost assessment for drivers related to minimising sewer flooding.

Reductions in forecast expenditure

Our September submission proposed a very challenging target for internal flooding, which we set at our calculated upper quartile (UQ) position. Ofwat's initial assessment of our plan (IAP) calculated the upper quartile target profile for internal flooding with slightly less stretching values. IAP action WSX.OC.16 requested that we change our committed performance levels to match the IAP profile. We have done this and also reduced the forecast expenditure, accordingly, as summarised below:

Ofwat model / driver	Reduction (totex) £m	Changes
Internal flooding reduction: • Annual target updated to UQ position specified in action WSX.OC.16 (e.g. 2024/25 target changed from 1.24 to 1.34 per 10,000 properties)	- 2.2	• Revised PC target for internal flooding updated to the UQ profile • Revised business plan enhancement expenditure tables

Additional evidence

We have reviewed the growth model and the deep dive assessments for minimising sewer flooding and provide a response on all the efficiency challenges included in the IAP.

Key issues that we request are considered in the draft determination are summarised below, with the quantum shown in the subsequent table:

- **Enhancement and maintenance Opex**
  We do not agree that it is possible to absorb the operating costs of a major step change to reduce the number of flooding incidents (internal and external) to below our current levels of service. Additional opex (£6.8m) is required for us to improve our flooding service levels.
- **Cost model**
  Ofwat's growth model reduces our proposed flooding programme capex from £80m to £54m. The growth model does not include other activities that we included in our proposed minimising sewer flooding programme. We provide additional evidence that flooding other causes, groundwater inundation and drainage and wastewater management plans are not related to growth and should be allowed for separately.
- **Cost adjustment claim deep dive**
  We provide additional evidence to all the points raised in the deep dive in the following sections and Annexes. This includes providing a more detailed hydraulic flooding programme with preferred options.

The quantum of the challenges of the flooding programme are summarised in the table below, along with our response and suggested actions for Ofwat for the draft determination.

	September submission value (£m)	Our response to the growth model and CAC	Value challenged (£m)	Suggested actions for Ofwat
Minimising sewer flooding (Table WWS2 L30 and L77)	Hydraulic flooding 47.5 Capex 0.5 Opex	Hydraulic flooding is not all related to growth. See Section 3.2 for additional evidence regarding the hydraulic flooding programme.	25.7 Capex 6.8 Opex	Review deep dive assessment based on the latest evidence. Allow costs in addition to growth model.
	Flooding 'other causes' 10.3 Capex 6.3 Opex	We have updated our PC target and costs for internal flooding in line with Ofwat's assessment of upper quartile position. We consider that Ofwat's base model does not allow for the costs of improving our service levels to the stretching UQ targets and the ODI mechanism will not fund the required works. Flooding 'other causes' is not related to growth. Additional evidence provided in Section 3.3.	-1.4 Capex -0.8 Opex	Allow enhancement capex and opex costs as submitted, adjusted for the reductions of £1.4m capex and £0.8m opex for the change in Internal flooding targets.
	Groundwater inundation of sewers 9.5 Capex	We are one of only a few companies are affected by groundwater inundation, and the programme of work to seal sewers is not reflected in Ofwat's models. Additional evidence is provided in Section 3.4.		Allow capex costs as submitted in our cost adjustment claim. Allow costs in addition to growth model.
	Drainage and wastewater management plans 12.7 Capex	This is a new obligation that requires a step change in asset data and sewer performance analysis. Additional evidence is provided in Section 4.0.		Follow a deep dive approach. Allow costs in addition to growth model.
	Total		**30.3**	

Contents

1. Introduction

This document provides our response to Ofwat's initial assessment of plans (IAP) published on 31 January 2019 with respect to minimising sewer flooding. Relevant documents in our September 2018 submission include:

- *Supporting document 5.4 – Minimising sewer flooding*
- *Supporting document 8.9.A – Claim WSX05 - Flooding programme*
- *Supporting document 8.10.A – Claim WSX06 - Pollution reduction strategy.*

In this document we provide additional evidence and responses in relation to:

- Hydraulic flooding
- Flooding 'other causes'
- Ground water inundation of sewers
- Drainage and wastewater management plans.

Section 2 below describes Ofwat's growth model, which Ofwat carried out as part of its assessment of enhancement related to growth.

We consider that there should be a separate sewer flooding model, rather than combining this with growth. This is because companies have different legacy hydraulic flooding issues and because sewer misuse, groundwater infiltration inundation, modelling, urban creep and climate change are not related to growth. The growth model is discussed in Section 2 below and in Section 2 of Appendix 10.

Section 3 comments on the deep dive on the cost adjustment claim for sewer flooding, with more evidence in the following sections and in the Annexes.

Section 4 provides our response on the action (WSX.CMI.A2) related to Drainage and wastewater management plans.

2. Ofwat's growth model

The growth model for enhancement investment triangulates companies' historical and future growth projections (new connections) against the sum of expenditure for wastewater growth (supply demand balance), treatment works growth and sewer flooding programmes. The growth model is also covered in Section 2 of *Appendix 10 – Accommodating growth and new development*.

We consider that there should be a separate sewer flooding model, rather than combining this with growth. This is because the majority of flooding is not related to growth. Some of the main causes of flooding and drivers for investment such as sewer misuse, groundwater inundation, and drainage and wastewater planning are not related to growth. Our minimising sewer flooding cost adjustment claim (CAC) included our investment proposals related to all these drivers:

- Hydraulic flooding can be caused by growth, which is why we have a separate 'New development and growth' proposal reported in Document 5.7 and our IAP response in Appendix 10. The proposed £48m for hydraulic flooding improvements is to address legacy assets and more general urban creep and climate change resilience. See below and section 3.2.
- 80% of flooding incidents are due to flooding other causes (including sewer misuse). These are not related to growth. They are most commonly caused by blockages, 75% content of which are due to customers flushing 'non-flushable' products. See section 3.3.
- Groundwater inundation is not related to growth. See section 3.4.
- Drainage and wastewater planning is an extension of our Drainage Area Planning. In AMP6 and previous AMPs we have spent £0.7m on these a year through capital maintenance. Due to the statutory status that DWMPs will have, we are required to make a step change in this activity and complete the work by 2022. See section 4.0.

As we reported in Document 8.9.A section 4.3 (extracted in Figure 2-1 below), urban creep and climate change will have a much larger impact on flooding risk, compared to the small amount of foul flows generated from new connections. This is even more likely now following the recent UKCP18 predictions of climate change having more intense rainfall than UKCIP09 which was used when Ofwat commissioned the flooding study in 2011.

Figure 2-1: Ofwat's report showing growth, creep and climate change implications

Median increase in sewer flooding, %	50th percentile
Population growth	5
Property creep	12
Climate change	27
Combined	**51**

We consider that our flooding allowance includes more activities than the Ofwat's growth model includes. In addition to the growth model allowance, there should be allowances for infiltration reduction, flooding other causes and drainage and wastewater management plans.

The different drivers which trigger investment decisions for the three areas within Ofwat's growth model are summarised in Table 2-1 below. This reinforces the point that sewer flooding investments have different drivers to the other areas included in the overall growth model in the IAP.

Table 2-1: Complexities and variation in investment drivers

Area	Activity	Investment driver			
		Regional new connections	Local STW capacity	Local sewerage capacity	Statutory obligation
STW growth	Increase in capacity	✓	✓	✗	✗
	Capacity provision in synergy with WINEP	✓	✓	✗	✓
	DWF schemes	✓	✓	✗	✗
	Strategic capacity enhancement (Poole STW)	✓	✓	✗	✗
New development and growth	Increase in sewerage capacity	✓	✗	✓	✗
Sewer Flooding	Hydraulic flooding (excl. growth)	✗	✗	✓	✗
	Sewer misuse	✗	✗	✗	✗
	Groundwater inundation	✗	✗	✓	✗
	DWMP	✗	✗	✗	✓

3. Minimising sewer flooding

3.1 Ofwat's deep dive into the flooding cost adjustment claim

In the deep dive on the Flooding programme our proposals received four partial passes and two fails, as follows:

- Need for investment – Partial Pass
- Need for adjustment – Fail
- Management control – Partial Pass
- Best option for customers – Partial Pass
- Robustness and efficiency of costs – Fail
- Customer protections – Partial Pass.

The overall reason given was:
'*The company is planning to improve its performance on sewer flooding beyond the expected benchmark level. It provides evidence of a range of feasible approaches with costs but* ***does not present detailed programmes of work****. An allowance is made for this activity under our assessment of enhancement expenditure. Any claim for investment* ***beyond*** *this is rejected on the need for adjustment as funding to deliver performance beyond the benchmark level is provided through* ***ODI out-performance payments***.'

Our September submission proposed a very challenging target for internal flooding, which we set at our calculated upper quartile (UQ) position. Ofwat's initial assessment of our plan (IAP) acknowledged that our internal flooding target was ambitious and calculated the upper quartile target profile for internal flooding with slightly less stretching values.

IAP action WSX.OC.16 suggested to change our service levels to reflect the IAP profile. **We have updated our internal flooding target to match Ofwat's calculated upper quartile position**, summarised in Table 3-1. We have reduced our costs proportionately to reflect the updated flooding (internal) service level target. We have reduced the Capex for flooding incidents by £1.4m and Opex allowance by £0.8m.

Table 3-1: PR19 submission PCs and Ofwat's challenge

Measure (Incidents)	PC Type	Unit	PR19 September plan	Ofwat IAP	IAP response
Pollution	OFWAT common measure	Incidents per 10,000 km of sewers	**17** (25% reduction from 2016 position)	**19** (13% reduction from 2016 position)	We have updated our target to match Ofwat's IAP
F1 Internal flooding	OFWAT common measure	Incidents per 10,000 sewer connections	**1.24** by 2025 (22.5% reduction)	**1.34** by 2025 (16.3% reduction)	We have updated our target to match Ofwat's IAP
F2 External flooding	Bespoke measure	Incidents per 10,000 sewer connections	**15.68** (10% reduction)	**15.68** (10% reduction)	No change
F3 Sewer flooding risk	Bespoke measure	Risk score	**50, 651**	**50, 651**	No change

Similarly, in response to Action WSX.OC.30, we have updated our pollutions targets and costs as described in Appendix 4, Section 3.4.1. The flooding (internal), flooding (external) and pollution reduction all contribute to the prevention of escape of sewage.

Our business plan contains several sub-programmes (hydraulic flooding, infiltration sealing, DWMPs and flooding other causes) which are related to the escape of sewage from the sewerage system, as detailed in Table 3-2. Scenario 2 in this table shows the implications on our hydraulic flooding programme if we did not receive the requested funding. Scenario 3 is our revised IAP submission which reflects the updated UQ flooding upper quartile service levels.

Under scenario 2, we would choose to target the 'other causes' programme of reducing blockages, because this is lower cost for more gain (80% of incidents are due to other causes). This means that our hydraulic flooding programme would be significantly reduced, making a Stable risk score unachievable.

However, as evidenced in Section 3.2 and Annex A we have a significant number of known hydraulic problems.

If in the draft determination our 'flooding' budget is reduced, then we will need to revisit the ODI for the F3 Sewer Flooding Risk score, and consider making this into a Deteriorating projection, rather than stable.

Table 3-2 shows the different funding requirements for the scenarios. Scenario 2 is assuming Ofwat's IAP funding levels with the budget deficit removed from the Hydraulic Flooding programme. This would result in a significantly reduced hydraulic capacity budget, reduced from £48m to £18m. This would increase the risk score by 7000 and result in over 200 properties not having schemes to lower their risk of flooding by 2025. Scenario 3 is our resubmission, with the change in allowance for the updated upper quartile PC targets.

We will be left with a plan that means that the risk of hydraulic flooding will be increasing over time rather than kept stable. As reported in Document 8.9.A the WISER encourages us to reduce the risk of sewer flooding.

Defra's recent surface water action plan[1] also intends to reduce flood risk from all sources. The government has added surface water flooding as on the National Risk Assessment, for the first time. This sets out key risks that the UK faces covering threats from various risks from cyberattacks to natural disasters. It will consider heavy rainfall events over a 3-hour duration with an annual chance of flooding of between 0.005 (i.e. 1 in 200-year return period) and 0.05 (1 in 20 year). Sewer flooding will occur during these event scenarios.

[1] https://www.gov.uk/government/publications/surface-water-management-action-plan

Table 3-2: Risk score implication if underfunded

Outcome		Investment							Scenario 2 - IAP modelled allowance plus WSX requirements			Scenario 3 - Resubmission		
	Description	Capex £m	Opex £m	Totex £m	Justification	Original targets	PC targets	IAP PC targets	Totex £54m	Comment	Impact	Totex £85m	Comment	Impact
Minimising sewer flooding	Additional hydraulic capacity	47.5	0.5	48.0	Delivering frontier performance related to sewer flooding. EA WISER highlights the need for us to continue to reduce the risk of sewer flooding.	Stable flood risk.	Stable flood risk.	Stable flood risk.	17.7	Allows for expenditure to reduce flooding other causes, thus reduction in this budget element. Only 10% incidents related to hydraulic floooding, increasing focus on mitigation only	Risk score increase by 1365 annually. Target plus change over AMP equates to a total of 57478, leading to a penalty of £490k in the last two years of the AMP.	48.0	Stable flood risk.	Stable flood risk.
	Infiltration sealing	9.5	0.0	9.5		10% reduction in internal & external sewer flooding.	22.5% reduction in internal & 10% reduction in external sewer flooding.	16.3% reduction in internal & 10% reduction in external sewer flooding.	9.5	Maintain original submission programme	None	9.5	Maintain original submission programme	None
	Reducing flooding other causes e.g. blockages	10.3	6.3	16.6					14.4	16.3% reduction in internal flooding reduced from 22.5%	None	14.4	16.3% reduction in internal flooding reduced from 22.5%	None
	DWMPs and sewerage modelling	12.7	0.0	12.7	Delivering framework developed by Defra, EA, Ofwat and the industry. Providing visibility of future sewerage needs.	Delivering DWMPs			12.7	Delivery of DWMPs	None	12.7	Delivery of DWMPs	None
		80.0	**6.8**	**86.8**					**54.3**			**84.6**		

3.1.1 Need for investment

The deep dive 'partially passed' our need for investment for the following reasons:
'*WSX will need to proactive manage their sewerage network for the benefit of the environment and its customers. However, it is **not clear what level of customer support** there is for the scale of the reductions in sewer flooding set out in the plan.*

WSX references several customer engagement surveys used to evaluate the customer willingness to pay for the investment to reduce customer property sewer flooding. Report 01.01 - Summary of research findings.pdf provides specific comments namely:
*-In Strategic direction research paragraph, the customers consider 'Areas such as resilience, reliability, sewer flooding and improved water quality were ranked **high in importance but not in need of improvement**.'(p.20) which suggests that support for the flooding programme is questionable. Based on the sample of 5,692 customers, 18% of the survey customers think that 'Reducing the chance of sewage flooding into properties' should be improved while the vast majority- 71% of the survey customers, are **happy with the current level of the service** (p.20).*
*-In Priorities for service improvements NETS - customers paragraph, based on the sample of 1,217 people who returned the magazine survey- only 12% of the respondents **needs** some improvement in addressing sewer flooding (p.78).*
*- In Resilience research, findings indicate that 'Sewer flooding was given a lower priority, due to the perceived **low likelihood** of this happening to customers. Investment activities preferred were modest infrastructure modification rather than major renovations'(p.42).*'

We do not think that the above quotes should provide grounds for a smaller flooding programme. Our customers do support our proposed flooding programme:
'*The priorities that were consistently of highest importance amongst all groups interviewed were "Reducing sewage flooding" and "Reducing leaks" ' is an extract from* pages 18/19 of supporting document report 1.1. Supporting document 8.9.A also mentioned this, with an extract below:

5.2 Customers willingness to pay

Sewer flooding is the worst service failure that customers can experience. Our customer engagement highlighted that internal sewer flooding, external sewer flooding and restricted toilet use were the top three most impactful service failures that customers could experience, ranking higher than restrictions to essential water use, supply interruptions, and any environmental impact. In fact, internal sewer flooding was around 10 times more impactful than supply interruptions,

Fortunately, very few customers are affected by flooding. This is why 71% of the customers are happy with their current level of service. And because most customers are not affected by flooding are not in need of improvement. This does not mean that we can reduce our investment levels. Those that are affected by sewer flooding have been subjected to the worst service failure, especially if it contains foul sewage.

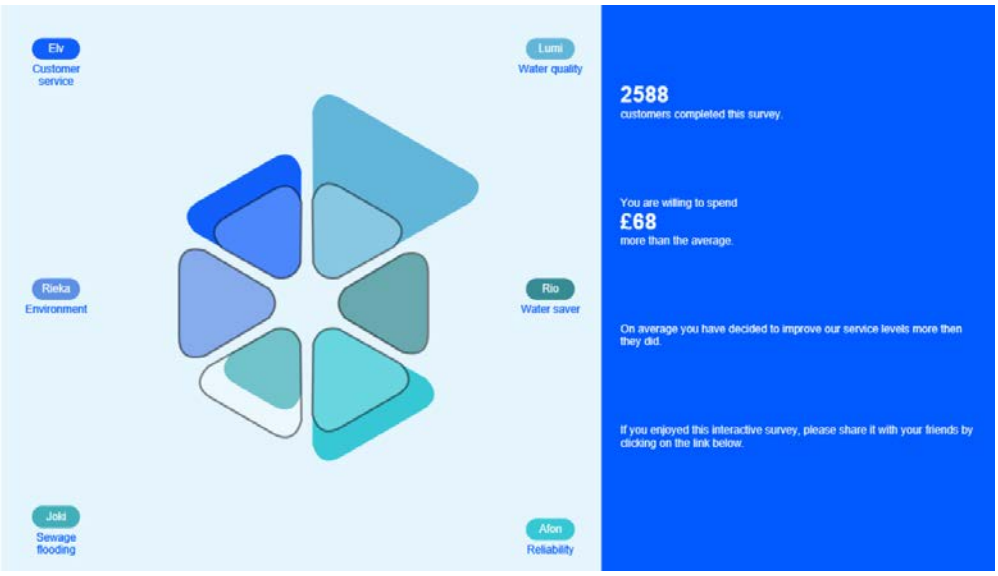
In developing our plan, we wanted to remain upper quartile for internal flooding performance. However, for us to become upper quartile for external flooding, from a just above average position, would require a considerable investment. However, there was more uncertainty on our relative position against other companies due to lack of consistently reported data.

We developed costs of investment needed to improve performance to more and more stretching targets. We did this for pollution incident as well as internal and external flooding. Table 6-2 of document 8.9.A contains the costs and benefit for different investment programmes. We could have proposed a larger flooding investment programme. For example, a 40% external flooding programme was still cost beneficial.

Our customer research, detailed in supporting document 1.1, and appendices, we asked customers to choose which package they preferred. And in the on-line game customers could choose to invest in reducing flooding or leakage, say.

Figure 3-1 shows an extract from Document 1.1.K below shows that in this single customer's opinion would place a lower than average spend on flooding, but would spend more on water quality.

Figure 3-1: Historical annual rainfall total



The conclusions from all this research, was that rather than going for a 40% reduction (which was cost beneficial), we would aim to remain upper quartile for internal flooding and set a modest improvement on external flooding to possibly achieve upper quartile. The reasoning for our targets were summarised in Table 6-3 of document 8.9.A, copied below:

Table 6-3: Proposed PR19 targets for the flooding programme

Measure	Proposed target	Reason
Internal flooding incidents	22.5% reduction	Industry leading, worst service failure, very strong willingness to pay, aiming to maintain frontier performance
External flooding incidents	10% reduction	Approaching upper quartile (limited dataset for comparison), however, definition changes brings uncertainty whether all companies have reported consistently
Sewer flooding resilience risk	Stable risk score	Move to reputational measure, innovative PR14 measure that Wessex Water would like to retain as investment linked to this improves resilience of sewerage assets

Supporting document 3.3 details the cost benefit analysis using our customer values to evaluate optimal investment levels.

3.1.2 Need for adjustment

The deep dive ‘failed’ our need for adjustment for the following reasons:

*‘An allowance for sewer flooding is made under our approach to **enhancement expenditure**. In relation to managing internal sewer flooding any adjustment to this allowance is rejected as the company is funded to deliver performance beyond the benchmark level through **ODI out-performance payments**. No allowance is appropriate in any case for external sewer flooding performance because the company is **not planning to exceed** the benchmark in this area.’*

We think that Ofwat has not made enough allowance for these items (both capex and opex) in its IAP enhancement expenditure. Improved service levels require additional funding.

Additional funding is required in order for us to deliver the reduction in sewer flooding incidents from our current performance, our infiltration reduction plans and the new obligation to prepare Drainage and wastewater management plans.

The growth model combines ‘supply demand’ and flooding into one model and triangulates investment against recent historical and future number of new connections. This approach is good for development driven investment but does not reflect all the drivers of our flooding programme.

As we discussed in Section 2 above, we have included additional activities in our flooding programme that are not related to growth and unlikely to be included in Ofwat’s enhancement model, such as groundwater inundation (£9.5m) and drainage and wastewater planning (£12.7m). If these were added to Ofwat’s IAP allowance of £54.3m, then £76.5m is not too far off our Capex flooding claim of £80m. If flooding other causes are not included in Ofwat’s model then this allowance should increase by £10.3m to £86.8m, which is more than our CAC.

Our current performance for internal sewer flooding is industry leading and we require additional operating cost allowances to push the frontier forwards – although we have reduced the investment required to account for a less tough UQ target.

Our recent External flooding performance (extracted from Document 3.1.a, p124) was:

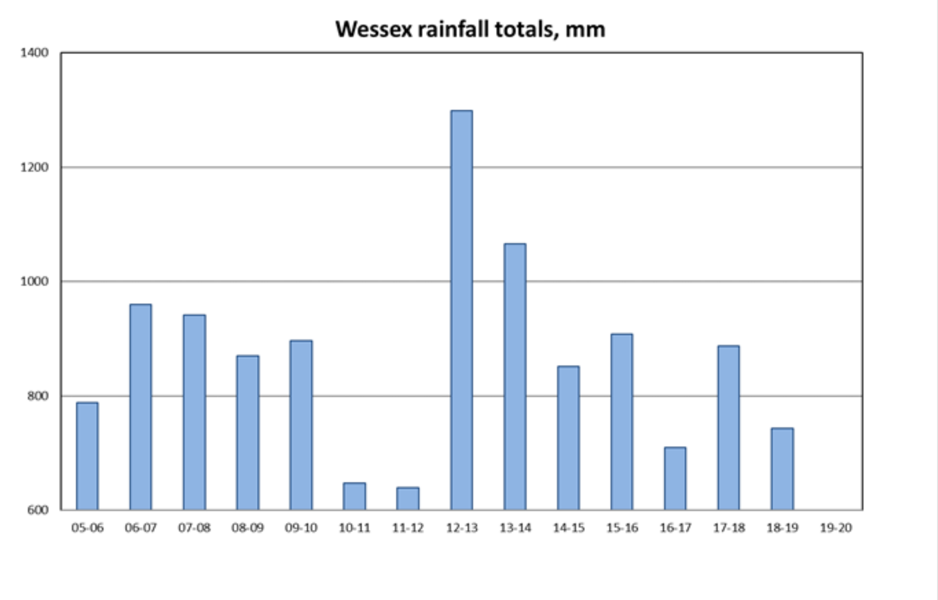
	Unit	2012-13	2013-14	2014-15	2015-16	2016-17
PC	No./10,000 sewer connections	27.35	20.81	18.75	16.79	16.94

Our proposed External flooding target (extracted from Document 3.1.a, p122) is:

	Unit	2020-21	2021-22	2022-23	2023-24	2024-25
PC	No./10,000 sewer connections	17.07	16.73	16.38	16.03	15.68

Flooding incident numbers in any year are heavily dependent on rainfall. The period 2012 to 2015 was wet so our numbers were high (> 20), and recent years the weather was more typical so our number of incidents were lower (around 17). Any target below our recent performance is very challenging.

Figure 3-2: Historical annual rainfall total



We are not expecting to get outperformance payments from this metric. This is because campaigns such as wet wipe behaviour change can take many years before we see any quantifiable improvement. Customers who are not affected by flooding will see not being able to flush wetwipes as an inconvenience – they think it is someone else's problem.

3.1.3 Management control

The deep dive 'partially passed' our management control for the following reasons:

'Performance in this area will be impacted by climate change, urban creep and sewer mis-use, for example. However, these challenges are **not unique** to WSX and are, at least partially, within their control through customer education and the **proactive management of surface water**.'

The extra pressures on our systems from urban creep and climate change (as evidence in Figure 2-1) will mean we will have more flow in our sewers in the future during a rainfall event. However, intense rainfall can occur anywhere already. So even without climate change flooding could happen practically anywhere, during an extremely intense rainfall event. Due to revised reporting definitions these incidents are now reportable as we no longer exclude severe weather events.

The Wessex region is very rural, which is more vulnerable to urban creep in virtue of having more space for extensions, however urban areas can reach saturation points of urban creep.

Connection of new gullies into foul only systems to relieve surface water flooding issues is becoming more common. As the customers have the right to connect, it is difficult to police and prevent this.

The proactive management of surface water is expensive and requires funding.
We have found that surface water management is rarely the most viable solution to address existing hydraulic flooding problems. It is also very disruptive.

Annex A contains a case study that describes one scheme, which residents used to complain to Ofwat about the frequent flooding, that we designed and built. The separation scheme would have cost £10m, whereas a more traditional solution of underground attenuation was delivered for less than £3m. This scheme allows surface water from the highway into the oversized new tank to reduce the risk of property internal flooding from highway flooding.

Our proposed sewer flooding programme in AMP7 does not include allowances for adapting to climate change everywhere – we have too many known flooding issues that we want to address first. When we are delivering a scheme, then that scheme will allow for climate change. The DWMP will be developing a strategy for adaptive pathways for proactive mitigation against climate change in PR24 and beyond.

Retrofitting surface water for better environmental performance is described in Appendix 4, section 6.3 Integrated urban drainage. Sustainable drainage is also mentioned in Appendix 10 to accommodate new growth and is an adaptive pathway option to delay major investment.

We also need to carry on making sure our sewers are operational by cleaning those that are vulnerable to partially block. We already clean 500km a year, but we need to do more, as described in 3.1.5 below. And more than ever before, we need to work hard to influence customers' behaviour and manufacturers / retailers to reduce the likelihood of sewer flooding.

3.1.4 Best option for customers

The deep dive 'partially passed' our options for customers for the following reasons:
'*The company states that their proposed flooding programme is concerned about reducing the risk of flooding to customers through removing risk points and is 'fluid in terms of* ***which schemes will be delivered****, as the priority of any scheme will change as costs and needs are continually refined/updated through the flooding programme process.'(p.29). They present a variety of options that will be considered to address various causes of flooding, as well as a methodology for deriving the best solutions for overloaded sewers, infiltration, operational interventions, customer engagement, enforcement for 'other cause' floods and improving drainage system resilience through Drainage and Wastewater Management Plans (DWMP) (p.24), etc..*

WSX does not provide a breakdown *of the likely options for specific flooding problems. Instead WSX proposes a methodology for derivation of the most cost beneficial solutions that are yet to be determined.* ***The claim would have been better evidenced with a detailed plan****.*'

We have appraised options for 400 known internal or external flooding issues in our area, as shown in Figure 3-3 and Table 3-3. The options are taken from the High Level Assessments that we have carried out to give a likely solution and estimated scheme cost. These are used in our prioritisation process to promote schemes to the next stages of design.

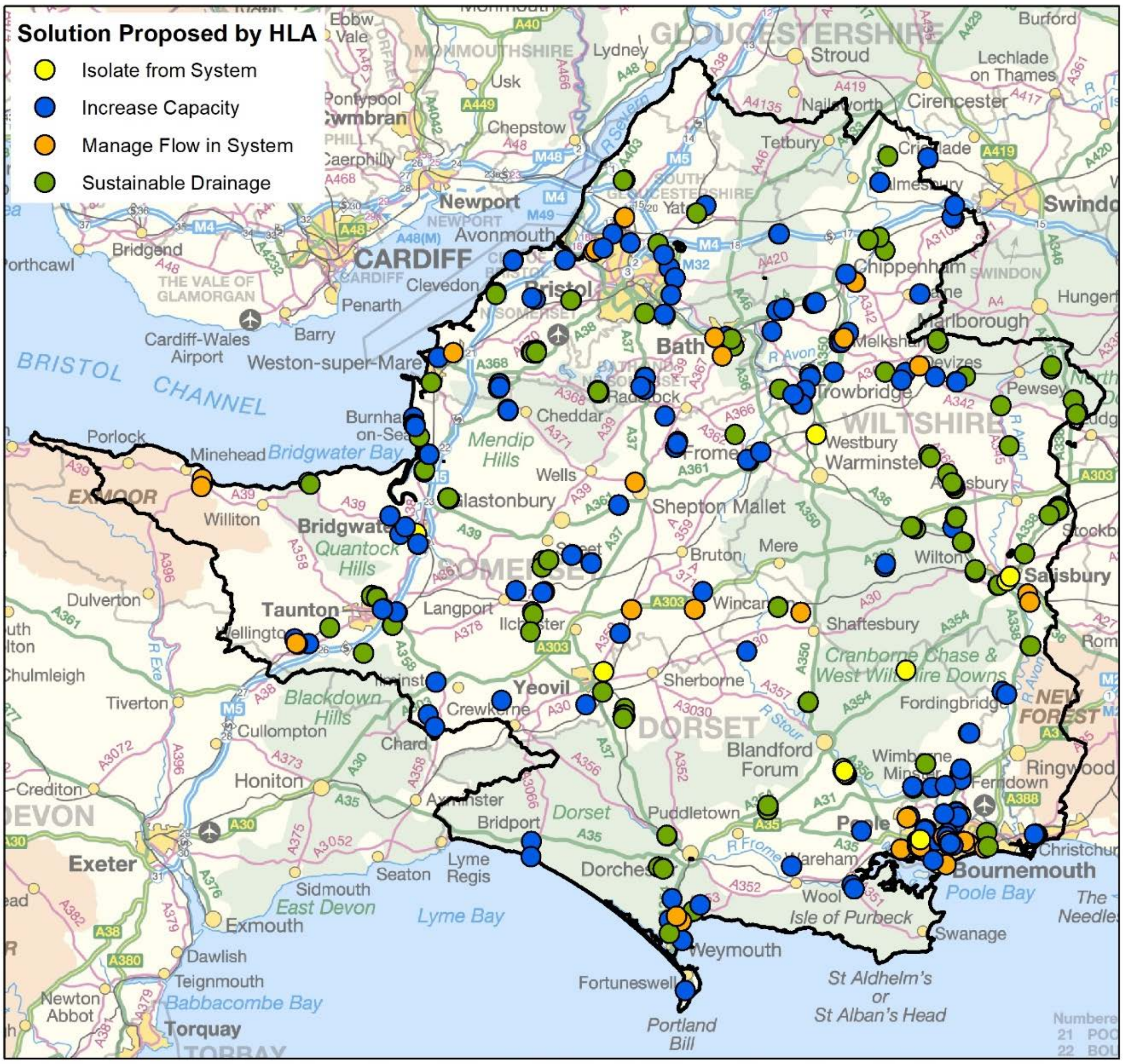
Section 3.2 provides more evidence for these hydraulic schemes, including the number of assessment and construction schemes. Annex A, Section 5.4, provides a breakdown of the 400 likely options for specific flooding problems.

Table 3-3 provides a summary breakdown of the 463 HLA appraisal options we have carried out over the past decade. Each appraisal considers the possible options and using Ofwat's solution codes (from AMP4 guidance). The 'Prioritisation' column contains the likely option type. We also flag if the solutions are strategic (i.e. solution for a large scale flooding issues rather than local schemes) or sustainable. Options for mitigation are also suggested in the HLA appraisals.

Table 3-3: Range of options considered in HLAs

High level assesment solution types	Ofwat AMP4 Solution code	HLA options identified				
		Prioritisation	Strategic	Sustainable Drainage	Mitigation + (R&M)	Other
Isolate from system - storage	X	4	1		8	2
Individual property isolation (by P.Stn)	A	9			18	5
Individual property isolation (by other means)	B	1				1
Isolate area (provide P. Stn)	C	8	7		2	2
Isolate area (provide package treatment plant)	D					
Purchase affected properties	E					
Increase capacity						
Sewer upsizing + new p.stn	F	5	2			
Sewer upsizing or duplication	G	111	61	3	3	21
New or replacement pumping station	H	13	3			3
Pumping station M&E upsizing	I	13	8		2	6
Flow attenuation (storage)	J	60	57	1	3	17
Sewer Upsize + New PS + Flow attenuation	K	2	1			
Sewer Upsize + New PS + New CSO	L	1	2			
Sewer upsizing-duplication + PS M&E upsizing	M	8	8		1	4
Sewer upsizing-duplication + Flow attenuation (one also	N	21	23			18
Sewer upsizing-duplication + Flow diversion (local)	O	26	9		2	15
New/replacement pumping station + flow attenuation	P	4	1			
Manage flow in system						
Flow diversion (local)	Q	33	15	4	2	17
Flow diversion (catchment)	R	16	5	1		1
New CSO	S	11	26		3	11
Temporary solution: eg individual property isolation (by	T	2	1	1	51	8
Control flows entering the system						
Foul-surface separation - infiltration reduction	U	90	20	136	8	9
Surface flow attenuation (eg water butts, dry ponds)	V	3	2	7	1	1
Other (to be specified)	W	22	5	2	64	7
None	-	-	206	308	295	315
Totals		**463**	**463**	**463**	**463**	**463**

Figure 3-3: Potential option selection for known hydraulic flooding



3.1.5 Robust and efficient costs

The deep dive 'failed' our robustness and efficiency of costs for the following reasons:
'*WSX provides a very high-level description of their approach to costing of Flooding programme and how the cost broadly broken down into the following;* ***flooding risk (hydraulic)- £48m, Infiltration- 9.5m, DWMP modelling- £12.7m, Flooding 'other-cause' incidents £17m****. (p.29). Based on Table 7-2 Summary of AMP6 flooding programme (p.30), historically, WSX averagely removed 2,100 flooding [~~locations~~ (correction 'risk points')] every year at cost of approx.* ***£8.5M a year****. This means that the likely whole AMP6 programme cost would be approx. £42.5m whereas the proposed AMP7 Flooding Programme doubles this expenditure and costs £86.8m. WSX claim that their efficient operational costs (8% of the total claim) have been historically driven by having an in-house reactive team rather than awarding a contract to an external supplier (p.32).*
On the basis that they do not have a ***detailed programme of work*** *then it may follow that it would be challenging to determine if their costs are efficient to deliver this service. The allowed costs in this area have been determined using our enhancement model.*'

Document 8.9.A - Claim WSX05 - Flooding programme, Section 7 detailed our robustness and efficiency of costs. Section 7.2 covered 'overloaded sewers' costs and stated the first 3 years of AMP6 investment of £25.8m Capex in the hydraulic flooding programme, which could be extrapolated to £43m in AMP6 (£8.6m per year).

This £43m investment in AMP6 (£8.5m per year mentioned in the IAP above) was taken from section 7.2 relating purely to the Hydraulic aspects of the flooding programme. It is almost equivalent to the proposed £48m for reducing flooding risk (hydraulic) in AMP7.

The hydraulic flooding investment has increased from £43m in AMP6 to £48m in AMP7 for two reasons. Firstly, our prioritisation process means we have already delivered the most cost-beneficial schemes and we are left with more expensive schemes in the future. Secondly the cost of construction has increased significantly. The increase in RPI/COPI over the last 5 years can give an inflation rise in costs in the order of 10%.

Hydraulic flooding unit rates in AMP5 were £74k which increased to £105k in AMP6 (see Table 3-6 below for costs). Our unit cost for AMP7 is £99k (see table 3-8 below), which shows a proposed efficiency.

This £48m proposed for hydraulic flooding **excludes** capex and opex investment for:

- Drainage and wastewater plans (£12.7m),
- Increase in infiltration reduction plans (£9.5m) and
- Flooding 'other causes' (£16.6m).

The DWMP process is a new obligation and is above our current AMP expenditure. In AMP6 our modelling programme was assigned against capital maintenance. For AMP7, due to the new requirement to undertake this significant undertaking on our surface water network, we have assigned this against enhanced (WWs2 Line 30). See Section 4 for more details.

Similarly, infiltration sealing in AMP6 for carrying out the Regulatory Position requirements to fulfil our infiltration reduction plans was assigned to capital maintenance. In AMP7 we have assigned all infiltration sealing against our flooding enhancement line. The schedule detailed in Annex B of Document 8.9.A contained a long list of catchments that will require sealing (labelled 'S'). Those catchments that have only been investigated in AMP6 (labelled 'I') will need sealing in the future. We are proposing to undertake more sealing in AMP7 than in AMP6. In AMP6 we made the large sources of infiltration (gushers) watertight in the highest profile catchments. However, there are more catchments that we have not undertaken any sealing works in and there remain less severe infiltration in all catchments that will require sealing eventually.

Operational costs are related to flooding 'other causes' which have historically been mostly reactively identified. However, we do currently undertake some proactive maintenance such as sewer jetting. We would be happy to provide a list of the schedule for proactively jetted sewers, all 500km of them. The enhanced funding we are proposing is **in additional** to our current jetting lengths, which costs c £1.6m per year under capital maintenance. We propose to undertake significantly more jetting in AMP7, to deliver our escape of sewerage reduction programme. We deliver this jetting programme efficiently by having our own staff and JetVac vans and inspecting lengths to check jetting is required. We optimise the frequency of jetting based on the severity of the problem and increase/reduce the future frequency based accordingly. Table 3-4 Details our historical and proposed jetting lengths.

The IAP comment that we have not provided a detailed programme of hydraulic work is answered in Section 3.2 and Annex A. A breakdown of recent and potential future hydraulic schemes is provided in Section 3.2.4.

Table 3-4: Historical and future jetting lengths (km)

	Planned			Actual			
Year	Jet Vac	Trailer Jet	Total	Jet Vac	Trailer Jet	Total	% Achieved
AMP7 proposal per year	900	100	1000				96
RR2017-18	496	61	557	473	59	532	95.5
RR2016-17	549	49	598	537	38	575	96.1
RR2015-16	584	18	602	566	18	584	97.0
RR2014-15	527	52	579	505	47	552	95.3
JAR2013-14	505	40	545	489	36	525	96.3
JAR2012-13	405	87	492	392	85	477	96.9
JAR2011-12	344	81	424	329	74	403	95.0
JAR2010-11	336	67	403	310	64	374	92.8
JAR2009-10	318	55	373	316	51	367	98.4
JAR2008-09	330	52	382	306	51	357	93.4
JAR2007-08	303	38	341	197	25	222	65.1
JAR2006-07	254	26	280	155	8	163	58.2
JAR2005-06	222	29	251	96	5	101	40.2

Our Opex proposals are further detailed in Sections 6.3 and 7.3 of Document 8.9.A.

Table 3-9 lists many more activities that require new Opex funding to reduce the risk of flooding other causes.

Annex A, section 5.5 contains an example sewerage investigation appraisal that we are undertaking to proactively prevent future flooding and pollution incidents due to 'other causes'. These generally highlight addition CCTV, local repairs and regular jetting.

Ofwat's growth model reduces our proposed flooding programme Capex from £80m to £54m. The growth model does not include other activities that we included in our proposed Minimising sewer flooding programme. We provide additional evidence that flooding other causes, groundwater inundation and drainage and wastewater management plans are not related to growth and should be allowed. We also need the addition Opex to be able to deliver these stretching flooding targets.

3.1.6 Customer protection

The deep dive 'partially passed' our customer protection for the following reasons:
'*Customers will be protected by three performance commitments: F1 Customer property sewer flooding (internal), F2 Customer property sewer flooding (external) & F3 Sewer flooding risk. The adequacy of this protection is covered under our* ***outcomes assessment****.*'

We consider that our proposed 3 performance commitments adequately protect our customers flooding interests. Our PCs are:

- F1 Customer property sewer flooding (internal)
  - The worst service failure needs a PC with a stretching target. We are proposing a 16% remain industry leading by matching Ofwat's upper quartile position.
- F2 Customer property sewer flooding (external)
  - Sewer flooding of gardens is unpleasant, especially if the flood water contains sewage. We are proposing a 10% reduction to possibly become upper quartile – position currently unknown due to changes in definitions.
- F3 Sewer flooding risk
  - This is Wessex Water's bespoke PC to ensure that we deliver a hydraulic flooding improvement (in addition to the flooding other causes programme).

We chose not to have a PC based on Blockages because this is very similar to our external flooding PC (F2) because over 80% of these incidents are caused by blockages.

We also chose not to have a performance commitment to monitor how much surface water we remove from our combined sewers. Our flooding risk grid reflects properties that have flooded and are at risk of hydraulic flooding. If the best options to reduce the flood risk is to remove surface water, then we will. However, as proven in the case study in Section 5.2 this is often not a cost-effective solution, so we do not want to commit to delivering a separation programme. Although, the WINEP does contain a couple of integrated urban drainage management (IUDM) projects to improve the environment by reducing overflow frequency.

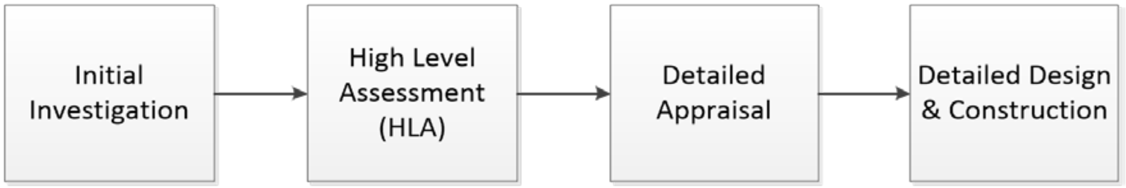
Please refer to our response in Appendix 3, Section 6 Minimising sewer flooding.

3.2 Hydraulic flooding – more evidence

Our submission document 8.9.A – Claim WSX05 – Flooding programme, provides significant detail of our approach to minimising sewer flooding. Document 3.1.A contains more detail on the performance commitments and ODIs.

Section 6 of Document 8.9.A states: 'Within Wessex Water, there are four main stages to delivering solutions for overloaded sewers; the initial investigation, a high-level assessment (HLA), a detailed appraisal and detailed design & construction' and contained a schematic, duplicated in Figure 3-4 below.

Figure 3-4: Delivery stages of the flooding programme (overloaded sewers)



These stages are discussed further in the following sections and Annex A.

3.2.1 Initial investigation

The initial investigation establishes the cause of incident. These are assessed at the time of the incident and verified by managers during regular reviews. If the cause if Hydraulic overload, or unknown, then the problem is passed to the second HLA stage.

3.2.2 High level assessments

We currently have 463 HLA which have confirmed flooding issues caused by an underlying hydraulic problem. There are about a further 100 HLA that are ongoing or not started which are probably hydraulic problems but not yet appraised. See Table 3-5 for the summary of HLA numbers.

Table 3-5: Number of high-level appraisals

Type of report	AMP5 HLAs	AMP6 HLAs
New HLA of confirmed hydraulic problems	245	100
HLA updates to previous HLA hydraulic problems	18	80
HLA locations (ongoing appraisals)	80	118
HLA Rejection reports (root cause is not hydraulic)	215	199

The HLA process develops a desk-top report on the potential options to solve the hydraulic flooding issues. These options consider traditional solutions (making pipes bigger, duplication of pipes, underground storage etc) as well as sustainable options (for example separation schemes and SuDS). These options are costed (at a high level) and the preferred solution and costs used to prioritise which schemes should pass through to the next stage of having a more detailed appraisal.

Table 3-3 shows the types of options considered under the HLA process. Each of the HLAs have a prioritised (preferred) solution which has been assigned to Ofwat's solution codes (used in AMP4). Alternative solutions are also considered such as strategic solutions, sustainable solutions. Opportunities for mitigation are also highlighted.

Ofwat's IAP criticised our submission as not providing a detailed programme of works. We have hundreds of HLA reports and can provide these if requested. Annex A contains example HLA reports (a full HLA report and some HLA executive summary reports).

Using the HLA preferred solution average cost of c£400k, then for the c500 known hydraulic flooding problems, a flooding programme of £200m will be required. To balance the risks and costs to our customers we and our customers (based on their willing to pay) consider these should be phased over several AMPs. We will be using this as part of our long-term planning for investment over the next 25 years, which may justify a higher investment requirement in AMP8.

Our prioritisation process promotes the most cost-effective schemes. So these have been delivered in this current and previous AMPs. The scheme remaining are becoming more complex and expensive to solve.

3.2.3 Detailed appraisals

Our prioritisation process uses the preferred HLA option costs and number of properties affected from each HLA appraisal. The most cost beneficial schemes (e.g. cost-effective schemes that address internal flooding) are released for detailed appraisal studies to our Engineering designers to fully appraise. We undertake outline design and detailed design for a rolling programme of flooding problems.

Scheme appraisals are undertaken to identify the best options using computer hydraulic modelling. Governance through Network Review Meetings / Investment Management Team meetings selects schemes and options likely to be viable to be advanced to the next stages of design.

Our programme for detailed appraisal in previous AMPs was sized so that just enough schemes were designed to be able to construct enough cost-beneficial schemes. In the last 5 years we are undertaking a larger programme of detailed appraisals to be able to have a fuller programme of named schemes that we could construct in the future. These will feed into the drainage and wastewater management plans.

An example of a detailed appraisal report (referred to as a Proposals report) is also provided in Annex A. We can provide more if requested.

3.2.4 Detailed design and construction

In the detailed design stage firmer costs estimates are developed based on using actual site investigation, which allow the risk allowance to be reduced. Occasionally we have schemes that are designed that would be very expensive to deliver, so we defer these - delivering more cost effective schemes elsewhere instead. However, the deferred schemes are still at risk of flooding, so in these cases, where possible, we will undertake mitigation at these locations, such as installing flood doors to reduce the impact of flooding (prevents external flooding escalating into internal flooding).

Table 3-6 summarises the historical hydraulic flooding programme outputs, appraisals and expenditure.

Table 3-6: Historical flooding scheme summary

Number of schemes	AMP5	AMP6*
Locations/properties risk of flooding reduced	536	397
Constructed	101	39
Constructed (ongoing monitoring)	7	28
Scheme revisit	4	2
Detailed designed	1	1
Appraised (financial approval)	1	11
Appraised (financial approval - monitoring)	0	1
Appraised (technically approval)	12	31
Appraisal - ongoing	18	33
Appraisal - no build	27	8
Total	**171**	**154**
Expenditure (£m)	**39.9**	**42.0**

We have a growing number of hydraulic schemes that are being designed. Table 3-7 lists the current schemes. This is not a confirmed programme of work and is subject to reprioritisation and budget constraints.

Table 3-7 provides evidence of our ongoing flooding reduction (hydraulic) flooding programme. These are schemes that are currently in various design stages for delivery in AMP7. The scheme costs are not finalised and are subject to change.

We also have a further 15 schemes which we have appraised, but the scheme solutions are not cost effective to deliver (i.e. the unit rate is more than £150k per property). We have offered mitigation (such as flood doors) to customers who have complained about lack of progress in delivering a full scheme. See Annex A for an example of mitigation works.

Table 3-7: Future designed hydraulic flooding schemes

Scheme	Stage of appraisal	No of locations/ properties	Initial Costs (£ m)
Berrow, Burnham-on-Sea	Appraisal - Technical	18	1.4
Bowleaze Coveway, Weymouth	Appraisal - Technical	5	0.8
Broad Walk Shopping Centre, Bristol	Appraisal - Technical	7	1.0
Church Lane, Fovant	Appraisal - Financial	2	0.1
Cotford	Appraisal - Financial	2	0.1
Iford Lane, Bournemouth	Appraisal - Technical	3	0.3
Great Brockeridge, Bristol	Appraisal - Financial	3	0.2

Milton Park Road, Weston-Super-Mare	Appraisal - Technical	7	0.4
Oake Woods & Hardings Lane, Gillingham	Appraisal - Technical	6	0.6
Philip Close, Melksham,	Appraisal - Financial	8	0.9
Rectory Lane, Norton Sub Hamdon	Appraisal - Technical	4	0.6
St Marys Road, Burnham-on-Sea	Mitigation (Monitoring)	6	0.7
Stone/Woodford, Berkeley	Completed (Ph1) (Monitoring)	9	0.9
Verity Close, Poole	Appraisal - Technical	5	0.7
Wilton	Appraisal - Financial	4	0.3
	Total	**89**	**8.9**

Table 3-8 provides a summary of our likely AMP7 hydraulic flooding programme.

Table 3-8: AMP7 Hydraulic flooding profile

	2020-21	2021-22	2022-23	2023-24	2024-25	Total
Locations/properties risk of flooding reduced	89	93	93	93	93	483
Construction	17	14	14	14	14	73
Appraisal	28	28	28	28	28	141
High level appraisals	23	23	23	23	23	116
Sewerage investigation appraisals	100	100	100	100	100	500
Expenditure (£m)	8.9	9.8	9.8	9.8	9.8	48.0

Annex A, Section 5.4, contain a list of High Level Assessment options for 400 locations where we have a known hydraulic flooding issue. Our ongoing annual prioritisation process will continue to move some of these schemes into the next phase of design, and construction. We will deliver cost-beneficial schemes to deliver a stable risk within the allocated annual budgets.

In summary, this section discussed funding requirements to deliver enhancement schemes to prevent sewer flooding during rainfall events (hydraulic flooding). We are continuing our hydraulic flooding programme at similar investment levels to previous AMPs.

Our flooding investment also includes more activities to address flooding other causes, infiltration sealing and drainage and wastewater plans which are discussed in the following sections.

3.3 Flooding 'other causes' – more evidence

Our customers do not want to experience flooding incidents and we do not want them to flood either. So, we set ourselves stretching targets. Ofwat's response to our plan updated the target slightly for internal flooding incidents (see Section 3.1).

To achieve our ambitious targets, we have already started a new process, which we have branded '***Escape of sewage reduction plan***'. This collates similar activities into one focussed group to address:

- Reduced pollution risks
- Reduced flooding risks (internal and external)

.

These activities were not double counted in our business plan (as stated in Document 8.10.A section 7), but both build to deliver a more flooding resilient performance.

Table 3-9 provides more details of how we need to invest more to achieve the targets.

The programme will focus on reducing blockages, as this is the highest cause of incidents, with over 80% of incidents being caused by blockages. There has been an increase in blockage rate which we think is because of the increased use of baby wipes and wet wipes being promoted as being flushable. They may flush, but they do not deteriorate like toilet paper, so cause blockages.

A recent study entitled ' wipes in sewer blockage study'[2] concluded that 75% of the content of blockage material were wipes.

We are co-funding more research being undertaken by the Water Research council (WRc) to examine in more detail the complexities of what causes blockages. The formation of these depends on many factors, such as toilet cistern size, gradient of sewers and defects in the sewers. This shows that the water efficiency savings, such as smaller toilet cisterns, increases the risk of blockage formation due to lower flushes.

We are continuing the 21st Century Drainage drive to stop wet wipes being promoted as being flushable, by writing to manufacturers and retailers. We support the 'fine to flush' national campaign. Although, we would have preferred a stronger policy of not flushing anything except the 3 P's.

The proposed Opex is needed to achieve this step change in what we currently do as well as the additional Capex to permanently repair assets that may be causing blockages.

[2] 'Wipes in sewer blockage study', WRc plc for Water UK, October 2017

Table 3-9: Our Escape of sewage reduction plan summary

	Proactive	Reactive	Reporting
Underway (2018/19)	**Rising main monitors** • Monitors installed to try and identify rising mains at risk of bursting (ongoing programme into AMP7) **Pollution Training for operational staff including sewerage crews/CSTs** • Toolbox talks/workshop regarding pollutions (to be attended every two years) • Training on formal EA sample procedures **Sewerage Investigation Assessments (SIAs)** • Scope of works undertaken by the High-Level Assessment (HLA) team to be expanded – using existing datasets to focus investigations to identify appropriate proactive interventions	**Pollution reviews** • Review of incidents with Sewerage Managers to be undertaken to identify any lessons to be learnt and examine opportunities to challenge pollution classification **Third-party environmental support** • Establish framework for the provision of environmental impact surveys etc.	**Review of existing pollution reporting processes** • Review, consolidation and initial improvement to existing pollution log & data capture
Short-term (2019/20)	**Escape of sewage team** • Focus on the management of activities leading to a reduction of escape of sewage incidents **Additional sewer cleaning** • Amount of sewerage proactively jetted will increase as a result of SIAs **Additional R&M works** • Additional R&M interventions as a result of SIAs **Development of escape of sewage risk model** • Development of GIS model to analyse available data to direct focus of pro-active investigation **EDM** • Early start on AMP7 EDM delivery where CSOs have pollution history **Behavioural Engagement/PR plan** • Customer engagement plan regarding sewer misuse to be developed • Behaviour engagement technician to develop engagement programme, tools etc. **SPS performance analytics** • Analytics tool monitoring to identify out of character SPS performance	**Review of repeat incidents on fixed assets** • 33 STWs, SPSs and CSOs responsible for multiple repeat pollutions – have the issues at these sites been resolved? If not, what works are required? **Operations equipment** • Do sewerage crews have the appropriate equipment? Is existing equipment being utilised? **Review of incident response** • Is our general response appropriate? Are the correct processes in place? How is over-pumping managed? Is our communication good both internally and externally? **Development guidance for specific causes** • Development of additional guidance/tools/training for specific causes for both crews & CSTs **CSU call handling** • Audit of how flooding, and pollution incidents are handled – are all incidents reported and dealt with correctly	**Pollution incident data capture** • Detailed specification of data capture and reporting system – IS project to be delivered in 2020/21

	STW research project – blockages • Research project examining the underlying cause of blockages **Pre-Bathing season maintenance** • Review that critical maintenance is undertaken before the start of the bathing season **Air-valve maintenance** • Locate and inspect all air-valves on critical crossings and undertake critical maintenance	**Rainfall Visualisation** • Interpretation of CSO alarms using rainfall data to determine whether the "spill" is a result of the CSO working as expected or whether operational investigation is required	
Medium-term (AMP7)	**Background environmental surveys** • No knowledge of environmental status around sites – what level do we need to achieve post-incident? **Rising main replacement programme** • **Visualisation** • Upgrade existing telemetry systems to help identify where proactive interventions are appropriate **In-sewer monitoring** • Install and use of monitors to instruct when preventative interventions should be undertaken – catchment trial **Yellow Fish project** • Community engagement project to raise awareness of misconnections and river pollution – currently on adhoc basis, roll-out as a permanent option	**Additional CST/crew resource** • For particular sewerage job types, crews allowed additional time to identify underlying cause on first instance **Enhanced over-pumping resilience** • Investigate enhancing response provided by existing contractor	**Improve self-reporting** • PR exercise & hotline for customers to report pollutions to ourselves rather than the EA • Water Rangers – volunteers trained in identifying pollutions walking regular hot spot routes **Improving self-reporting – pollution site signage** • Public information signage describing how to report a pollution **Pollution incident data capture** (IS project Phase 1) • Update WIF form to capture incident data from the sewerage crews • Develop pollution App for non-sewerage disciplines **Pollution Register** (IS project Phase 2) • Replacement for pollution log

We have already started this strategy by undertaking a more thorough assessment of repeat blockages and pollution incidents. Our Sewerage Investigation Assessments (SIA), which review the underlying cause of repeat incidents in more detail, are described with examples in Annex A.

In summary, we need a step change in our activities to achieve the stretching upper quartile targets of 16% reduction in Internal flooding incidents and a 10% reduction in external flooding incidents. We consider that Ofwat's growth model does not provide an adequate allowance (capex and opex).

3.4 Ground water inundation of sewers – more evidence

The IAP does not recognise that very few WaSC suffer from the phenomenon of groundwater induced infiltration. Wessex Water suffers this for two reasons:

- Chalk geology in the east of our area is prone to springs, winterbournes and sewer infiltration due to high groundwater levels
- Somerset Levels and Moors flooding saturating the west of our area

This is a significant problem in the Wessex Water region, as described in our cost adjustment claim Document 8.9.A, section 6.2.4. As such, we co-chaired the 21st Century Drainage workstream 5, which focussed on groundwater inundation – both developing better technology / best practice (see below) and developing the campaign video (here).

Our sewer sealing programme, to make our sewers watertight so groundwater cannot inundate them, in AMP6 has been successful in a limited number of catchments, as detailed in Table 3-10. This programme primarily targeted 'gushing' infiltration in pipe so that we obtained maximum benefit, in as many catchments that funding allowed.

Table 3-10: Example of effectiveness of sewer sealing

STW Catchment	AMP6 Sealing	Reduction in dry weather flow at STW*
All Cannings	Sealed summer 2016 and autumn 2018	10%
Bradford-On-Tone	Sealed autumn 2015 and spring 2018	40%
Sydling St. Nicholas	Sealed summer 2015 and spring 2018	10%
Tisbury	Sealed summer 2016	15%
Wookey	Sealed summer 2015 and 2018	20%

*During dry periods of similar groundwater condition

In AMP6, we have undertaken substantial sealing in 21 catchments. But we have a total of 78 catchments that are vulnerable to groundwater inundation. This is a long-term process where we need an iterative process of inspection followed by sealing.

Our AMP7 proposals will continue this process in other catchments vulnerable to groundwater inundation (see Document 8.9.A, pages 44 to 65, for the complete list of catchments). We will also revisit the highest risk catchments and seal further sewers, addressing the defective junctions, manholes and less major infiltration sources, such as 'running' or 'seeping' infiltration.

In AMP7 we have combined the drivers for infiltration sealing, such as flooding reduction, dry weather flow compliance at STW and preventing illegal discharges to rivers (overpumping) during times of inundation. This has all been allocated against our minimising flooding programme which is the main driver.

Because this phenomenon only affects a few companies, we consider that our proposed £9.5m investment in infiltration sealing is not in Ofwat's model. We need to have this ongoing programme of sealing our sewers to comply with the Environment Agency's regulatory position statement. This can involve us sealing private sewers and manholes where we find they have a significant impact on our system performance.

3.4.1 Innovation to develop better options

Since the floods of 2013, we have instigated an enhanced infiltration reduction programme, as described in Document 8.9.A, section 6.2.4.

Technology is advancing and Wessex Water are at the forefront of innovation.
We have a dedicated rehabilitation team that are innovative, as demonstrated in Figure 3-5.

Figure 3-5: Extract from Trenchless International magazine showing our innovative approach

PLUGGING THE MANHOLE

by Julian Britton, Wessex Water Critical Sewers Manager, England, UK

The second in a two-part series, the following article presents information on a joint investigation by IKT and Wessex Water, looking at the effectiveness of cementitious plugging compounds and injection grouting systems in sealing sewer manholes.

The laboratory investigations undertaken by the Institute for Underground Infrastructure (IKT) were mirrored in the summer of 2015 when Wessex Water was confronted with high levels of groundwater infiltration in the small village of Sturminster Marshall in Dorset, England, and decided to conduct a practical installation of external grouting to seal manholes.

Wessex Water, who was at the forefront of the use of epoxy cured-in-place pipe (CIPP) sewer lining to exclude groundwater infiltration, found 1.4 km of 150 mm diameter sewers in Sturminster Marshall had been compromised. In addition to this, approximately 60 manholes in the area – varying in diameter, depth and structural configuration – were found to be leaking.

Two of the manholes, located within farmland to the south of the main village, were chosen by Wessex Water to trial the new injection grouting method for sealing manholes. The geology surrounding these two manholes was representative of the whole village and was identified as A) alluvium; B) river terrace deposits; there were three across the valley; and C) Portsdown 'Putty' Chalk Formation (see image B).

Considering the soil conditions it was imperative that any material injected to seal the manholes could be placed and cured without dilution, thus preventing the excessive use of materials, allowing the grout to form close to the manhole, and presenting no risk of leachate which could compromise the local ground water abstraction points (see Table 1).

Three injectable materials were trialled; however, this paper focuses on the polymer modified cementitious grout which was eventually found to have the most effective sealing results in these geologies. The objective of this trial was to complete, establish and observe:

- The geological baseline ground conditions at the trial site
- The process of groundwater quality monitoring which was carried out in association with the cementitious grouting trial
- The rheological movement/formation of any of the injected materials during a post placement excavation around each manhole.

Five boreholes were excavated, three of which were located in a line leading away from each manhole. Standpipes were installed within the boreholes to record the groundwater levels and to pick up the depth of any grout that may present in the standpipe, from which the hydraulic gradient of the grout could be established over the standpipes. In addition, water sampling was executed throughout the process to establish any leachate associated with the cementitious grout.

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SALINE INTRUSION AT MINEHEAD SEWAGE TREATMENT WORKS, SOMERSET

Immediately following the completion of the Sturminster trials, a massive inundation of sea water was found in sewers along the quayside of Minehead Harbour, Somerset, which led to the sewage works. This had a detrimental effect on the bacteriological process at the work, and five manholes were found to be leaking at high tide. All five were located in coarse beach gravel, with a high volume of voids and a potential for high phreatic flow.

The polymer modified cementitious grout was used, with 4 tonne injected around each manhole at low tide, relying on the 45 minute set to resist washout. The manholes were observed as being watertight at the next series of high tides, although it would be interesting to understand any erosional effects on the mass grout generated by the wave energy dissipating through the beach a few metres away.

With silicate cured-in-place repair (CIPR) patching of some additional points of infiltration, on comparing actual kilograms of chloride into the works against benchmark similar tide levels prior to sealing works, there was a 28 per cent reduction in the volume of seawater reaching the sewerage works.

For more information visit www.wessexwater.co.uk

A: Viscosity check.
B: Borehole geology.

MATERIALS USED IN THE TRIAL

The trial involved the installation of three separate injection sealing products. The first product was a cementitious grout that had been polymer modified to reduce bleeding and encourage a rapid cure to retain the grout close to the external periphery of the manhole. This was a relatively new material to the Wessex Water engineers. In addition to this, two types of resin sealing materials were also trialled.

The grout was a pre-blended polymer (anti-washout) modified cementitious material that contained Ordinary Portland Cement, selected fillers and a chloride accelerator. The material had a low heat of hydration and plastic shrinkage characteristics. The grout was mixed with potable water and combined using a high shear colloidal mixer. The grout had a laboratory tested compressive strength of 6 N/mm2 at 7 days and 12 N/mm2 at 28 days. The correct viscosity of the grout was important and Wessex Water utilised the ASTM C939 method of control entitled 'Standard test method for Flow grout for pre-placed aggregate concrete (flow cone method)'. The manufacturer's instructions stipulated a 90 second evacuation of the flow cone. In practice, a window of 15 seconds was sufficient. »

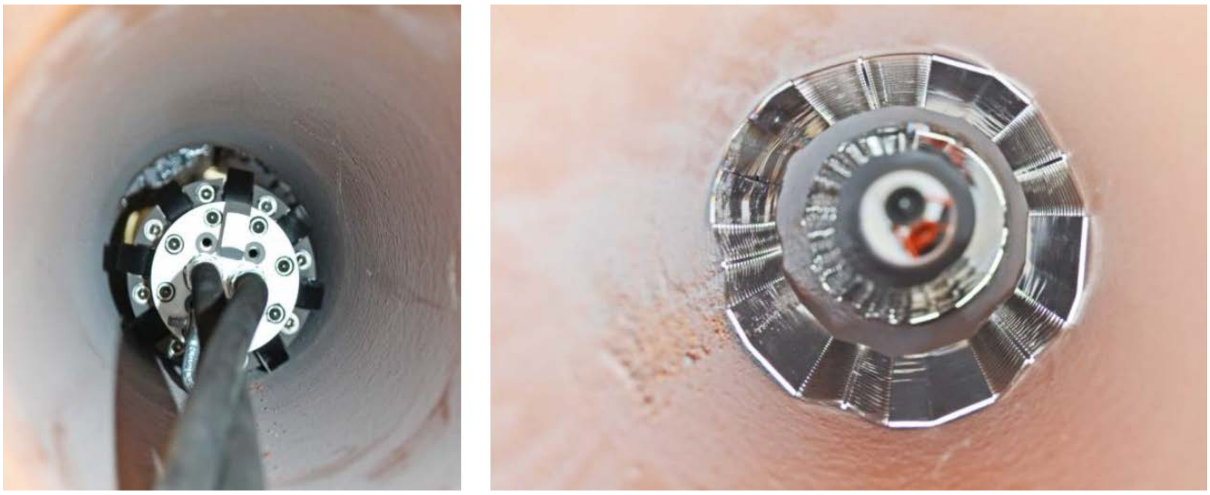
Sewer sealing technology to make sewers watertight is successful and should last decades (as opposed to previous AMPs where gel sealing processes decayed after ten years). Sewer lining, using epoxy liners to make assets watertight, is cheaper and far less disruptive that open-cut replacement. We are testing new liners to try to make further savings on the material costs of lining.

Figure 3-6: Test rig for epoxy lining trials using new resin technology

We have worked with designers in Australia to build robotics, which can seal underground junctions, without excavation. This technology should be available in AMP7.

We have also designed and patented a re-rounder machine. The new robotic Re-rounder machine allows collapsing sewers to be reformed via “man hole surgery”. The machine uses specifically designed stents which are put in place to repair significant defects within sewers. A patent application has been filed for this innovation.
The machine can generate enough force to restore sewers to their original shape which then allows the sewer to be relined. This technology further reduces the need for water companies to carry out expensive traditional excavation repairs on their sewer network. The equipment currently caters for 150mm diameter sewers but could be replicated to repair larger sewers.

Figure 3-7: The innovative re-rounder, developed by Wessex Water



In summary, by sealing sewers, manholes and lateral junctions, we now have a holistic approach to making our and private assets watertight to reduce groundwater infiltration in sewers. This prevents groundwater entering our sewers which used to then inundate them causing sewer flooding and the occasional need to pump foul flows into river systems. This sealing programme is unique to only a few companies, so we consider this is not included in Ofwat’s models so requires addition funding.

4. Drainage and wastewater management plans

4.1 DWMP obligation and timeline

We have included the new obligation of developing Drainage and wastewater management plans (DWMP) into our flooding programme. DWMP will develop our long-term plans to address flooding both now and in the future, and will potential influence PR24 investment levels to significantly address flood risk.

Defra have requested that we develop DWMP as described in Supporting Document 5.4. This is a new obligation.

Since our September submission, Defra has referred to DWMPs in their Surface Water Action Plan (here) which expects companies to follow the framework. Defra is also currently consulting to include DWMPs in primary legislation, with full statutory requirement status in AMP7. WaterUK is supportive that DWMPs become statutory in AMP7.

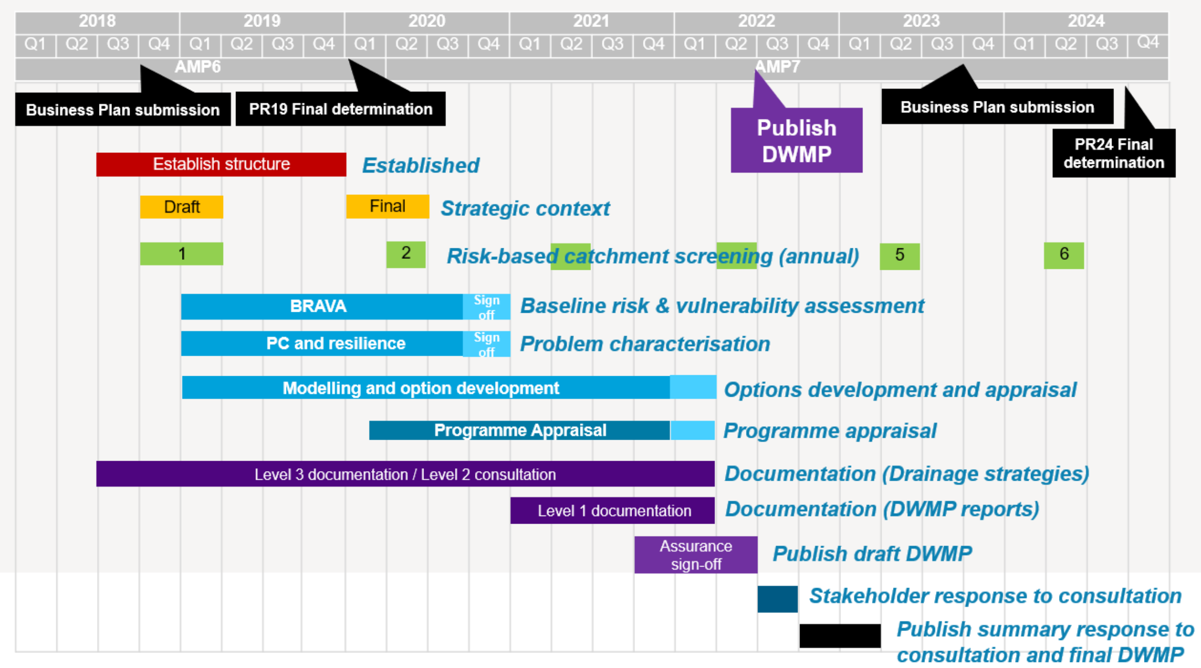
Our PR19 business plan submission included for the delivery of our DWMP by December 2022 (Document 5.4, section 3). There were significant implications to achieve this expectation in such a short timescale.

Ofwat's action **WSX.CMI.A2** asked companies to '*provide a commitment to provide a detailed work programme by end August 2019 to assure us that the company will deliver appropriate drainage and wastewater management plans. The programme should ensure that the company can prepare and consult on its first drainage and wastewater management plan no later than the summer of 2022 to enable revised plans to be prepared in early 2023 to inform PR24 business plans*'

This has accelerated the DWMP timeline by 6 months, to complete and consult by the Summer of 2022, rather than December 2022. Our revised timeline is shown in Figure 4-1.

Wessex Water commits to providing a detailed work programme by the end of August 2019. The level of detail of this programme will be at the regional / river basin area levels (Level 1 and Level 2 as defined in the DWMP framework). The Baseline risk and vulnerability assessment (BRAVA) process will not be complete by then, so it will not contain detail of specific catchments that will require Drainage Strategies (Level 3).

Figure 4-1 DWMP timeline revised to comply with Ofwat's IAP



We have already started the DWMP process:

- We have established a DWMP website and portal (here). This was launched in September 2018 and was referred to in our business plan Document 5.3, Section 3. This will need expanding to including Drainage Strategies for probably over 200 (depending on the BRAVA process) catchments by 2022.
- We have completed our initial risk-based screening, and are preparing to provide the results to WaterUK, who in turn will pass this onto the NIC (to show progress).
- The D in DWMP is to promote surface water drainage, which now needs investigating in the same way as we have done in recent decades for the foul and combined sewers works. We have very few surface water models and a significant proportion of the AMP6/AMP7 DWMP budget will be spent on survey work to inform hydraulic modelling. We have accelerated modelling, optioneering and reporting to be able to deliver the required strategies by 2022. See section 3.2.

The 'formal' consultation will follow the Summer 2022 submission allowing feedback from Stakeholder (for example Defra and National Infrastructure Commission) and updates so that the PR24 submission can reflect on the agreed DWMP. The DWMP will be strategic in nature to achieve these targets.

4.2 Asset survey and computer modelling requirements

The DWMP framework states that is not intended to create a 'modelling cottage industry' to develop DWMPs. However, computer hydraulic models are the best tool we have for predicting future problems. Our plan (Supporting Document 5.4, section 3) therefore proposed a pragmatic approach to modelling:

- Complete sewer models of our foul/combined sewers (to the current standard[3])
- Start building sewer models of our surface water asset to a lower verification standard, fit for near term purposes which will provide a good basis for refinement in the future
- Build overland flow models (integrated 2-dimensional models) of three catchments known to have integrated issues (Bristol, Corsham and Minehead).

Table 4-1: DWMP estimated modelling and optioneering costs

DWMP activity	Cost (£ m)
Build cost (foul sewers)	0.7
Build cost (Surface water sewers)	2.1
Survey (flow and assets) and verification	5.5
Model upgrade cost	1.6
Integrated modelling (Bristol, Corsham, Minehead)	0.8
Options/reporting cost	1.7
BRAVA and other costs	0.3
Total cost	**12.7**

Almost half of this cost is the requirement to undertake surveys of our assets. Annex C provides a breakdown of the estimated survey costs required in each of the 270 catchments requiring a surface water understanding. These costs are only to get an overview understanding (assets and flows). We are not building fully verified hydraulic models of all these catchment – firstly the costs would be disproportionate to the benefits, and secondly the UK would not have enough flow survey contractors to undertake this. Further work can be undertaken during future AMPs to enhance the models as and when needed.

The data we collect and the computer hydraulic models of our surface water and foul/combined assets will then be available for sharing with other risk management authorities, such as the Lead Local Flood Authorities and the Environment Agency.

This will allow the EA to improve the validity of their national surface water flood maps - a requirement under the Defra surface water action plan. Water and sewerage companies are RMA so have a duty to share that information with the EA. Currently we are not able to provide this as we have not collected the relevant information for many of our surface water assets.

It is also in line with Defra's strategic policy statement[4] for Ofwat which prioritises:

- Securing long-term resilience
- Protecting customers.

[3] CIWEM Urban Drainage Group's hydraulic modelling code of practice

[4] https://www.gov.uk/government/publications/strategic-policy-statement-to-ofwat-incorporating-social-and-environmental-guidance

Figure 4-2: Extract from Defra strategic policy statement

> **Objective**: Ofwat should challenge water companies to improve planning and investment to meet the wastewater needs of current and future customers.

We support this approach, which is why we want to invest more in asset surveying and computer hydraulic modelling of our assets so that we can better understand risks and resilience.

4.3 DWMP summary

In summary, the delivery of drainage and wastewater management plans is a new obligation. In 2019 we have started to survey surface water assets and build computer hydraulic models so that we can predict their performance (both now and in the future); this work will continue through to 2022. We have an obligation to share this information with other risk management authorities.

We have proposed a pragmatic approach to deliver DWMPs in the timescales required to influence PR24, as requested by Defra and Ofwat. This requires additional funding which is not reflected in Ofwat's IAP growth cost model.

5. Annex A – Example hydraulic flooding schemes

As described in Section 3.2 we have different stages of flooding appraisals to ensure that we invest efficiently. This Annex contain examples of flooding report.

Section 5.1 describes some recent hydraulic flooding schemes that we have constructed. The range and mix of different solutions show how complex hydraulic flooding is. It also contains a case study of a scheme.

Section 5.2 contains further evidence on our High-Level Assessment (HLA) processs, including an example summary report and a list of all 400 known problems and potential options.

Section 5.3 explains our approach to Sewerage Investigations Assessments (SIA), which is extending our successful HLA process to investigate flooding other causes and pollution incidents.

5.1 Detailed appraisals

Table 5-1 lists some recent flooding schemes with an explanation of the solutions (options) that were constructed.

Table 5-1: Recent flooding schemes showing options constructed

Scheme Name	Solution
Fletcher Road, Bournemouth	Local diversion
Somerset Road, Christchurch	Local diversion
Bowerleaze, Bristol	Local diversion
North Newnton, Pewsey Flood Alleviation	SPS/CSO Improvements
Leybourne Avenue, Bournemouth	Surface water storage
Flood Alleviation Golf Links Road, Ferndown	Underground storage
Milton Hill - Spring Hill	Underground storage
Mendip Close, Melksham	Network solution - relief sewer & storage
Springleaze, Bristol	Surface water upsizing
Durleigh Road Flood Alleviation	Network solution - Relief sewer/upsizing & storage
Chantry Gardens, Trowbridge Flooding Alleviation Scheme	Relief sewer
Weymouth Strategic Flooding	Catchment diversion - new pumping station
Brent Knoll Flooding	Catchment diversion and major pumping station improvements
Kings Street, Sturminster Marshall	Phased approach - Sewer sealing plus SPS/CSO Improvements and sewer upsizing
Lower Langford, Bristol Flood Alleviation	Phased - Infiltration sealing plus relief sewer
Clayton Street, Bristol	Surface water separation
Crudwell, Central Area Flood Alleviation	Surface water separation

5.2 Hydraulic flooding case study

This case study is to give Ofwat an update on a scheme that had a high profile. The residents used to complain to Ofwat about the frequent flooding at this location where 19 properties were at risk of frequent flooding.

5.2.1 Background

We began appraising this vulnerable valley in Weston super Mare a decade ago.

The source of the flood waters was a combination of flooding from the foul and surface water sewers, combined with rapid run-off from highways and driveways on this very steep catchment. Water that could not enter gullies flowed overland (normally contained within the road by kerbs) until it reached the natural valley. From here the flood waters flow though the gardens and garages and into residential properties of the low-lying bungalows in the valley. External flooding occurred every few years with internal flooding occurring less frequently. Flooding has not recurred since we constructed both phases of the scheme.

5.2.2 Computer hydraulic modelling

Traditional modelling only predicted highway flooding in this location, which we knew was not representative of reality during a severe storm. The study therefore included detailed hydraulic modelling.

This was the first time we used overland flow modelling. It was required here to understand the overland flow routes that moved highway flooding into garden flooding - and when the depth increased, flow entered linked garages and inside people's houses.

We appointed consultants to develop the detailed overland flow hydraulic computer model. This involve detailed Lidar topographical survey, many manhole surveys, CCTV surveys, flow surveys and even survey kerb, gullies and wall to ensure the water flowed overland in the correct paths.

Figure 5-1: Overland flow modelling replicating flooding

The model was verified against a short-term flow survey for flows in the pipes and against a historical flooding event to ensure the overland flow routes were correct. We held several public meetings to inform the residents of the scheme progress.

5.2.3 Developing options

Once the model was verified it was used to predict what would happen during a major rainfall event. Flooding predictions were as expected putting properties at risk of internal flooding. The model was then used to develop options to reduce the impact and risk of flooding.

The preferred option was to undertake a separation scheme to convert the combined sewers in foul sewers and providing a new surface water network with sustainable drainage at the bottom of the hill. However, when we estimated the cost of undertaking this, the scheme was not seen to be cost effective, as the £10m estimate far exceeded the benefits of reducing 19 properties from risk of flooding.

The residents were informed of this and, after disappointment, were offered mitigation.

5.2.4 Mitigation

Mitigation was undertaken at an early stage in the project by providing door, conservatory and air brick protection to five properties that suffered internal flooding. Two residents refused to accept these mitigation measures. The cost of this mitigation for internal flooding was £26k, equating to a unit cost of £5k per property.

Figure 5-2: Mitigation against flooding

5.2.5 Phase 1 construction

We became aware of a new development proposed on the hill upstream of the properties at risk. The sewers in this road flooded and contributed to the overland flow that flooded the valley. The developer was proposing to discharge surface water into the foul sewers, which we refused.

However, we took the opportunity to build a 300m^3 underground tank in the developer's land, before they started building the new properties. By proactively doing this, we were able to build the attenuation tank – if we had not acted then the tank would not have been buildable once the houses were built.

This tank was a wide diameter shallow tank so that flows can return following a storm by gravity. This tank is now under the car park of the development.

Figure 5-3: Construction of tank 1 (2011)

5.2.6 Phase 2 construction

In 2014/15 we reappraised the catchment to see if we could revaluate options to deliver a more cost-effective solution. We took a risk and proposed to construct in a deep underground tank under the road junction in a very tight location. This required a road closure for several months and many customer / public meetings to ensure that the resident understood the benefits of our disruptions.

Figure 5-4 shows the underground tank under construction.
Figure 5-5 shows the location of the construction in the urban area.
Figure 5-6 is the design for construction in the tight work area.

Figure 5-4: Construction of tank 2 (2015/16)

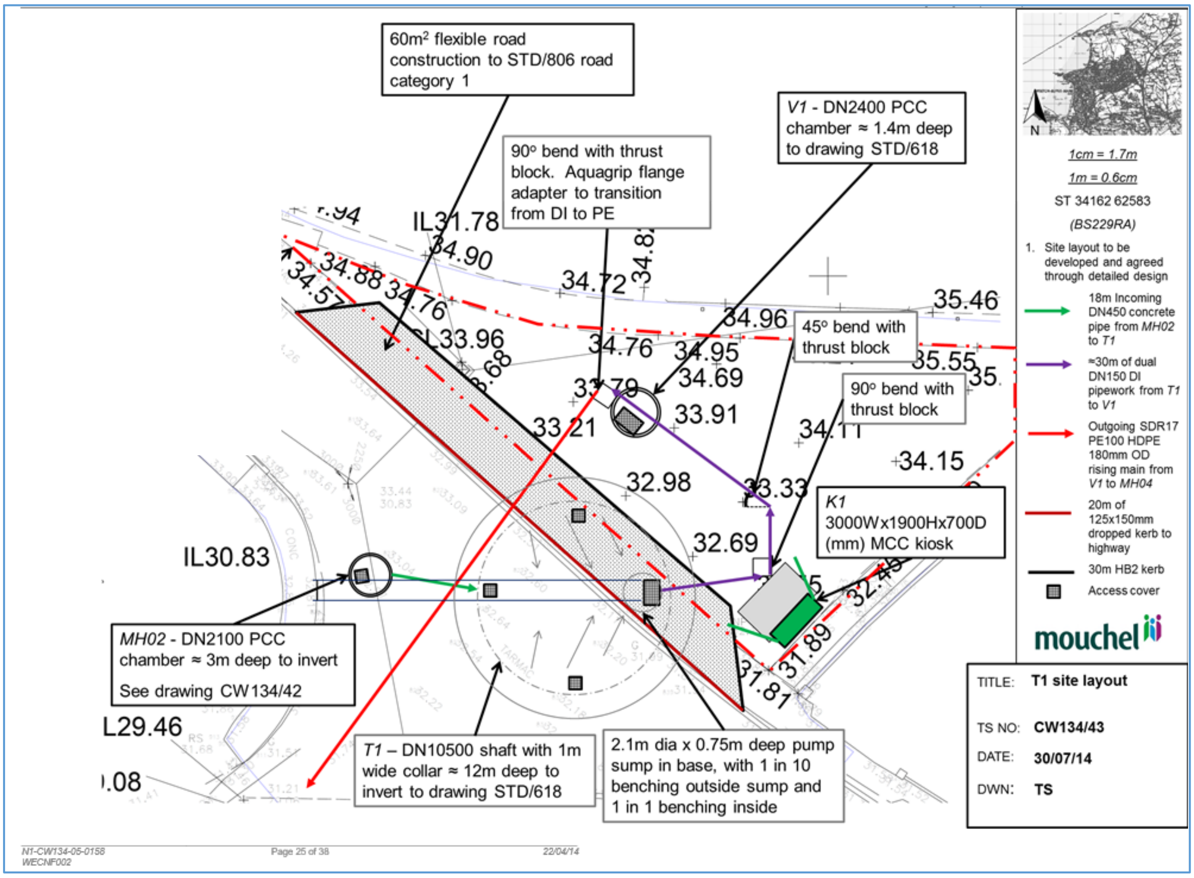
Figure 5-5: Construction of tank 2 in a busy road

5.2.7 Scheme costs and outcomes

The scheme to build the traditional solutions cost £3m. This is significantly lower cost than the sustainable solution that was estimated to cost £10m.

There has been no reported flooding in this area since we constructed the scheme in 2015/16.

Figure 5-6: Detail design of tank and the buildability issues



5.3 High Level Assessments (HLA)

We have carried out hundreds of HLAs and could provide these if requested. Each one has about 10 pages of information from location, properties at risk, incident details and proposed solutions. Each one also has a one-page summary report. Some examples are included on the following pages.

Section 5.4. contains a list of all 463 HLA we have undertaken over the past decade and refers to the preferred solution that was selected for prioritisation.

AMP6WWILT003 [redacted]

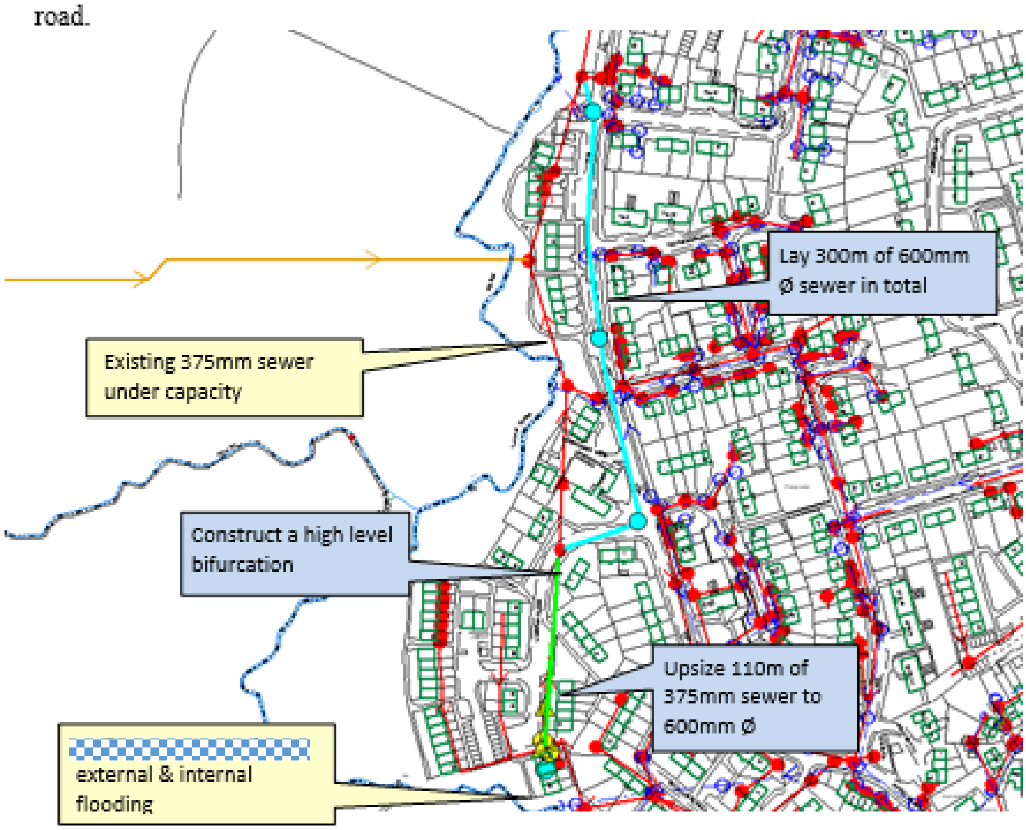
Outputs	Internal	2	External	2	RTU		**Cost**	**£ 465k**
Recommended Scheme Progression	Minimal Optioneering		Detailed Optioneering		Rejection Recommendation		Watching Brief	✓
Proposed Scheme Type	Infiltration Sealing		Surface Water Separation		Other Capital Works	✓	Mitigation Only	
Prepared	K Maloney		21/05/14	**Approved**	R Henderson			23/05/14
Reviewed	Helen Isaacs		26/04/2016	**Approved**	Rob Henderson			27/04/16
Reviewed	Rob McGinty		02/11/2017	**Approved**	Harry Wheeler			19/12/17

Problem

External foul flooding attributed to inadequate hydraulic capacity (IHC) has been experienced on a number of occasions from a manhole located in a parking area near [redacted] have also experienced internal foul flooding attributed to inadequate hydraulic capacity. The hydraulic model suggests this is due to under capacity in the 375mm trunk sewer serving Lambrok Close.

Proposed solution

- Upsize the 375mm sewer serving [redacted] and provide 84m³ offline storage in the road.



AMP6WWILT103 [redacted]

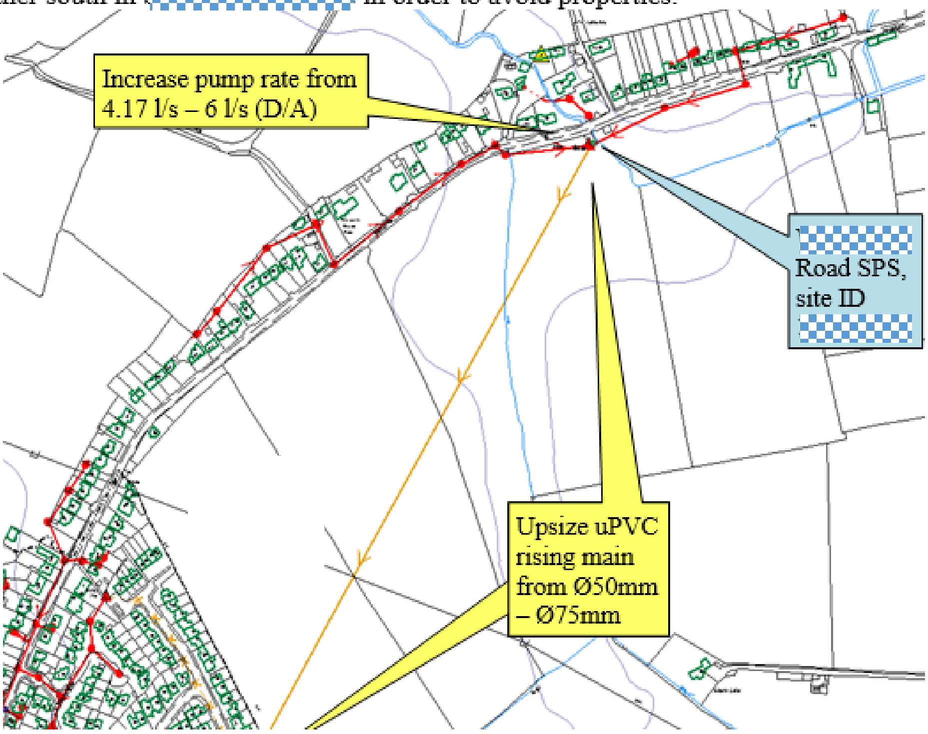
Outputs	Internal		External		RTU		Cost	£ 595k
Recommended Scheme Progression	Minimal Optioneering		Detailed Optioneering	✓	Rejection Recommendation		Watching Brief	
Proposed Scheme Type	Infiltration Sealing		Surface Water Separation		Other Capital Works		Mitigation Only	
Prepared	Robin Pearcey		25/02/14	**Approved**	Mike McMahon			12/03/14
Reviewed/Updated	Ana Oliveira		31/05/17	**Approved**	Rob Henderson			19/06/17

Problem

On the 29th April, 1st May 2012 and 27th January 2013, inadequate hydraulic capacity at [redacted] Road SPS; site ID 14479, caused high wet well levels res ulting in flow to backing up and surcharging out of a private manhole close to [redacted] Road. On all three occasions, sewage from this manhole flowed overland into the adjacent stream. During rainfall, the SPS is believed to be unable to match the incoming flows due to the amount of connected impermeable area. Historically flooding has been attributed to blockages and SPS pump failures.

Proposed solution

As part of a network solution, the pass forward rate from [redacted] SPS; site [redacted], should be increased from 4.17 l/s to 6l/s (D/A). This would require the 2 existing mono pumps (2.2l/s each) to be replaced with 2x 4l/s Flygt N-pumps. The existing 650m long Ø50mm uPVC rising main should be upsized to Ø110mm (OD) to accommodate the increase in flow rate. The upsizing / replacement of the rising main will probably require it to be diverted to join the gravity sewer some 160m further south in [redacted] in order to avoid properties.



5.4 HLA Preferred options

This section lists each preferred option for all the 423 HLAs, in order to show that we have many known hydraulic flooding issues that are already prioritised for delivery.

HLA	Prioritisation
AMP5BANES003	Replace the existing 225mm sewer between manholes ST65684509 and ST65686405 with a 300mm diameter sewer. A total of 235m
AMP5BANES004	Upgrade the SW sewer in [redacted] from M/H ST65672904 to M/H ST65672801 to 225mm to connect to the existing surface water sewer at manhole ST65672801 and upgrade the foul sewer in [redacted] from manhole ST65672802 to manhole ST65673815 to 225mm. A total of 218m.
AMP5BANES005	Lay 70m of 225mm rider sewer to provide online storage with NRV to prevent surcharging from the existing main sewer. Lay 35m of 150mm connection from the garden [redacted] to a new manhole in the carriageway, abandon the current Ø100mm foul sewer running beneath [redacted]. Intercept the existing Ø100mm connection outside No.104 [redacted] and collect all the private drainage connections.
AMP5BANES006	Solution is to construct a high level relief sewer to protect the upstream properties from internal foul flooding. This would include the construction of a new manhole in [redacted] West with 34m of 300mm sewer.
AMP5BANES007	Construct 200m3 storage in the park or car park
AMP5BANES103	Suggested solution is to construct approximately 60m of 225mm dia foul sewer along [redacted] Road with relief to allow backing up from MH 2602. Upsize 150m of 150mm dia foul sewer in [redacted] to 225mm dia. Construct 50m of 225mm dia foul sewer in [redacted]. Construct 50m of 1.2m dia foul sewer in car park area of [redacted] with outgoing flow control into 40m of 225mm dia foul sewer, e.g. a hydroslide.
AMP5BANES104	It is recommended that the sewer between Mhs ST6856 1001 and 2102 is upsized to 225mm and the backdrop manhole is reconstructed. The length of sewer is 100m, the average depth is approximately 1.5m, the soils are clay over limestone.
AMP5BANES107	Upsize 116 metres of public sewer from 100mm to 150mm, through the garden of [redacted] Close.
AMP5BANES109	Construct approximately 320m³ of offline storage with pumped return • Upsize 620m of 200mm Ø foul sewer to 300mm • Upsize 105m of 225mm Ø foul sewer to 375mm
AMP5BANES112	Construction of small pumping station & storage at [redacted] Place.
AMP5BANES113	• construct 50m of 150mm Ø high level overflow pipe.
AMP5BANES114	• Create a high level overflow at manhole ST6567 7801 by constructing a weir to bifurcate excess flow via 13m of 225mm Ø spill pipe to a new manhole A approximately 1.9m deep in the road • Lay 100m of 600 mm Ø tank sewer in the road to new manhole B approximately 1.6m deep in the road creating 28m3 of storage • Install flow control; for example a hydrobrake or penstock in manhole B • Lay 50m of 225m Ø pipe from manhole B to manhole S6567 8001 in the junction with Lime Kilns Lane between 1.2 an 1.6m deep
AMP5BANES117	• Construct a high level overflow between two combined sewers in [redacted] the option requires modelling checks.
AMP5BANES118	The estimated option is to upsize 52m of 225mm to 375mm online between manhole ST65536506 and ST65537509. Provide a 450mm high level relief sewer from ST65537509 to the stream down [redacted] Walk by laying 65m of 375mm. Construct additional road gullies to take a way the ponding outside [redacted] Walk.
AMP5BANES119	• Upsize 140m of foul sewer from 375 to 450mm
AMP5BANES120	• This option involves extending the CSO chamber, replacing a brush screen. • Replace 39m of sewer. • Downstream sewers onto routine jetting.
AMP5BAVON 104	Upgrade 107m of 300mm to 375mm, 294m of 375mm to 450mm and 45m of 975mm to 1500mm
AMP5BAVON103	• Assess hydraulic impact of the bifurcation and possible adjustment to the pass forward flow. • Upsize 166m of 300mm diameter sewer in Salisbury road • Undertake CCTV, flow and level surveys.
AMP5BBRIS102	• Raise the manhole cover at ST7271 2803 by 1m • Implement Capital Maintenance scheme, 20623
AMP5BBRIS103	The recommended solution is to remove the obvious hydraulic throttle by upsizing 75 metres of sewer from 225mm to 375mm.
AMP5BMALA001	High level relief sewer to divert excess flow to a separate part of the catchment
AMP5BMALA103	• Extend Ø100mm rising main from [redacted] SPS 14014 to alleviate flows in ST5669 3102. • Create storage in ST5669 4203X by construction of 52 metres long Ø450mm overflow pipe to a new manhole at the junction [redacted]. Retained peak flows release to be controlled by construction of 9m of Ø150mm connection to ST56694202.
AMP5BMALA107	• Construct a high level surcharge relief overflow at ST5868 2003. • Construct 114 metres of new Ø150mm foul sewer along [redacted], to link ST5868 2003 to ST5868 1006 in [redacted] Road. • Undertake sewer cleaning works in the overloaded foul connection, ST5868 2003X.
AMP5BMALA108	• Construct approximately 880m³ of storage with soffit level overflows at manholes ST5667 2510/ 3601 & 5701 to the rider sewers.
AMP5BMALA110	The solution involves providing either online or offline storage for up 150m^3 in one of the open spaces either off [redacted]. There are numerous possible sites stream depending on constructability, depths, levels and modelling results. The bifurcation would have to be modified to ensure surcharge goes to the tank and it may require either a restricted return if there is enough depth or a pumped return if not
AMP5BREDL001	• Manhole, CSO, CCTV and flow surveys need to be carried out and then model re-verification. Clean sewers • Rationalisation of [redacted] CSOs
AMP5BTRYM001	• Construct storage tanks in the field at [redacted] to create 350 – 400 m3 of storage
AMP5BTRYM002	Intercept the local drainage and divert it to the 450mm Ø overflow line from the bifurcation
AMP5BTRYM101	• Create between 300m3 and 350m3 of storage by: o Laying 60m of twin 1.2m deep x 2.4m wide box section culverts in the field upstream of the flooding, at a depth of between 2 and 4m. The exact position will need to be determined following a topographical survey of the area o One of the culverts will require a 225mm equivalent dry weather flow channel o Construct a benched weir in the upstream manhole (levels to be determined in the model). o Install a flow control device at the downstream end of the tank sewers to restrict the pass forward flow (flow to be determined by further modelling) o The flow may need to be controlled using real time control (RTC) linked to the depth of surcharge in the sewers at [redacted]
AMP5BTRYM101	Twin box culverts to provide 300-350 m3 storage and flow contol device
AMP5BTRYM102	Suggested solution is to construct a new manhole at ST5676 5240 and lay approximately 42m of high level 225mm foul sewer overflow across [redacted] with ST5676 5205 in [redacted] Upsize 52.4m of Ø225mm foul sewer in [redacted] Ø300mm between ST5676 5205 and ST5676 4104.
AMP5BTRYM105	• Construct 117m of 300mm diameter sewer. • Divert flow from approx 400 properties into new sewer. • Manhole survey needs to be undertaken prior to this.
AMP5DBBOUR112	To lay a high level overflow to the foul sewer to the north. The current model suggests that there may be a need to construct around 60m3 of storage. This could be achieved by laying 28m of 1200m twin sewers.
AMP5DBOUR001	• Divert the excess flow in the catchment with a high level relief sewer
AMP5DBOUR002	There may a possibility that flow into the open channel can simple be reduced by using a baffle plate. Or the following solution can be implemented: • Increase the size of the 600mm pipe, which runs from SZ05963704 to SZ05963807 to a 750mm. • Lay a 900mm rider pipe alongside the 900mm pipe between points SZ05963805 and SZ05964906. The 900mm pipe cannot be replaced with a larger pipe due to limited cover over the pipe. This is to ensure it can cope with the extra flow created by increasing the size of the 600mm pipe
AMP5DBOUR003	• Divert flows
AMP5DBOUR101	Construct either a SUD's type open water feature or an underground storage system. For example; Weholite or equivalent pipes / underground tank storage.
AMP5DBOUR101	Disconnect the length behind properties and install a small SPS.
AMP5DBOUR102	The estimated option is to lay up to 115m 300mm sewer and connect [redacted] possibly with an NRV to create up to 8m^3 of storage
AMP5DBOUR103	R&M and [redacted]
AMP5DBOUR104	Isolate [redacted] from the main 450mm by diverting the local sewers to the 150mm foul sewer in [redacted] (lay up to 55m new 150mm). Also • Divert the local sewers at 141 - 143 Castle West Road into the nearby 225mm system.
AMP5DBOUR106	Estimated option is to create 200m^3 storage in the park with a pumped return to manhole SZ08917002
AMP5DBOUR107	Provide a 150 mm high level overflow connection between MH SZ13931203 and MH SZ13931301 in [redacted].
AMP5DBOUR109	• Install a 100mm high weir in manhole 9503 to spill at approximately 38.05m (AOD). • Lay 125m of 225mm Ø ductile iron pipe between manholes SZ08929503 and SZ09920501 between depths of 0.9m and 2.5m to achieve a gradient of 1/150.
AMP5DBOUR110	The prioritised option is to upsize the foul sewer in [redacted] H SZ09930104 and bifurcation SZ09930203 to 375mm (80m in the road)
AMP5DBOUR111	prioritisation option is to construct a 250m³ storage tank with pumped return
AMP5DBOUR113	construct an offline storage tank at [redacted]
AMP5DBOUR113	construct an offline storage tank at [redacted] 945m³
AMP5DBOUR114	To lay 30m of 225mm Ø relief sewer between MH SZ08960404 and SZ08960407 in [redacted]
AMP5DBOUR115	• Scope for reducing the invert level at MH SZ0795 6304 and improving the gradient of the foul sewer • Relay 75m of 225mm foul sewer at a gradient of 1/200 between MHs SZ0795 5304 and 6304 • Recommended that 24m of high level relief sewer is constructed between foul manholes SZ0795 6306 and 6309

HLA	Prioritisation	o
AMP5DBOUR116	• Upsizing 99m of 225mm Ø sewer in [redacted] to 450mm Ø	
AMP5DBOUR117	• Upsize 230 metres of clay 225mm Ø foul sewer to 450mm	
AMP5DBOUR118	• Construct a high level relief in the form of a weir and 7m diameter new storage tank. Install pumped return and lay 20m of 150mm pipe. Remove 2 NRV's	
AMP5DBRID101	• Repairs to main Brick Egg sewer running down [redacted] • Requires some further modelling and survey work. • Create a 225 mm high level relief sewer from SY46924906 and 25m3 of local storage by laying 30m of new 525mm diameter sewer in the car park. Construct a throttle into manhole SY 46924802 to mobilise the storage.	
AMP5DCHRIS101	Estimated option to provide a storage shaft at the SPS with a pumped return for 250m^3 to solve the flooding only (subject to modelling).	
AMP5DCHRIS101	Construct a new pumping station using dry weather flow for calculating 12-hour storage - 15m diameter and 12m deep. Install 3 Duty /Assist/Standby Pump	
AMP5DEDOR001	The proposed solution is to construct a high level relief at manhole SZ08992901 which removes the surcharge from the sewer and spills it into 100m³ of offline storage. When the storm response reduces, the stored water will be pumped back into the sewer.	
AMP5DEDOR002	To install a SiPPS unit [redacted] and add 350m 225mm Ø to the routine jetting schedule	
AMP5DEDOR101	• Create a high level relief sewer from MH SZ01991902 to the P[redacted] by constructing high level bifurcation and layin 250m of sewer in road.	
AMP5DEDOR105	• Construct a high level relief in manhole SU03010405 at approximately 49.3m AOD. • Lay 65 m of 150mm Ø VC foul sewer between manholes SU03010405 SU03010402 at between 1.5 and 2.5m in highway. This will achieve a gradient of 1/67.	
AMP5DEDOR106	Extend the rising main from [redacted]15058 (30l/s) down to manhole SY94995901, to divert the bulk of the flow away from the flooding.	
AMP5DEDOR108	Upsize the 400 DN pipe, from the SPS back to the nearest manhole, to a 525 DN pipe	
AMP5DEDOR109	300mm high level overflow in the road between MH SU09075905 and MH SU09075803, although this would depend upon further investigation and the levels of the adjacent s/w culvert.	
AMP5DEDOR110	• Lay 205m of 1200mm diameter tanks sewer parallel to existing foul sewers. • Install Hydroslide/Penstock downstream of tank sewer • Selective infiltration sealing upstream	
AMP5DNDOR001	• Upsize 10m of 225mm to 300mm, install a new bifurcation manhole in the road. From the new manhole lay 108m of 225mm relief sewer to the existing 300mm sewer outside 26 St [redacted]stall with an adjustable weir plate in the bifurcation to control the amount of flow taken off.	
AMP5DNDOR102	• Extensive sewer sealing works • [redacted]ew SPS reburbishments and improvements, including telemetry upgrade	
AMP5DNEWF001	Increasing the pass forward flow at [redacted] by upsizing the pumps and rising main or installing storm pumps with a dedicated rising main. Constructing a pumped overflow at the SPS with an outfall to the river possibly via a reed bed Providing storage at [redacted] SPS with inhibits linked to [redacted] Diverting [redacted]S directly to the works Extensive sewer sealing and inflow reduction works	
AMP5DNEWF101	Lay 160m of 500mm Ø rider sewer to provide 30m3 of storage. Construct a weir at the upstream end of the new sewer such that DWF passes down the existing 150mm Ø sewer	
AMP5DNEWF102	• Lay 305m of new 300mm Ø pipe adjacent to the existing 200mm Ø sewer between manhole SU13149002 and SU14130703 • Lay approximately 780m of 450mm Ø sewer between manhole SU14130703 and [redacted] Treatment Works (13128). • Abandon and grout the 225mm Ø sewer between manholes SU14130703 and SU14130702.	
AMP5DPOOL101	Upsize 88m of 150mm SWS to 225mm SWS and lay up to 150m of 150mm SWS to the crest of the hill picking up all the road gullies and possibly constructing a number of new ones.	
AMP5DPOOL103	divert the properties private drainage alone to the Ø150mm sewer that drains to [redacted]	
AMP5DPOOL104	Lay 50m of new 450 mm surface water sewer, to create a culverted water course in place of the open ditch and. upsize 165m of 150mm surface water to 300mm in the road.	
AMP5DPOOL105	Create a high level overflow to a storage tank (up to 200m^3 storage) in the hard standing near the bus shelter from one of the manholes in [redacted]46607 or SZ04946608), with a pumped return. [redacted].	
AMP5DPOOL108	• The costed option is to provide up to 250m3 of storage with a pumped return. Possibly in the field to the north of SZ06923302 or in the car park • The 13m length going into the bifurcation at the head of the tunnel may also require upsizing to 750mm	
AMP5DPOOL108	Same as mitigation - replace the 22m of existing sewer (225mmϕ) by a larger sewer (450mmϕ).This additional capacity will result in a diversion of the flood water into the 1800mm downstream culvert via this replaced sewer instead of running off into the car park of the Business Park.	
AMP5DPOOL110	Upsize 220m of 525mm Ø sewer to 1200mm in the road to provide an additional 200m3 of online storage.	
AMP5DPOOL110	Create 850m3 of SUDS storage system in a green space during Phase 1	
AMP5DPOOL111	Upsize 31m of 450mm of main sewer in the road to 525mm from SZ06921812 to SZ06921804 and upsize and upsize up to 60m of collector sewer in the road from unknown (suspected 200mm) sewer to 300mm	
AMP5DPOOL112	• construct a new wet well with storage on the existing Wessex Water site next [redacted]. • Lay 35m of 525mm sewer from the existing SPS to the new wet well and 10 of rising main between the new wet well and the 225mm sewer.Lay 35m of 525mm sewer from the existing SPS to the new wet well and 10 of rising main between the new wet well and the 225mm sewer.	
AMP5DPOOL113	Relay sewer from SZ03925704 to SZ03925710 at an improved gradient by deepening it through SZ03925701 (the gradient should be able to be improved to under 1/100) and reconstructing the manholes/ sewer to create a better sweep.	
AMP5DPOOL114	Lay 100m of 150mm sewer from the local drainage and connect it in further D/S.	
AMP5DPOOL115	Construct a local sewer diversion connecting in to a Ø1200mm attenuation sewer, with the storage being mobilised by a 225mm throttle return pipe:	
AMP5DPOOL117	340m High level relief sewer	
AMP5DPOOL120	• Upsize 120m of 150mm Ø pipe i[redacted]t to 300mm Ø	
AMP5DPOOL121	Upsize 116m of surface water sewer from 200mm/225mm to 300mm (87m using no dig technology through gardens and under garages at 1-2m deep)	
AMP5DPOOL122	* Construct 7mØ, 11m deep storage tank (mobilise depth 9m), approx. usable storage of 350m3 (estimated based on model results – further investigation needed at design stage). • Install two storm return pumps within the storage tank (duty/standby), 17l/s at max 9m head (approximate retention time 5hr 45min). • Lay 40m of 225mm Ø overflow pipe from MH SZ00964001 to tank (approx. depth 3m). • Lay 40m of 125mm Ø rising main from the tank to the manhole SZ00964001.	
AMP5DPURB101	Remove the surface water sewer from SPS and put it directly into the watercourse that runs nearby. Relay / upsize the combined sewer from SZ03783002 at [redacted] the SPS in order to achieve an improved gradient.	
AMP5DPURB102	Separation of highway gullies. [redacted] single property pumping station at the property below road. Reconstruct the benching in manhole SY82803502 to improve the hydraulics.	
AMP5DPURB103	Install a new SPS, lay 125m of Rising Main and 100m of gravity sewer	
AMP5DPURB104	Estimated option; Upsize 88m of 300mm to 450mm sewer from SZ02797102 to SZ02796005.	
AMP5DSALIS101	• Build a new deeper wet well (estimated 4-5m depth) at [redacted] SPS, upsize the pumps accordingly, use existing wet well as extra storage (Pumps to be upsized from 13.5KW to 15KW) • Replace the existing 225mm sewer with 163m of new 300mm sewer from either ST99296202 or ST99296202 to the SPS at a better gradient. 43m in gardens/properties at a depth of 3-4 m	
AMP5DSALIS101	• Further investigations include infiltration study including CCTV of up to 2km of sewers, flow survey, manhole/ SPS survey modelling • Build a new deeper wet well (estimated 4-5m depth) at Church lane SPS, upsize the pumps accordingly, use existing wet well as extra storage (Pumps to be upsized from 13.5KW to 15KW) • Replace the existing 225mm sewer with 163m of new 300mm sewer from either ST99296202 or ST99296202 to the SPS at a better gradient. 43m in gardens/properties at a depth of 3-4 m • Further investigations include infiltration study including CCTV of up to 2km of sewers, flow survey, manhole/ SPS survey modelling • Build a new deeper wet well (estimated 4-5m depth) at [redacted] SPS, upsize the pumps accordingly, use existing wet well as extra storage (Pumps to be upsized from 13.5KW to 15KW) • Replace the existing 225mm sewer with 163m of new 300mm sewer from either ST99296202 or ST99296202 to the SPS at a better gradient. 43m in gardens/properties at a depth of 3-4 m	
AMP5DSALIS103	• Phase 1: • upgrade the pumps at the SPS • upsize 4300m of rising main. • Phase 2: infiltration sealing of up to 2500m of sewer	
AMP5DSALIS104	• Upsize of pumps from 2.6 L/s to cope with heavy flows/storm • Upsize of rising main from 32mm to 100mm to cope with larger pumped volumes	
AMP5DSALIS105	• Very large scale project with solution to treat properties individually including [redacted]f Inn.	
AMP5DSALIS106	Catchment to be surveyed 12km Sealing works 15% Assume 1793m sewer sealing and 33 manholes	
AMP5DSALIS107	• A thorough cleaning / de-tuberculation of the clay, concrete and cast iron sewers to remove debris and scale • Sewer sealing works of the clay and concrete sewers • Replace 144 meters of 150mm cast iron pipe with 225mm VC pipe between manholes SU1721 0511 and 0405	
AMP5DWARE101	Costed option is to lay up to 35m of 2.1 box culvert in the road providing approximately 150m^3 of storage with 40m of 300mm sewer connecting it to the SPS.	

HLA	Prioritisation	o
AMP5DWDOR101	Lay a new 225mm diameter sewer from manhole SY47932201 to manhole SY47932101 including a new manhole on the line	
AMP5DWDOR102	• Undertake the infiltration scheme to complete 2.5km of infiltration sealing	
AMP5DWDOR103	• 5km of public foul sewer [redacted] and the upstream catchments should be sealed to reduce ground water infiltration.	
AMP5DWEYM001	30 year solution: Relief sewer to a 600mm storage pipe	
AMP5DWEYM003	Modify the outfall to V[redacted]Harbour so that the outfall pipe enters the harbour at am alternative angle so as to not spray the docked boats and so the flow is dissipated on entering the harbour. Install variable pumps for the pumped overflow at [redacted]PS to operate at up to 1000l/s.	
AMP5DWEYM005	200m of infiltration sewer sealing works	
AMP5DWEYM104	Upsize the sewer in Ne[redacted]ad between MH SY67793201 and MH SY67793103, from 300 mm to 450 mm (approximately 33 metres), at an improved gradient if possible, in order to increase the pipe capacity, and create some additional storage.	
AMP5DWEYM500	Upsize sewers downstream of the [redacted] Road and C[redacted]ose area and construct new SPS which pumps directly to [redacted]STW	
AMP5KENNET001	• Carry out 160m of sewer sealing works and replace 60m of 150mm pitch fibre sewer wth with 225mm diameter clay pipe.	
AMP5KENNET101	Construct 300m of high level relief sewer, diameter 600mm from Mh 0701 to Mh 7601.	
AMP5KENNET102	• Construct a new manhole at the blind junction SU01613306 with overflow weir arrangement • Construct 172m of 300mm overflow sewer in Roseland Avenue (possibly strategic solution)to a new manhole with NRV connection.	
AMP5KENNET103	• 5km of infiltration investigations and an estimated 1.5km of infiltration sealing upstream of the [redacted] Avon Canal crossing. • Reconstruct MH SU0643 6902 to include swept bend into downstream sewer. • Construct a 37m length sewer at 200mm Ø between MH SU0643 6902-6901 by guided Auger under the stream. Provide a benched weir overflow connection from the existing sewer.	
AMP5KENNET104	**Bottlesford** • Suggested solution is to seal approx 850m of 150mm dia FWS. • Upsize 15m of 150mm dia FWS leading to SPS to 225mm dia (MH SU11592103 to SU11592102). • Upsize pumps at [redacted] SPS (Site id 15704) from 4 l/s to approx 6 l/s. • Abandon 40m of 150mm dia gravity overflow. • Construct pumped CSO (2KW) with 30m3 off-line storage (total storage 6hr x dwf). **Woodborough** • The HLA for the AMP4 scheme [redacted]gh suggested some upsizing and modifications to the CSO • CW725 Options were storage, link the telemetry together in order to optimise the upstream storage or a pumped overflow • Estimated option is to provide some storage up to 50m2 with a CSO and link the telemetry to make use of the upstream storage.	
AMP5KENNET105	Infiltration sealing of up to 900 meters of sewer and carry out further CCTV works to establish whether the sealing was successful	
AMP5MEND001	Upsizing two strategic locations resulting in 515m of Ø225mm (or greater) in place of the existing Ø150mm.	
AMP5MEND002	• Upsize the 46m of 150mm sewer in[redacted] • Copa cyclone screen retro fitted to the CSO and a duckbill valve added to the overflow. • This is a network option	
AMP5MEND101	Relay 75m of 225mm dia, lay 15m of new 225mm dia sewer, 50m of new 600mm tank sewer complete with hydroslide and re-route [redacted] to west.	
AMP5MEND107	Lay 67m of 225mm dia. sewer between manholes ST67490002 and ST67490001	
AMP5MEND108	• Upsize 360m of 150mm dia. sewer to 225mm dia. between manhole ST52334601 and [redacted]. • Divert flows away from High St by installing a bifurcation manhole between manholes ST52331701 and ST52331700 and laying 35m of 150mm dia sewer from the new manhole to manhole ST52331702.	
AMP5MEND108	• Upsize 360m of 150mm dia. sewer to 225mm dia. between manhole ST52334601 and [redacted]. • Divert flows away from High St by installing a bifurcation manhole between manholes ST52331701 and ST52331700 and laying 35m of 150mm dia sewer from the new manhole to manhole ST52331702.	
AMP5MEND109	• Infiltration investigations followed by sealing works. • Estimated length of 500m.	
AMP5NSOM002	NRV and storage	
AMP5NSOM003	• Reinstate temporary pumping station[redacted]e installing new Flygt pump in the existing chamber. • Further investigation and modelling will be needed to verify there will be no adverse impact downstream.	
AMP5NSOM005	Fit a flap valve or rubber duckbill valve on the 525mm Ø surface water outfall. This may require the construction of a new chamber to house it.	
AMP5NSOM101	• Upsize 213m of 225mm dia foul sewer to 450mm dia from ST33611903 to ST33612705. • Remove 2 No. 150mm dia suspected SW connections from ST33621007. Connect into SW manhole ST33621008	
AMP5NSOM102	• Seal surface water sewer pipe in ST34621102 (incoming B, outgoing Y) Abandon 150mm lower level foul outgoing pipe (X). Remove enclosed 300mm diameter pipe and lower outgoing pipe to invert of chamber (Z). Divert all incoming foul flow into new outgoing 450mm diameter pipe (Z) (see below). • Upsize 237m of 300mm dia foul sewer to 450mm dia from ST34621102 to ST34612901. • In chamber ST34621004, join incoming 150mm surface water inlet to 150mm diameter outgoing surface water outlet.	
AMP5NSOM105	The solution is phased to include the construction a high level relief foul sewer and replacement of a 48m length of sewer as part of phase 1 and the construction and upsizing of 13m and 87m of surface water sewer as part of phase 2.	
AMP5NSOM108	132m of 225mm dia. sewer from manhole ST43639411 to the 300mm dia. sewer between manholes ST43638501 and ST43638503. This new line will act as a relief overflow sewer during wet weather events. A high level weir is to be constructed in manhole ST43639411.	
AMP5NSOM111	• Isolate 3[redacted] Town Road from the main sewer by connecting to a new parallel 150mm diameter serving just those 4 properties. Drain this new sewer to a new small pumping station which would pump to the existing sewer in [redacted]Road. • Repeat this process for the 4 properties affected by flooding on Farleigh Road. • Upsize 30m of 300mm diameter to 375mm diameter in S[redacted]	
AMP5NSOM113	Conduct infiltration sealing of up to up to 1200m of sewers[redacted] Levels of infiltration should also be assessed in the 2.7km 225mm sewer connecting [redacted]	
AMP5NSOM114	Re-route SW sewer in order to alleviate flooding location. Ammend entry angle of downstream MH.	
AMP5NSOM115	• Lay 83m of 300mm dia. sewer between manholes ST48693904 and ST48693901 to divert flows away from the problem area and improve sewer gradients. • Install a high weir in manhole ST48693904 to direct flows towards the new 300mm dia. sewer.	
AMP5NSOM118	Reroute some existing flows to a new line and provide circa 90m3 of storage via twin 825mm [redacted]RP pipes.	
AMP5NSOM118	Construct 100m3 offline storage tank with pumped return	
AMP5NWILT001	• Lay up to 30m 150mm private drainage up to 1m deep • Install an NRV with local storage	
AMP5NWILT002	• Upsize 160m of 150mm diameter clay sewer to provide adequate hydraulic capacity.	
AMP5NWILT003	Alleviate local internal and external flooding with a local diversion and turning existing 150mm into a rider sewer	
AMP5NWILT101	Install two storm return pumps within the storage tank (duty/standby), 17l/s at max 9m head (approximate retention time 5hr 45min).	
AMP5NWILT104	• Carry out a mini-DAP for the catchment upstream of [redacted]). • Carry out manhole surveys, impermeable area surveys, CCTV and a flow survey to support the model build and verification. • Rebuild the [redacted] and replace the overflow pipe (590m @ 225mm diameter). • Improve [redacted] SPS (Site 14188) by including an offline storage tank (50m3) and pumped emergency overflow. • Provide 7m3 of additional storage at [redacted]. This could be achieved by upsizing the connecting sewer to 300mm dia (160m length) and moving the NRV to Mh 5901.	
AMP5NWILT107	Upsize sewer to 300mm from the development to the point where the [redacted]e Building 488 (Ps 11 and 12) 14643 rising main connects in	
AMP5NWILT109	sglos112	
AMP5NWILT111	Infiltration sealing of main sewers i[redacted]on up to 2km. If levels permit lay a 50m high level 150mm overflow from manhole ST96779202 to a 60m 900mm sewer and return it back to manhole ST96778102 via a short 150mm throttle provide online storage	
AMP5NWILT116	• Construct a high level relief sewer • Construct 114 metres of 300mm Ø sewer • Limit the pass forward flow at the downstream end of the 300mm sewer with a Penstock or Hydroslide • Re-lay the existing 67m of 150mm clay sewer at a depth of 1-2 metres. • Using the pipe bursting technique, upsize 14 meters of 150mm sewer to 300mm sewer, between the CSO and MH SU00696701 at a depth of 2-3 metres. and re-connect up to 3 private lateral drains.	
AMP5NWILT117	• Construct a new manhole downstream of the existing hydroslide and install a new hydroslide chamber.	
AMP5SEDGE001	• Install a pumped overflow at ST46530202 (CSO) utilising the current outfall. This will prevent the outfall from becoming locked out when the river level rises. • Pump capable of 35l/s discharge (based on M50-90 storm).	
AMP5SEDGE003	• Network solution which involves the provision of 170m^3 of online storage. (80m of 900mm d sewer and 120m of 1200mm d sewer) • 29m of 225mm d sewer upsized.	
AMP5SEDGE003	Sewer upsize or parallel offline storage.	
AMP5SEDGE101	• Disconnect [redacted] from the affected line • Lay 145m of 150mm sewer through the fields and connect to ST29535102 downstream	
AMP5SEDGE105	1050mm Storage pipe at the inelt to SPS.	

HLA	Prioritisation	o
AMP5SEDGE107	Phased solution preferred as phase 1 will initially relieve issue • Phase 1: • Upgrade pumps at [redacted] SPS & sewer cleaning as required. • Phase 2: • Provide 6 hours of DWF storage at Withy Road SPS • Provide DWF channels in both pipes	
AMP5SEDGE108	• Lay 850 m of 375mm Ø sewer between MH ST45531304 and [redacted]W: • Construct a bifurcation at MH ST 45531304 with flows entering the new sewer at a depth of 1.3m. • Abandon [redacted] SPS and direct flows down the new sewer • Construct a new SPS at the STW to pump into the inlet works. The wet well should be at a depth of 4.5m.	
AMP5SGLOS003	150m³ of storage with a pumped return	
AMP5SGLOS004	• Intercept the existing overflow lateral and lay it to a storage tank with a pumped return and overflow	
AMP5SGLOS103	• Construct new sewer to divert flows from ST66741611 to ST66742602 and install NRV on incoming 225mm at ST66742603	
AMP5SGLOS104	Create a new manhole in the track behi[redacted]and lay up to 85m high level 150mm relief sewer to the private sewer connecting in either in the garden of No.19 [redacted]or near garages between N[redacted]e.	
AMP5SGLOS105	Consruct 1.8km of rising main to move abattoir waste away from village and local sewers.	
AMP5SGLOS110	• Construct a new storage tank adjacent to the current wet well at [redacted]S that will provide 75-100m3 of storage with a gravity return. • Upgrade the pumps at T[redacted]S to 5l/s. • Construct an emergency overflow with a screen that will discharge from the storm tank into a highway drain.	
AMP5SGLOS111	• This option involves constructing 186m of 225mm Ø rider sewer to protect the low lying properties on the North side of Sa[redacted] from backing up from the main sewer.	
AMP5SGLOS112	• Extensive sewer sealing works (estimated at 2.5km) based on the results of the infiltration investigations.	
AMP5SGLOS113	• Create a hydraulic model for [redacted]W catchment and determine duration and capacity of storage required at [redacted]use. • If adequate storage cannot be provided it may be necessary to provide a SiPPS solution or relay 670m of trunk sewer outfall to the STW. • CCTV and manhole survey will be necessary. • Provide 120m of 225mm foul sewer with NRV at downstream MH.	
AMP5SGLOS114	Inflitration sealing of 30% of the catchment	
AMP5SGLOS119	Construct 62metres of Ø600mm of surface water sewer to provide a dulicate sewer.	
AMP5SSOM002	• Subject to verification of the hydraulic model, upgrade the combined sewer along [redacted]ad to 300mm diameter • Subject to verification of the hydraulic model, upgrade the combined sewer along [redacted]ove to 375mm diameter • Subject to the preparation of a hydraulic model, upgrade the surface water sewer along [redacted] to 375mm diameter • Subject to the preparation of a hydraulic model, upgrade the surface water sewer along [redacted] to 450mm diameter	
AMP5SSOM004	• Replace existing 100mm ID rising main to 140mm OD pipeline. The total length is 1575, 1110m in fields and 465m in road.	
AMP5SSOM101	Construct a new pumping station at the downstream end of the siphon just outside of [redacted]STW and pump flow into the works balancing tank.	
AMP5SSOM102	It is recommended to upsize ~260m of 300mm sewer to 375mm	
AMP5SSOM103	Take a phased approach sewer sealing and then installation of an overflow	
AMP5SSOM104	Construct a 900mm [redacted] to improve flow characteristics.	
AMP5SSOM107	• Lay a 150mm diameter sewer from Manhole ST54165702 to manhole ST54165701. • Abandon the sewer length between manhole ST54165702 to manhole ST54165703.	
AMP5SSOM113	Circa 621m of infiltration sealing following CCTV / Electroscan investigation.	
AMP5SSOM113	Infiltration sealing of an estimated 30% of the catchment (621m)	
AMP5SSOM116	Construct a small package pumping station.	
AMP5SSOM119	Lay 71m of 225mm dia. relief sewer between manholes ST32087405 and ST32087409, with a high level weir installed in manhole ST32087405.	
AMP5SSOM122	• Construct off-line storage tank in the parking area off C[redacted]ne.	
AMP5STROUD103	Sewer sealing of up to 1100m of 150mm Ø sewer within the H[redacted] catchment	
AMP5STROUD104	• Construct new overflow at [redacted]uth SPS with 55m3 of pumped storage (12 hours at DWF). Discharge to [redacted]ok and formalise existing deemed consent. • Further sealing works may also be required, depending on the results of the CCTV surveys and design investigations.	
AMP5STROUD105	Four M/H surveys and CCTV between these m/hs approx 53m. Impermeable area surveys of the church to determine the roof run off and investigate where this connects to the sewer. Possibly re-connect to the surface water sewer to reduce flow in the combined sewer. Upsize 47m of 150mm sewer to 225mm between m/h ST75934406, ST75934303, ST75934301 as the current 150mm pipe is acting as a throttle and reducing flow.	
AMP5STROUD106	• Sewer sealing works of the 100mm Ø and 150mm Ø clay sewers • Cleaning / de-tuberculation of the 150mm Ø cast iron sewers	
AMP5STROUD106	Conduct approximately 1.62km of infiltration investigations coverin[redacted] and perform an estimated 0.48km of sewer sealing works, subject to investigation results.	
AMP5STROUD501	Sewer sealing of the 100mm Ø and 150mm Ø clay sewers in the S[redacted]atchment to reduce infiltration into the network. Conventional joint sealing work is recommended. The estimated length is 400 meters. A thorough cleaning / de-tuberculation of the 150mm Ø cast iron sewers to remove silt, scale and debris (blockages) identified in the 2011 CCTV survey.	
AMP5TAUN102	Online storage tank and flow control. Capacity to be determined from 2014 DAP.	
AMP5TAUN103	Conduct approximately 3225m of infiltration investigations and perform an estimated 650m of sealing works	
AMP5TAUN104	• Carry out infiltration sealing works in the foul sewer system • Provide 21m3 of online storage upstream of the NRV	
AMP5WEYM002	Install a package pumping station to pump the local drainage into the surcharged 225mm sewer and seal the covers on the flatter section of the 225mm sewer.	
AMP5WSOM102	• Construct 100m of storage in T[redacted]ad. • Some sewers may have to be repaired there current conditions.	
AMP5WWILT101	Phase 1 • Upgrade the pumps at the SPS from 8/s to 12l/s • Construct storm relief storage capacity of approximately 70m³	
AMP5WWILT103	• Divert 50 properties upstream of the flooding	
AMP5WWILT104	• Option 1 - increase the capacity of the existing outfall • Option 2 - install a pumped overflow to prevent the CSO from becoming tidelocked.	
AMP5WWILT104	The prioritisation option is to construct 315m³ of storage at [redacted]CSO and replace the gravity overflow with a pumped one, which outfalls directly into the River Avon.	
AMP5WWILT105	• Rebuild MH ST90644501 so that rising main comes inon 'y-piece' • Negotiate with C[redacted]s to reduce pump rate from private SPS (site 10291) • Repair grade 6 sewer upstream of MH ST90644501	
AMP5WWILT106	• upsizing 140m of 225mm sewer to 450mm diameter. • This sewer is relayed on the same line • Lay 250m of 450mm diameter sewer In [redacted]oad • At MH ST86507804, direct all flows down the new sewer and cap off the old 300mm sewer. • Retain the remainder of the 300mm sewer.	
AMP6BANES001	Upsize 185m of 225mm pipe to 300mm	
AMP6BANES002	re bench the outlet to the CSO to provide a smoother transition of flow	
AMP6BANES003	Relay approximately 30m of sewer and increase the size from 150mm to 225mm from MH ST68672210 to ST68671305	
AMP6BANES004	Diverted the flows from the [redacted]ge and [redacted] to the MH ST62575301 located DS the properties by laying approximately 95m of 300mmØ sewer and upsizing 15.5m of 300mmØ sewer to 375mmØ.	
AMP6BANES101	improvement to the [redacted]ale CSO which will prevent any flows backing up from the surface water sewer. Includes new screen and extended chamber with benched flows.	
AMP6BANES102	This option involves reconstructing manhole ST60624902 with a slightly elongated chamber and swept benching to improve flow in the existing sewers and subsequently sealing the cover.	
AMP6BANES104	Replace the throttle pipe with one of the same size as the existing incoming sewer, re-bench the existing chambers, may require the replacement of the chamber and the resealing of the spill pipe to the river if required.	

HLA	Prioritisation	o
AMP6BANES105	Upsize store and local diversions as per the developers study	
AMP6BANES106	infiltration sealing to reduce inflow to the SPS	
AMP6BANES107	Construction of 100m^3 storage tank alongside SPS	
AMP6BANES108	• Upsize approx. 150m of 150Ø to 225Ø – possibly by on line pipe bursting, May require relaying, depending upon actual gradients. Depth 2 - 3.5m.	
AMP6BBRIS001	Reinstate the previously abandoned surface water connection into the main surface water system and install flap valves on the receiving ends to prevent flows backing up towards the properties	
AMP6BTRYM101	2.52km tunnel with either a 2.4m or a 3m Ø • A second tunnel, measuring 528m long with a 1.8m Ø, will also be constructed between [redacted] and The Bristol Trunk • Approximately 4 hectares of surface water run-off will be removed 750m of 1800mm Ø sewer and 70m of 450mm Ø sewer	
AMP6BTRYM102	Construct 38m of 225mm Ø high level relief foul sewer and upsize 108m of 150mm dia to 225mm	
AMP6BTRYM103	348m of surface water sewer laid, removing approximately 1.2ha of impermeable area from foul sewer.	
AMP6DBOUR001	Surface water separation by the construction of 315m of 225mm dia sewer with an additional 120m of 150mm dia sewer to connect properties private SWS.	
AMP6DBOUR002	Isolate the properties with a small package pumping station:	
AMP6DBOUR101	• Connect property drainage and highway gullies into [redacted] (phase 2 of CW599) • Involves laying 140m of foul water sewer, disconnecting 9 properties from the 875mm diameter sewer and increasing SPS capacity	
AMP6DBOUR102	• Constructing 100m of 225mm diameter sewer • Connecting lateral sewer from [redacted] into new 225mm diameter sewer • Abandon and seal the downstream end of the two 150mm diameter lateral sewers and replace NRV's	
AMP6DBOUR103	Upsize approx 75m of 225mm sewer to 300mm. Reline 85m of sewer.	
AMP6DCHRIS101	• Increase flows from the existing Hydroslide to allow more control from the unit and reduce risk of settlement / blockage. • Increase upstream pipe diameter link SZ21936802, from 150mm @ 1:200 gradients, to 200mm D.I or 225mm VC to allow self-cleansing. • Rebench MH SZ21936802 to provide better flow characteristics and install scum boards on tank inlet	
AMP6DCHRIS103	Overflow sewer to alleviate surcharged surface water sewer	
AMP6DCHRIS104	Carry out infiltration sealing of the lengths upstream of [redacted] SPS	
AMP6DEDOR001	• Adopt the existing pumping arrangement Phase 2 • Upgrade the existing arrangement to a single property pumping station	
AMP6DEDOR002	infiltration sealing on approx. 20% of the catchment Create a pumped overflow at [redacted] SPS	
AMP6DEDOR003	Abandon the existing sewers in the back gardens, divert the flows down [redacted] Lane away from the flooding, upsize 255m of downstream sewers:	
AMP6DEDOR004	The original cast iron Ø225mm sewer should be upsized to a concrete Ø400mm (or larger) to the bifurcation at SU03006205 and further section to be upsized to Ø300mm. Further upsizing to Ø300mm at several strategic locations would need to be undertaken downstream of the property	
AMP6DEDOR005	380m long Ø225mm high level relief sewer running on top of the existing sewer from SU05005501 to SU06000603	
AMP6DEDOR101	Upsize pumps, lay new rising main	
AMP6DEDOR102	• CCTV and infiltration survey of up to 7km including targeted CCTV and infiltration survey and possible use of electroscan. • Rehabilitate an estimated 30% of inspected sewers (approximately 1750m requiring rehabilitation) • The adjacent plan highlights in yellow sewers that have been sealed in the past comprising: o (2003) 1.4 km Polyester Resin Joint Sealing and 55m softlined o (2006) 2.7 km Acrylate Joint Sealing o (no date) 280m soft lined) These will have to be resurveyed and relined if necessary	
AMP6DEDOR103	upsizing 155m of 150mm Ø foul sewer to a 300mm Ø pipe	
AMP6DEDOR104	Laying a new Ø225mm relief surface water sewer from SU07028952 to SU07028906	
AMP6DEDOR105	infiltration sealing is recommended to include manhole sealing at the SPS as well as pipe lining	
AMP6DEDOR107	It is proposed to lay a total of ~265m of 375mm high level relief sewer and upsize ~118m of the existing 150mm sewer to 375mm.	
AMP6DEDOR108	Solution proposed from C9872 - Network solution which involves STW improvements; construction of storage tank.	
AMP6DEDOR109	Lay a SW sewer paralel to the existing in order to remove the restricition via apporx 42m of 150mm sewer and 81m of 225mm in the main road	
AMP6DNDOR001	Relay 1190 sewers with an improved gradient and at 225mm through the village of Motcombe	
AMP6DNDOR002	• Upsize the sewer down [redacted] Lane from Ø225mm to Ø300mm from MH ST81101902 to MH ST81107902	
AMP6DNDOR101	As per Sustainable Option	
AMP6DNDOR102	Isolate [redacted] sewer with its own lift SPS [redacted]	
AMP6DNDOR103	about 144m2 of pumped return off-line storage	
AMP6DNDOR104	Infiltration investigations and sealing of approx. 25% of the catchment, as well as installation of a flap valve over the overflow outlet.	
AMP6DNDOR105	Infiltration sealing approx 2km of 300mmØ sewer and approx 30 MHs that would also require sealing works.	
AMP6DNEWF001	250 m3 storm storage tank	
AMP6DNEWF101	Upgrade the assist pump at [redacted] SPS from 2.5 l/s to 6 l/s	
AMP6DNEWF502	seal approximately 15% of the catchment	
AMP6DPOOL002	Direct flows to a new Ø225mm sewer parallel to the Ø225mm on the [redacted] removing sewers from the woodland.	
AMP6DPOOL003	SW separation at No21A and 27 and provide more storage for No21A in the form of additional manhole	
AMP6DPOOL004	Construction of 790m^3 SW Swale	
AMP6DPOOL005	Upsize the current Ø300mm concrete sewer passing through [redacted] Road to Ø900mm concrete section and flow control device	
AMP6DPOOL101	• Construct a high level bifurcation, 140m of 225mm Ø sewer, a new manhole and install ultrasonic telemetry in another	
AMP6DPOOL102	upsizing the 225 mm sewers in [redacted] to 300mm and the 300mm in [redacted] Road to 450mm.	
AMP6DPOOL103	70m of 225mm Ø high level relief sewer between MH SY99912506 and SY99912602 in [redacted].	
AMP6DPOOL104	Construct a small package pumping station at [redacted] Road	
AMP6DPOOL105	Construct a small package pumping station / SiPPS type unit	
AMP6DPOOL106	Upsize 417m of 150mm Ø foul pipe on [redacted] to 300mm Ø – including the bifurcation	
AMP6DPOOL107	Lay new pipe to connect the affected line with the main sewer via non-return valve:	
AMP6DPOOL108	Relay 135m of the existing 200mm sewer at a better gradient of 1 in 171 using 225mm pipe	
AMP6DPOOL109	Upsize, high level relief	
AMP6DPOOL110	Divert the sewer from MH SZ00919602 to [redacted] SPS ID 15642 by upsizing 38m of 200mmØ foul sewer to 450mmØ and lay 124m of 450mmØ pipe.	
AMP6DPOOL111	lay ~165m of 450mm high-level relief sewer in [redacted] Road.	
AMP6DPOOL113	Ø225mm high level relief sewer from SZ03899901 (this is currently a lamp hole and would require an installation of a manhole) to SZ03899801.	
AMP6DPOOL114	(145m) on line replacement (or sewer duplication) to provide increased capacity and to lower the hydraulic head.	
AMP6DPOOL117	Construct 400m3 of offline storage with a pumped return in the car park to the rear of [redacted] Road. A high level relief bifurcation will need to be constructed 35m downstream from SZ02931106, (MH1). The lengths of foul sewer between manholes SZ02933106 and SZ02931105 will be upsized from 225mm to 450mm. Then the 225mm foul sewer between (SZ02931105) and the newly constructed (MH1) will be upsized to 600mm. After this, a new 300mm sewer will be laid from MH1 to the storage tank via a new (MH2) in the carpark of 68 [redacted] Road	
AMP6DPURB101	• Upsize 75m of 225mm Ø foul sewer to 300mm Ø and remove the negative gradient upstream of [redacted] Kings Arms SPS (14216). It is also recommended that the pump on/off levels are lowered to allow a free discharge into the wet well. • Upsize 380m of 150mm Ø foul sewer to 225mm Ø and lay 230m of new 450mm Ø surface water sewer adjacent to the foul sewer in highway.	
AMP6DPURB102	Sewer diversion away from flooding• Construct approximately 107m of foul sewer	
AMP6DPURB103	Pumped overflow and SPS improvements	
AMP6DPURB104	Reduce spill level in wet well, abandon illegal o/flow	
AMP6DSALIS001	Install Sipps [redacted]	
AMP6DSALIS002	Infiltration reduction	
AMP6DSALIS003	Infiltration reduction	
AMP6DSALIS004	Sewer sealing	
AMP6DSALIS005	Approx 15% of the catchment would require sealing works using epoxy resin. This equates to approximately 13 lengths of sewer equalling 450m ranging between depths of 1.14m and 3.94m. It is recommended the mitigation option is included to the prioritisation solution.	
AMP6DSALIS101	Infiltration sealing 750m	
AMP6DSALIS102	350m infiltration sealing	
AMP6DSALIS103	10km of infiltration investigations and perform an estimated 2km of sewer sealing works, subject to investigation results.	
AMP6DSALIS104	Infiltration investigation and sealing	
AMP6DSALIS105	Infiltration sealing - estimated 205m	
AMP6DSALIS106	The prioritisation option would be to construct the overflow that already has consent but using a different layout	
AMP6DSALIS107	Infiltration reduction	
AMP6DSALIS108	(Phase 1): Infiltration sealing of the identified areas and increased pump rate of 5l/s at [redacted] Cottage SPS.	
AMP6DSALIS109	Construct a multi-property pumped NRV at manhole SU14309507 in the alleyway between properties [redacted]	
AMP6DSALIS110	Carry out sealing works	
AMP6DWDOR001	2.85km of infiltration investigations followed by an estimated 0.6km of sealing works.	
AMP6DWDOR101	upsizing 755m of foul sewer from Ø150mm to Ø225mm	
AMP6DWDOR102	Sealing 30% of catchment using appropriate sealing methods. An infiltration reduction study should be carried out on the catchment upstream of [redacted] SPS.	

HLA	Prioritisation	o
AMP6DWEYM001	Construct 216m of 225mm Ø and 105m of 300mm Ø of high level relief sewer to the foul system. Construct approximately 350m³ of pumped return storage.	
AMP6DWEYM002	• Pump flows from the existing surface water sewer into the ditch to prevent high water levels from locking out the outfall due to the concrete apron level of the flood defence structure being 0.43 m higher than the current surface water outfall. • The maximum capacity of the existing surface water sewer is around 50 l/s. Therefore install 2 x 50 l/s pumps running duty/standby. There would be a static head of around 3.3 m. • Also construct: o 60 m of 600 mm Ø surface water sewer at a depth of between 1.6 m and 1.8 m. o A 3.0 m Ø pumping chamber with a depth of 2.0 m. o A 10 m 250 mm diameter rising main at a depth of between 3.8 m and 0.5 m. o A 3.0 m Ø discharge chamber with a depth of 2.0 m. o A 1.2 m Ø manhole chamber. o A surface water outfall fitted with a tide flap. • Abandon the existing surface water sewer between manhole SY68805604 and the existing outfall.	
AMP6DWEYM003	Divert the main sewer Construct a 300mm Ø relief pipe to a into a 1.2m Ø storage sewer	
AMP6DWEYM101	Upsize 380m of 225mm Ø VC sewer to 375mm Ø pipe between manholes SY66835601 and SY66836302 (this is as envisaged in phase 2 of scheme CW111).	
AMP6DWEYM102	• Construct a high level relief at manhole SY68780509 to spill at approximately 1.20m AOD. • Lay 10m of 400mm Ø concrete sewer between manhole SY68780509 and the storage tank at a gradient of 1 in 50 to achieve a peak flow of 305 l/s. • Build 500m³ of off line storage in [redacted] to provide flood alleviation up to a 30 year return period storm event.	
AMP6DWEYM104	Major surface water seperation	
AMP6DWEYM105	Upsize 84m of 150mm pipe to 225mm.	
AMP6DWEYM106	New surface water sewer	
AMP6DWEYM107	perform surface water separation where proven viable.	
AMP6DWEYM108	Upsize pumps at [redacted] SPS	
AMP6DWEYM109	duplicate 850m of 225mm sewer from SY66846401 down to SY66835601	
AMP6DWEYM112	• Re-rounding and lining of the sewer to improve the hydraulics together with local repairs where the defect is beyond the limits possible for rerounding	
AMP6KENNET001	upsize 220m of 150mm foul sewer immediately upstream of [redacted] SPS	
AMP6KENNET002	Remove roofs to allow storage in 450mm to be utilisedfor foul flows	
AMP6KENNET003	Phase 1 - carry out sewer investigations in the [redacted] catchment and seal any infiltration found.	
AMP6KENNET004	Construct 40m3 storage with pumped return at [redacted] Park.	
AMP6KENNET005	Install 245m of Ø300mm sewer from a new manhole to be constructed on length ST99583602 to the main trunk sewer	
AMP6KENNET101	• Phase 1 is infiltration sealing and reduction program	
AMP6KENNET102	• Phase 1 - undertake sewer rehabilitation to address the areas of infiltration currently identified	
AMP6KENNET103	infiltration sealing	
AMP6MEND001	Infiltration sealing and seling manhole covers	
AMP6MEND002	Using Epoxy liner seal the infiltration sources within the sewer leading to [redacted] identified in CCTV118753, to seal all lengths had were identified to have sources of infiltration within the SPS catchment would equate to 0.63km	
AMP6MEND101	• upsize 270m of 150mm diameter foul sewer to 225mm. • Appropriate pipe protection will have to be incorporated into the design as at point pipe is only 0.91m depth	
AMP6MEND102	The prioritisation option involves carrying out localised CSO improvements. These include modifying the chamber benching, checking the ultrasonic setting and replacing the gatic cover with a Technocover to improve access. The continuation sewer should be CCTV surveyed and cleaned out on completion of the CSO works.	
AMP6MEND103	Construct 150m of 300mm relief sewer utilising a weir to spill.	
AMP6MEND104	Construct a 26m length of 150mm Ø high level relief sewer. Construction of 215m of 225mm Ø relief sewer.	
AMP6MEND105	Move the existing CSO and provide online storage.	
AMP6MEND106	To seal MHs and sewers adjacent to the river to prevent the flood water wntering the sewers and groundwater infiltration.	
AMP6MEND107	Upsize the pumps at [redacted] SPS (14112) to 8-10l/s (new) in order to meet the consent (7l/s) and relay approx. 330m of 100mmØ (possibly 125 mmØ) rising main	
AMP6NSOM001	Upsize and extend existing SW sewer	
AMP6NSOM002	It is proposed that [redacted] access to clean and survey the tank and then put forward a project proposal report / project brief recommending take over including an estimated Opex element for future survey and maintenance work.	
AMP6NSOM003	Relocate the CSO chamber to within the SPS compound and install a MecMex mechanical screen. A 1m long, single sided 90° unit will suffice. The new chamber will measure approximately 3m (L) x 2m (W) x 2.8 (D). Screened flow will pass into an 1800mm ø sump immediately adjacent to the CSO chamber and then be pumped to the existing outfall. The sump will contain a Duty and Standby pump capable of 20l/s and approximately 4m static head. The pumps will require float control as well as a telemetry alarm to notify of CSO operation. Upsize approximately 14m of 300mm sewer between the existing CSO chamber and the newly constructed CSO chamber, to 450mm ø. The existing 225mm overflow line and Copasac chamber will be abandoned.	
AMP6NSOM004	• Lay new sewer from MH 5404 downstream to MH 3502	
AMP6NSOM101	upsizing a 15m length of twin 600mm Ø surface water sewer (beneath disused railway) to a single 1200mm	
AMP6NSOM102	Infiltration sealing	
AMP6NWILT001	Upsize the sewer from ST82685805 to ST82684802 to remove the local restriction. Install a screened overflow chamber and two storm pumps (duty/assist) to discharge to the local watercourse.	
AMP6NWILT002	Upgrade the pumps at [redacted] and upsize rising main.	
AMP6NWILT003	"Blind" offline storage of 1500mm, which fills through surcharging of the existing [redacted] oad sewer network during storm events. The storage is able to gravity drain back into the existing sewer system, once capacity becomes available. Install a Hrydrobrake of 100l/s limit flow	
AMP6NWILT101	Create capacity along [redacted] y laying a rider sewer and high level relief between ST86697612 and ST87690706	
AMP6NWILT102	sealing up to 835m of 150mm Ø foul	
AMP6NWILT103	• An infiltration reduction study should be carried out on the pumping station catchments and the SPS upstream of [redacted] SPS.	
AMP6NWILT104	Pump upgrades	
AMP6NWILT105	infiltration sealing	
AMP6NWILT106	upgrade overflow Replace pumps, install screen, change invert level and upsize o/flow	
AMP6NWILT107	Divert the [redacted] sewers to a new screened CSO and abandon the existing [redacted] CSO.	
AMP6NWILT108	• Upsize the pumps at [redacted] SPS to 12l/s and retain the existing 100mm rising main. • This is predicted to provide 1 in 10yr protection against external flooding.	
AMP6SEDGE001	Up to 1.2km of infiltration investigations and 0.2km of sealing works, subject to investigations.	
AMP6SEDGE002	Construct 200m of 600mm SW system.	
AMP6SEDGE003	Infiltration sealing - circa 785m.	
AMP6SEDGE005	Attenuation and pumped discharge to a separate catchment to the west of [redacted] Construct a pumped storage chamber 8m diameter, 8m in depth. Adoption of 300mmØ private sewer surface water and directionally drill 400m of 300mmØ diameter rising main.	
AMP6SEDGE101	• Carry out infiltration sealing where appropriate. • Upsize the existing rising main from [redacted] SPS to Burnham from 250mm to 300mm	
AMP6SEDGE102	Isolate low lying properties by constructing a 50m³ storage tank to pump flows into main sewer when it surcharges. Phase 2 to remove surface water.	
AMP6SEDGE103	Phase 1: extensive CCTV/electroscan surveying the catchment of foul sewers draining to [redacted] SPS and subsequently sealing to limit infiltration. And SPS will have its pumps upgraded to their design value of 25 l/s.	
AMP6SEDGE103	Appraised option as per C9775: Offline attenuation storage tank with telemetry controlled pump return adjacent [redacted] age Hall	
AMP6SEDGE104	of impermeable area to be removed which is cost beneficial	
AMP6SEDGE105	The prioritisation option is to upsize the impellers at [redacted] SPS so that 75 l/s can be pumped through the 250mm Ø rising main to the Weston Super Mare STW.	
AMP6SEDGE106	upgrading the Showground No.1 SPS. 295m of rising main will need to be upsized. Inhibits should be installed at [redacted] Village and [redacted] pumping stations .	
AMP6SEDGE107	Seal the 3 lengths already identified by the June & July 2014 CCTV surveys (approx. 220m). Carry out a wider infiltration investigation, including approx. 3km of CCTV survey, and seal an estimated 15% of the catchment (0.45km).	
AMP6SEDGE108	Upsizing of 100.5m of Ø150mm sewer to Ø300mm	
AMP6SEDGE109	Carry out surface water separation of the 45 properties highlighted below, including construction of approx. 560m of 300mm surface water sewer discharging to a local watercourse. [redacted] and a high level relief to ST30504602, to isolate the local system during periods of surcharge in the downstream 225mm sewer	
AMP6SEDGE110	Use structural lining to repair open joints and two pipe breaks on a 45m-long 150mm sewer section.	
AMP6SGLOS001	Investigate 1.6km of main. Infiltration sealing where needed (estimate based on 20%)	
AMP6SGLOS002	Clean and rehabilitate the surface water and foul sewers and clarify ownership of the culvert under the railway line	
AMP6SGLOS003	• Relay lower section of 150mm sewer with a 225mm to provide increased capacity and attain self-cleansing ad removal of highway drains	
AMP6SGLOS101	• Raise MH covers by 750mm after conducting a CCTV survey downstream to ensure there is no debris after the 2011 repair works.	
AMP6SGLOS102	20m length of sewer is upsized to 150mm.	
AMP6SGLOS103	Storage and upsize pumps [redacted]. Upsize sewer and pumps at [redacted]	
AMP6SGLOS104	seal 50% of the sewers in the catchment upstream of manhole. 1km	

HLA	Prioritisation	o
AMP6SGLOS105	Wessex type SIPPS	
AMP6SGLOS106	• Upsizing 20m's of foul sewer between Irving Close CSO and a new manhole in the footpath outside No. 66, from Ø225mm to Ø600mm.	
AMP6SGLOS107	Raise cover levels and repofile path	
AMP6SGLOS108	Upsize approx. 0.6km of sewer and construct approx. 0.5km of diversion sewer to increase capacity through Hambrook	
AMP6SGLOS109	clean , survey and reinstate second syphon	
AMP6SGLOS110	Divert the entirety of foul flows from the catchment upstream of the property to the F[redacted]Tunnel located 60m to the North West of the property. This will require the construction of approximately 65m of Ø300mm sewer and a 35m long Ø225mm drop-shaft to the tunnel invert with a flow control device.	
AMP6SGLOS111	Construct a high level relief overflow into a 900mm storage pipe which is connected to a separate 150/225mm system via a throttle pipe/RTC penstock or other flow control measures (71m3 storage)	
AMP6SSOM001	Seperation of land drains from gardens.	
AMP6SSOM002	Small package SPS [redacted]	
AMP6SSOM003	80m of rider sewer and construction of a high level relief flow diversion	
AMP6SSOM004	Upsize approx 117m of sewer and lay 145m of high level relief sewer.	
AMP6SSOM102	Sealing 80m	
AMP6SSOM103	Flow diversion to avoid suspected 'pinch point'.	
AMP6SSOM104	• This option involves relocating the outfall via a new 41m, 300mm Ø sewer which discharges directly into the Brook. • A flap valve or rubber duckbill valve will need to be fitted on the outfall to prevent the river from backing up into the sewer. • The weir would have to be relocated at the CSO and a 6mm static screen would be installed.	
AMP6SSOM105	280m new 150mm line. Abandon 65m of old 150mm and route flow down new line.	
AMP6SSOM106	69m^3 Box culvert [redacted]	
AMP6SSOM107	Phase of 2 of C9131 856 - Relay 351 mm of 225mmm sewer between ST32159501and the bifurcation ST33151503 at the treatment works and reopen bifurcation	
AMP6SSOM108	Relay approx. 615m of sewer to achieve a steeper gradient a terminal pumping station is required to lift the sewage into the treatment works	
AMP6SSOM110	Infiltration sealing of the 14 identified lengths and two manholes	
AMP6SSOM111	Carry out infiltration sealing including four manholes	
AMP6SSOM112	Extend the rising main 18.3m connect into next MH	
AMP6SSOM113	New, larger (375mm or greater) outgoing pipe from MH ST32096002, linking to ST32096003, along the southern side[redacted]. Abandon the existing 300mm sewer between MH ST32096002 and ST32096016	
AMP6SSOM114	Replace/upgrade pumps at [redacted]	
AMP6SSOM115	Install a Huber Rotamat ROK1 mechanically raked screen to the CSO Chamber ST59223308 to prevent screen blinding from foul waste	
AMP6SSOM116	flow diversion with oversized 450mm to provide extra storage	
AMP6SSOM118	Carry out a manhole cover sealing program to the sewers along the river side seal and the internal walls of the manholes	
AMP6SSOM119	Divert part of the S[redacted] via approx. 688 m of new 225 mm sewer. The HDPE SDR11 pipe should be used to minimise infiltration.	
AMP6TAUN001	PR14 Otpion: Divert flows that currently pass through [redacted] the construction of 1050m of 300-450mm Ø sewer to gravitate to a replacement SPS with a pass forward flow rate of 120l/s. Construct 360m of 400mm Ø rising main to allow pass forward flow from the new SPS to Taunton STW.	
AMP6TAUN002	**Phase 1 (A)** • Fit a flap valve or rubber duckbill valve on the 525mm Ø surface water outfall. This may require the construction of a new chamber to house it. **Phase 1 (B) (£211.2k)** • Construct a separate 38m length of 150mm Ø foul overflow pipe to discharge to the River Tone and abandon the original overflow. • Upgrade the overflow to a pumped overflow to prevent the discharge facility from being tide locked when river levels are high. • Construct a flap valve or duckbill valve on the surface water outfa	
AMP6TAUN003	Provide x2 pumps at SPS.	
AMP6TAUN003	Upgrade the existing SPS to accommodate 2 pumps utilising a duty/assist regime	
AMP6TAUN101	• Inflow/infiltraton reduction	
AMP6TAUN102	Sealing of 27m of sewer and one manhole, and the capping of an abandoned connection, as well as installation of a standby storm overflow pump and reconfiguration of the overflow pump wetwell at Hockholler SPS	
AMP6TAUN103	Abandon existing CSO and install a new CSO chamber downstream.	
AMP6TAUN104	Infiltration sealing pump upgrade	
AMP6TAUN501	Sewer sealing of defects.	
AMP6WSOM001	Upgrade the Flygt pumps at [redacted]to operate at a fixed pump rate of 12l/s	
AMP6WSOM002	Phases 1 and 2. Upgrade Ol[redacted] Farm CSO to a pumped overflow. Construct 85m³ of pumped return offline storage. Construct 30m of 150mm Ø rider sewer or upsize to 225mm Ø.	
AMP6WSOM101	• Divert the flow from[redacted]rough the field to the main sewer	
AMP6WWILT001	create a high level relief sewer between MH SU01608703 to SU01609705.	
AMP6WWILT002	Lower the existing overflow and provide storage to compensate for that lost.	
AMP6WWILT003	Upsize the 375mm sewer serving [redacted] and provide 84m3 offline storage in the road.	
AMP6WWILT003	Upsize the 375mm sewer serving [redacted] and provide 84m3 offline storage in the road.	
AMP6WWILT004	pump[redacted]	
AMP6WWILT005	Construct an 8m deep, 8m diameter circular offline storage tank in the field opposite 10[redacted]ad creating approx. 400m^3 of storage, with a pumped return.	
AMP6WWILT006	Upsize the 53m length Ø150mm pipe from MH ST86615803 to ST86615701 to Ø225mm	
AMP6WWILT007	Construction of a 300mm Ø high level relief sewer [redacted] total length approx. 250m.	
AMP6WWILT008	Diversion and upsizing of the 225mm Ø sewer serving R[redacted]	
AMP6WWILT101	• A strategic option has been designed under 'Option 2 South' as part of the T[redacted]udy, which aims to construct a 300 m length of 1200 mm Ø trunk sewer between manholes ST85569201 and ST86561501 at a depth of 2 – 3 m, effectively providing 340 m3 of storage.	
AMP6WWILT102	Phase 1 sealing the 4 lengths of 150mm Ø foul sewer against groundwater infiltration 243m	
AMP6WWILT103	Increase pass forward flow and upsize the rising main	
AMP6WWILT104	GRP*1 storage tank with a capacity of ~ 14m3	
AMP6WWILT105	Isolate [redacted] by disconnecting from the 300mm sewer in [redacted]591464) and constructing 50m of 300mm Ø sewer draining to ST86591502, with a flap valve at the point of connection.	
AMP6WWILT106	Relaying and upsizing pipework to remove and decrease flows down 150mm dia pipe behind [redacted]. Refurbishing deformed 150mm dia pipe adjacent to garages behind 18 [redacted]	
AMP6WWILT107	Carry out sewer investigations in [redacted]atchment and seal any infiltration found. Incorporate the infiltration sealing with Phase 2 of Scheme C9811[redacted]od Alleviation).	
AMP6WWILT108	Construct in total 800m of twin 2100mm diameter sewer just upstream of the River Biss syphons - 2750m3 storage	
AMP6WWILT109	Construct 105m3 of 93m of 1200mm Ø concrete storage pipe with a 25l/s flow control on the downstream outlet and 130m3 115m of 1200mm concrete storage pipe.	
BANES020	Recommend scheme is an off-line storage tank with pumped return. approx size 400m^3, will need modelling to determine exact size. Will need a pumped return and an emergency overflow	
Banes101	Due to the high levels of infiltration, investigation and sealing works are recommended together with 190m of sewer upsizing D/S of flooding location.	
BFROM004	constructing a screened CSO	
DCHRI001	Upsize 62m of surface water sewer in road to provide storage and install flow control.	
DEDOR102	400m3 storage and uprate pumps at[redacted]	
DM#1360928	Lay 40m of 225mm Ø overflow pipe from MH SZ00964001 to tank (approx. depth 3m).	
DM#1380358	• Recommended that CCTV is completed upstream of Forge House SPS	
DM#1381858	• Sewers CCTV surveyed to establish current fat/debris levels	
DM#1383189	• Recommended th[redacted] brief until the DAP has reached its conclusions	
DM#1389008	• Serious consideration should be given to replacing and upsizing 58m of sewer to 300mm or greater.	
DPOOL018	Install a single property pumping station and provide local storage. (Only one property flooding)	
DSALI002	Undertake infiltration investigation and sealing works in the Eastern [redacted] catchment. Seal any infiltration found using epoxy tight lining / patch lining where appropriate.	

HLA	Prioritisation	o
DWDOR003	Package SPS for 5 properties	
DWDOR017	• Upsize and relay the 66m of pipe from SY46904501 to SY46904401 as a Ø375mm pipe to the bifurcation	
DWDOR018	Provide 200m3 storage 2kw pumped return with an overflow outfalling to the nearest watercourse.	
DWDOR101	Three pumped overflows positions to be determined during appraisal and infiltration sealing following extensive CCTV and Infiltration survey.	
DWDOR107	To construct a new pumping station in the verge to pump surcharged flow to the STW.	
DWEYM003	Upsize approx. 270m of sewer and Renovate approx. 280m of sewer, by lining the sewer	
DWEYM103	Suggested scheme is to lay 200m of surface and Highway drains [redacted] connect into newish SWS from development area.	
KENET500	Phase rebench tank, improve hydroslide aarangement	
MEND021	The works include CSO improvements at [redacted] and upsizing 169m of combined sewer from 375mm to 525mm.	
MEND021	The works include CSO improvements at [redacted] and upsizing 169m of combined sewer from 375mm to 525mm.	
MEND023	As above. Modify pumping arrangemets / ultilise storage	
MEND023	Upsize 200m of 150mm to 450mm in road to provide storage. Modify pumping arrangemets / ultilise storage	
NEWBANES026	Construct a SIPPs unit to isolate the property from the hydraulically inadequate system at the best available site.	
NEWBAVON007	Construct a new surface water sewer from [redacted] to the 600mm SW sewer that leads from the overflow. Reconnecting the few highway gullies present and providing a few new ones will effectively separate the area. This sewer will need to be 225/300/375 in diameter and be a total of 285m long. The foul sewer leading from the CSO down [redacted] will also require upsizing from 300mm to 450mm or duplicating with a 375mm. (135m long) This will enable the reverse flows to increase without raising the surcharge levels.	
NEWBBRIS011	• Investigation into the operation and condition of the attenuation tank and Hydrobrake will be required, including a CCTV, manhole survey and possibly a small flow survey. The existing model should be upgraded and verified • Improvements to the outgoing sewer from the attenuation tank. Possible installation of a high level overflow /bypass and improvements to the hydrobrake settings. Create additional storage (amount to determined on updated model) by laying up to 100m of large diameter pipe (1200mm pipe if possible depending on available depth, with a flow restriction on the downstream end.	
NEWBBRIS012	Upsize 50m of 225mm SWS to 300mm and construct 90m of new 375mm SWS	
NEWBBRIS013	Lay a 375mm foul rider sewer from the private sewer connecting into ST61692403 taking advantage of the extra depth due to the suspected backdrop. Possibly with a restricted return or flap valve to mobilise storage during times of surcharge	
NEWBMALA101	Increase pass forward from Wedmore Place (via new 525mm diameter sewers) to existing 525mm diameter sewer at manhole ST 5970 2745 – same as Option 1. Construct offline storage in order to offset the detriment identified in Option 1	
NEWBRED012	• Construct an off-line storage shaft with pumped return provide a minimum storage of 500m3	
NEWDBOUR014	Divert the local 150mm sewer and the drain from the property in to the adjacent 600mm sewer	
NEWDBOUR020	Construct a high level overflow, 200m of 450mm duplicate sewer and a 300mm throttle pipe to control flow back into downstream sewer.	
NEWDNDOR103	Upsize 370m of 225mm to 300mm and some infiltration sealing.	
NEWDPOOL035	Rider sewer and 200m3 storage at the SPS	
NEWDPOOL041	High level relief sewer to divert excess flow to a manhole D/S of the hydraulically inadequate sewers.	
NEWDWDOR200	Reduce the amount of flow reaching the pumping station through infiltration sealing work, and by making modifications to the caravan park surface water drainage. Increase the pass forward rate from the pumping station by laying a new rising main to a new discharge point, and providing larger pumps.	
NEWDWDOR200	Reduce the amount of flow reaching the pumping station through infiltration sealing work, and by making modifications to the caravan park surface water drainage. Increase the pass forward rate from the pumping station by laying a new rising main to a new discharge point, and providing larger pumps.	
NEWDWEYM025	Isolate the properties from the main sewer by installing a SiPPS unit and modifications / improvements to the downstream bifurcation.	
NEWKENET013	Provide local storage [redacted] the large grassed area in the centre of the housing area. Preliminary modelling indicates the volume of storage required is 300m3.	
NEWMEND029	514m parallel 225mmrelief sewer to works	
NEWMEND109	• Lay a new 225mm diameter sewer in parallel with the existing 150mm diameter sewer from [redacted] WwTW	
NEWNSOM034 & AMP5NSOM103	Upsize 80m of 150mm diameter to 225mm diameter in [redacted] upsize 185m of 150mm diameter to 300mm diameter in [redacted] Road and upsize 270m of 375mm diameter to 525mm diameter in [redacted]	
NEWNSOM109	Construct the largest gravity tank feasible within the allocated area and drain by gravity back into the Milton Hill foul sewerage system via a flow control.	
NEWNWILT034	A possible solution to alleviate the flooding would be to seal the manhole which floods and duplicate the 300mm sewer with a 450mm diameter sewer for a length of 125m. this work would involve the following: • Fit sealed covers to manhole SU0682 6004, this may require the cover slab to be made more secure. • Construct a new manhole approximately 10m upstream of SU0682 6004. • Lay approximately 125m of 450mm dia pipe.The top invert level to be above the soffit level of existing 300mm foul sewer. • Connect this new pipe back in to the 300mm foul sewer at SU6902. • Fit a flap valve on this pipe, may need a new manhole.	
NEWNWILT034	intercept overland flows with an Aco drain	
NEWNWILT038	Construct a high level flood relief overflow to divert high flow, lay 18m of 150mm sewer, upsize 23m of 100mm to 150mm.	
NEWNWILT043	Lay a 225mm relief sewer in the road at a better gradient and modify the upstream manhole to optimise the flow down the existing and relief sewer.	
NEWNWILT044	Install a SiPPS	
NEWSGLOS110	full upsizing of 235m of 300mm sewer to 375mm including replacement of the pipe bridge (Option 2B).	
NEWSOM032	Construct a high level relief from ST46709106 - ST47700201 to divert flows and provide additional storage.	
NEWSSOM047	Convert manhole ST43183704 into an overflow / bifurcation manhole as per Operations suggestion and lay 45m of new 450mm concrete pipe to a new outfall.	
NEWTAUN019	Construct a high level overflow at M/H ST2725 2401 at a level that will protect the properties [redacted]. Lay a new Ø225mm sewer to collect storm flows from M/H ST2725 2401 to M/H ST2725 2404, a distance of 65 metres. M/H ST2725 2404 may require to be deepen to allow the new sewer to pass beneath the railway and to improve the sewer gradient on section ST2725 2403X. Construct a new Ø375mm rider sewer from M/H ST2725 2404 along the [redacted], reconnecting at M/H ST2725 4102, a distance of 300 metres. This will intercept the main flows whilst leaving the existing sewer to carry storm flows and collect connected downstream properties. Construct a new Ø375mm syphon under the River Tone a distance of 30metres, with the existing syphon acting as a storm relief solution. Upsize 267m of the existing outfall sewer from manhole ST2725 4101 to the connection with the Taunton trunk sewer at ST725 5903 from Ø225mm to Ø375mm.	
NEWTAUN019	Off-line storage tank; upsize from 150mm to 225mm and lay 300mm - Scheme C9427	
NEWTAUN020	Relay 46m of 150mm foul water sewer at an improved gradient and lay 90m of duplicate 150mm foul sewer	
NEWTAUN022	Divert flows from private sewers to new pumping station, rising main will deliver flows into main foul	
NWILT028	Suggested scheme would be to duplicate a 300mm sewer and provide a high level connection to existing 300mm.	
SEDGE001	Upsize the 150mm/225mm main running from ST30499601 – ST30498207 to 300mm	
SEDGE004	The sewers are fairly deep so a high level relief from ST32413701 to 100m^3 storage with either a pumped or gravity return, depending on levels.	
SGLOS106	• CCTV of downstream surface water sewer and culvert under the railway line • Investigation into flow characteristics of the stream and some stream clearing may be required as well removing the screen from the outfall as above • As per previous assessment divert 825mm via a 900mm pipe from either a new manhole in the verge or ST72915909 /5910 to ST72926003. No dig 40m under railway line from manhole and 47m machine dig) • Improvements to outfall ST72927105 to reduce blockages • Adjustments to baffle plate at ST72915814 to ensure the 875mm bifurcation is utilised effectively.	
WSOM001	Infiltration investigation and sealing of approx 740m	
WWILT003	Offline storages shaft 5m diameter and 6m deep, with a pumped return and 100m new 300mm sewer 3m deep in the road.	
WWILT003	Duplicate the downstream 300mm Ø sewer with a 375mm Ø pipe, in order to remove the local restriction	

5.5 Sewerage Investigation Assessments (SIA)

The high-level assessment (HLA) team within our engineering department has been undertaking HLAs for over ten years - investigating sewerage issues, primarily hydraulic but has increasingly looked at operational issues e.g. saline intrusion, dual manholes, pipe bridge surveys etc.

We have expanded the scope of the HLA team to investigate non-hydraulic issues, referred to as SIA reports. Using existing datasets to focus investigations to identify appropriate proactive interventions which have the potential to reduce escape of sewage issues. The team produces Sewerage Investigation Assessment reports (SIAs), 2 or 3 pages in length, that summarise the problem and propose interventions.

The SIA process (shown on the next page) allows for significant input and liaison with operational staff, to gain knowledge of the problem, establish what interventions have taken place and agree if additional intervention is required. Possible interventions resulting from a SIA:

- Do nothing
- Hydraulic issue identified – carryout HLA
- Non-hydraulic issues identified
    - PR intervention – from letter drops to local social media campaign
    - Local R&M repair
    - Add to routine inspection and cleaning schedule
    - In-sewer monitoring

SIAs will then be reviewed 12-18 months after inventions to establish whether interventions have been successful or need to be modified, obviously reviews will occur sooner if incidents occur in the meantime.

The SIAs provide focus for acquiring knowledge of issues at a location and will in future provide good evidence to the EA of how Wessex is managing its sewerage assets. Within the company we have existing data sources for examining the sewerage network – proactive rehabilitation CCTV, sewerage risk model, sewerage hotspots, CCTV downstream of CSOs, repeat pollutions, repeat sewerage contacts, EDM and in-sewer monitoring, hydraulic sewer models and telemetry.

The SIA process has started analysing repeat pollution incidents and serviceability issues identified from recent CCTV surveys undertaken downstream of CSOs. Examples are provided below.

Going forward the plan is to develop a serviceability sewer risk model to evolve from interventions based on reactive incidents to proactive intervention to reduce the risk of escape of sewage. An objective risk model can be used to highlight areas of greatest risk, giving the business a tool to help prioritise its inspection and investigation work.

As part of the Drainage and Wastewater Management Plans programme a risk-based catchment screening exercise has considered likelihood and consequence factors affecting customer risk on a catchment by catchment basis. This initial scoring, and subsequent work under the BRAVA will result in a list of prioritised catchments for the investigating team to begin working on as part of a rolling programme.

The serviceability sewer risk model will then help the investigating team to focus their catchment investigation on specific high-risk lengths in the first instance. Investigations should be flexible in nature and evolve based on evidence on the ground.

The factors that the model may use are shown in the table below:

Consequence Score Factors	Likelihood Score Factors
• Proximity to watercourse / waterbody • Proximity to SSSIs etc. • Proximity to other high consequence polygons – Sewer Risk Model could provide additional consequence factors • Diameter of sewer • Repeat incidents • Proximity to SW sewers	• Location of takeaways/restaurants • Nursing homes, nurseries • Tree density data • Structural Grade • Condition Grade • CCTV results • Incidents • EDM data • Recently moved house • SPS telemetry

The efficacy of the model will be assessed from feedback from both the HLA team and operations, also by keeping track of whether CCTV or site surveys confirm the risk predictions made by the model.

5.5.1 Example SIA reports

On the following pages we show an example SIA report, as further evidence to support our Escape of sewage reduction programme. This highlights how often sewers block despite being on frequent jetting rounds.

Sewerage Investigation Assessment (SIA)

Location	[redacted]		**Asset ID**	6000084	**Coordinates**		[redacted]	
Report Stage	Investigation	✓	Action proposed	✓	Action completed		Review	
Action Recommended	Maintenance Operations		Minor Works R&M		Pollution HLA		No further action	
Report Approval	**Prepared by**	Francieli Thums			**Reviewed by**	Harry Wheeler		

Actions

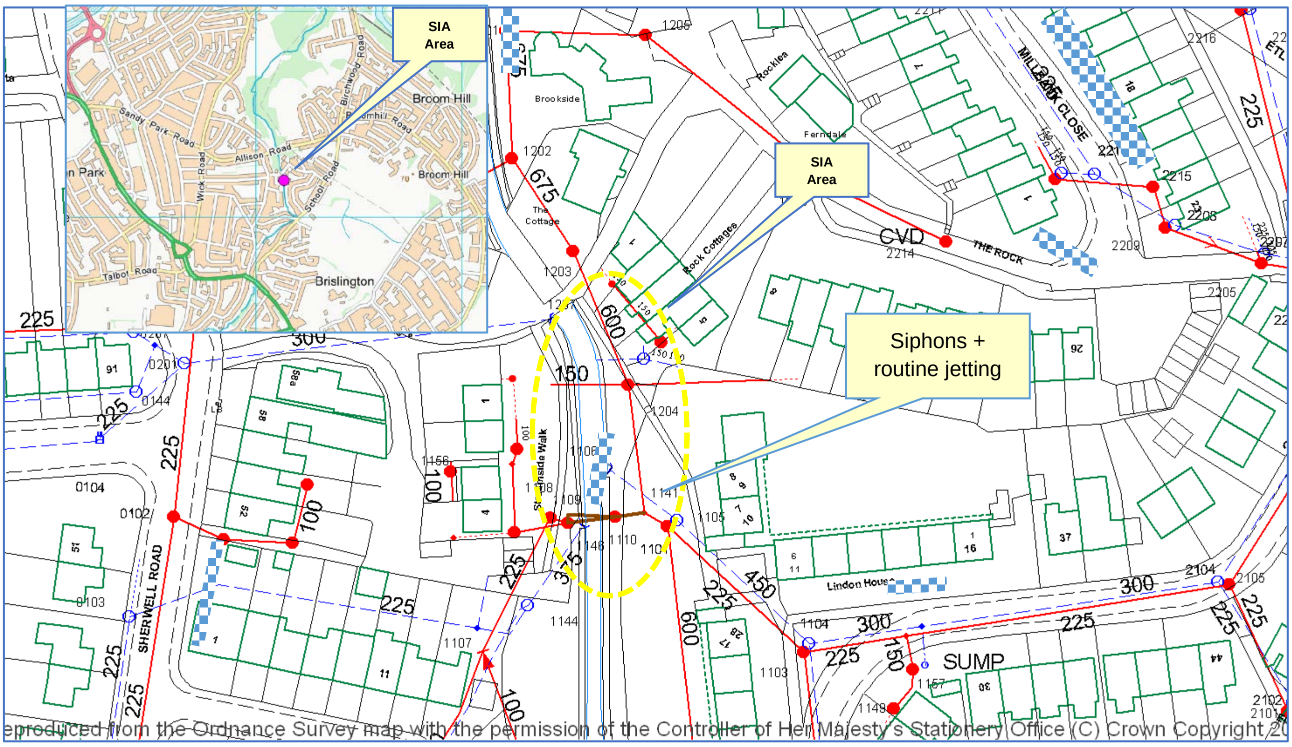
Action	Responsibility	Date	Comments
SIA (updated)	HLA team	15/01/2019 23/01/2019	Completed initial SIA, requires CCTV of siphons and adjacent sewers. Requested CCTV survey.
CCTV	HLA team	14/02/2019	Reviewed CCTV122992 results of siphon and adjacent sewers. Crew to return and complete CCTV
Access	OPS /CST	24/01/2019	Operations reviewed and catalogued D/S access arrangements on My Maintenance HLAPROJ-48652894-8
Maintenance	OPS /CST		To review increasing jetting frequency to 3 months

Incidents

Five pollution incidents have been reported around [redacted] mainly from the two siphons (150mmØ and 225mmØ). There has been only one incident reported recently (2017). All the incidents were considered water cat 3 (minor).

Date	WW ID	EA ID	Report	EA cause	Water Cat	EA_INCIDENT
13/10/2001	1080	36442	Sewage in the brook with only local effect.	Blockage	3	Materials into the MH and blocked the sewer.
18/09/2003	1764	190887	With/blue discolouration to Brook	Outfall	3	Discharge noted from outfall on side of bank at [redacted] House, sewage fungus and debris down concrete bank. 001772234001
26/03/2005	2211	301524	Sewer blocked D/S siphons and flooded into brook	Blockage	3	Jetted sewer and CCTV'd. 004255410001
17/09/2007	2934	532153	009336042001 – Reported flooding into the stream.	Blockage (rags)	3	Jetted to clear blockage (rags) in the siphon under river. 009336042001
07/03/2017		1506308	Pollution from siphons, from ST62711109-1110.	Damage (rags)	3	Siphon damaged and leaking Structural damage 032911936001 WAM 6167741 – (also found rags)

Location

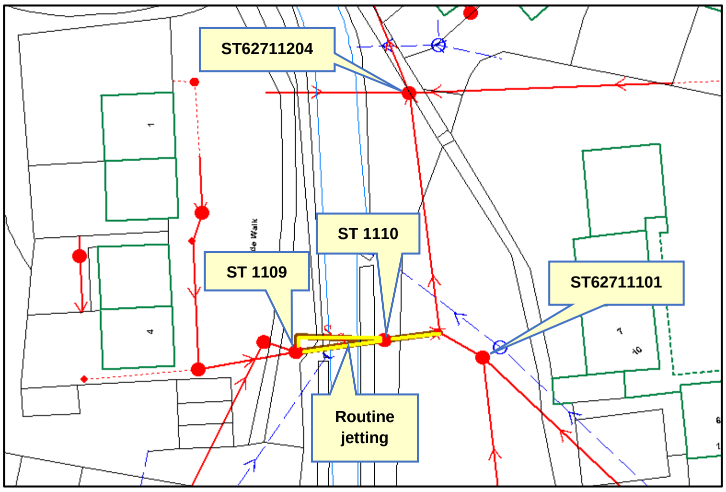

SIA
Area
SIA
Area
Siphons +
routine jetting
Broom Hill
Brislington
THE ROCK
SHERWELL ROAD
SUMP
CVD
eproduced from the Ordnance Survey map with the permission of the Controller of Her Majesty's Stationery Office (C) Crown Copyright 20

Investigation Undertaken

There have been four more incidents reported by the residents related to blockages/pollution along the siphons:

- *05/08/2005 (4916099001)* – Blockage (fat) causing MH to surcharge but not overflowing.
- *03/05/2011 (18343747001)* – Smell complaint and Ops found blockage along the siphons, jetted and dragged around MH ST62711109.
- *18/07/2016 (31443662001)* – EA had a report of pollution from a resident. Ops found ST62711146 spilling – tested ammonia 1.5mg/l – siphons found blocked and were jetted.
- *18/07/2018 (35476325001)* – Streamclean testing for ammonia (positive) and found siphons to be blocked – jetted from MH ST62711109 and removed large rag ball.

The siphons have been on 6 monthly routine jetting round ID 9000278 since April 2009. Prior to this date, the jetting was under 3 monthly routine from 2006 (see Appendix for full detail). On 31/01/2017, Operations found the lower siphon blocked and overflowing. High levels of fat and rag were then removed. Jetting teams have fed back that there are access issues at the downstream manhole and that 6 months is too infrequent.



Dye test showing foul sewer interacting with the river 2017

A CCTV survey (CCTV114544) was carried out in January 2013 which found a 20% blockage along the 150mmØ siphon and 10% along the 225mmØ.

Following the recommendation of this SIA, *CCTV122992* survey was carried on 29th of January 2019 and found 40% blockage (debris) along the 250mmØ siphon. The 150mmØ siphon was unable to be surveyed due to high water levels. The lengths from ST62711101 to ST62711203 were also unable to be surveyed and CCTV crew is to return to complete. It should be noted that the siphons had been jetted on 19/12/2018, according to MyMaintenance, and a month later 40% blockage was found. Operations were made aware of the findings on 19/02/2019.

There are two records of collapses in the siphons, one on 31/12/2007 and 5 m of 225mmØ sewer was relayed on the 08/03/2018.

The siphons are not modelled, however the downstream 600Ø main is predicted to surcharge in a 1 in 1-year event but not predicted to flood at ST62711204 or ST62711101 during a 75-year event with 1.6 - 2.6 m of freeboard respectively (FM Explorer model).

Conclusion
In total, there have been 9 incidents reported (blockages, pollution and asset damage) around the siphons ([redacted]) in which 7 of them entered the brook causing minor pollution. The pollution incident on the 07/03/2017 was due to damage in the siphon. All the others were caused by blockages.

The two siphons serve a small catchment with a 150mmØ duty and a 225mmØ storm relief. The siphons are already on routine jetting every 6 months. There are no recent CCTV surveys.

Proposed Actions
It is proposed that consideration is given to increasing the routine jetting frequency to 3 months and that a CCTV survey is undertaken to check structural integrity and serviceability of both siphons and the sewer lengths upstream and downstream. It is also recommended that access to the downstream manhole on the siphons is reviewed and improved if possible.

6. Annex B – Infiltration sealing results

Following significant and sustained flooding events during the wet winters of 2013 and 2014 we have undertaken a comprehensive infiltration sealing programme. Our full infiltration reduction programme was detailed from page 44 to page 65 in Document 8.9.A.

This Annex contains examples of how successful the sewer infiltration sealing programme has been over the past five years in a couple of catchments.

6.1 Examples performance improvement after infiltration sealing

Below shows two case studies showing that infiltration sealing to make assets watertight can be successful. This is evident by having lower dry weather flows – the flows at night-time contain a small amount of domestic flow and is when the infiltration component of the flow is more apparent. This is shown for two example catchments by showing the flows arriving at treatment works are lower after carrying out sewer sealing works.

It compares plots of the recorded flows to various treatment works, during similar groundwater conditions (the green line which is the groundwater level recorded at a borehole in Barcombe). The first graph shows the flow before the sewer sealing works and the second graph after the sewer sealing works in the catchments. The flows before sealing are generally above the purple dashed line, but after sealing they are below the purple line.

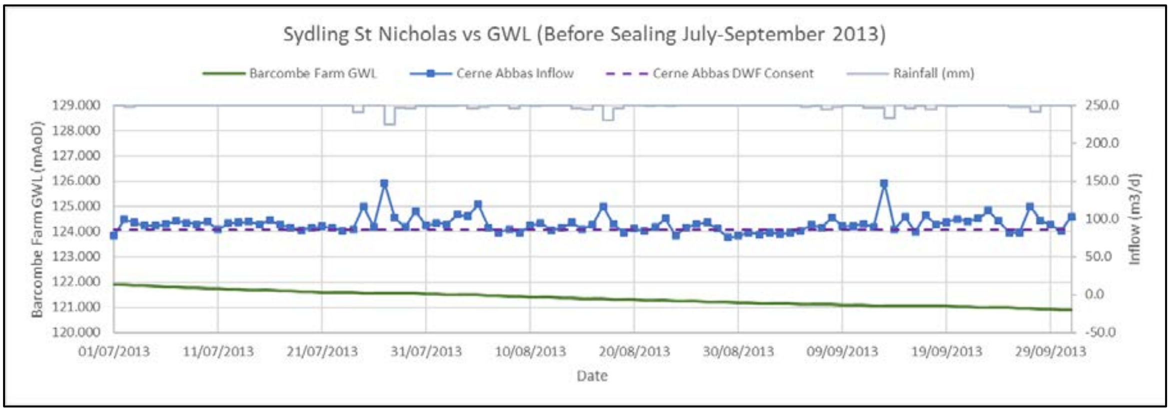
The third graphs show the historical flooding incident data including when properties flooded due to ground water inundation (shown as red triangles) and due to blockage (cyan squares).

There have been a significant lower number of hydraulic incidents after sewer sealing. This could also be because the weather conditions have not been as severe as that in 2013 and 2014.

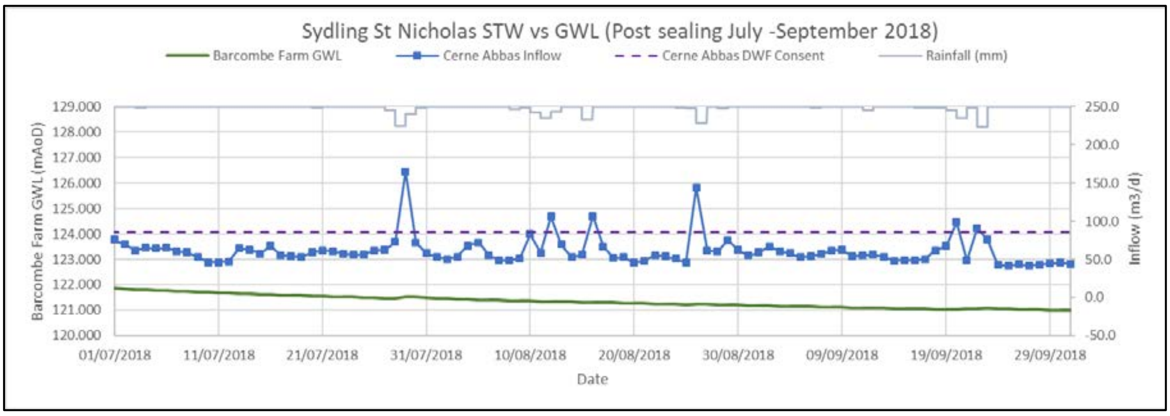
In summary, , the dry weather flows have reduced significantly in the examples shown on the following examples. These are two of the best successes in the 19 catchments that we substantially sealed in AMP6. There are 78 STW catchments that have a need for undertaking sealing to make our and private sewers, drains and manholes watertight.

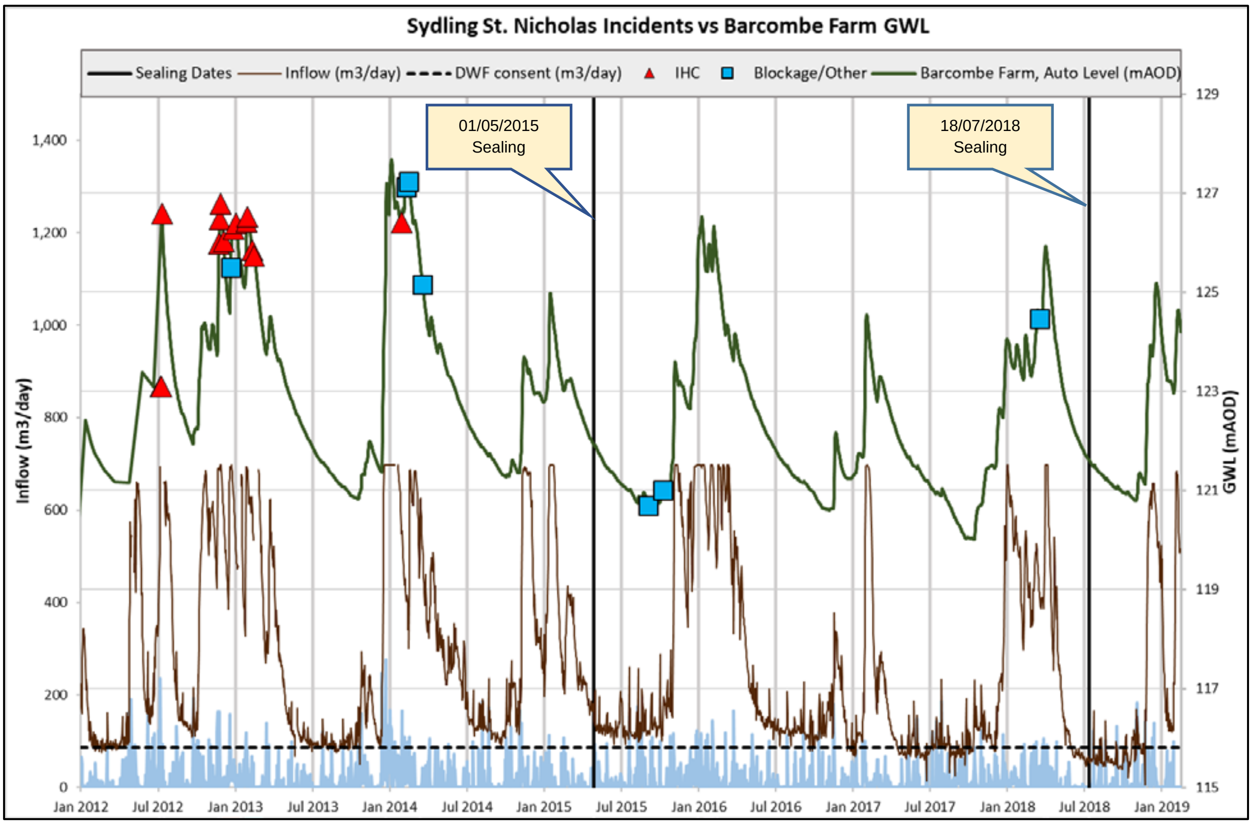
Sydling St Nicholas STW catchment infiltration sealing effectiveness

Before sealing (2013)



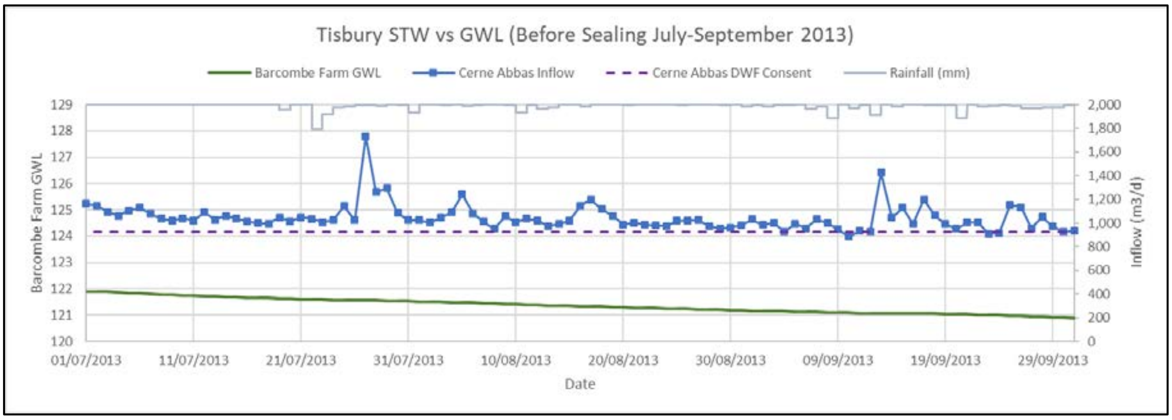
After sealing (2018)



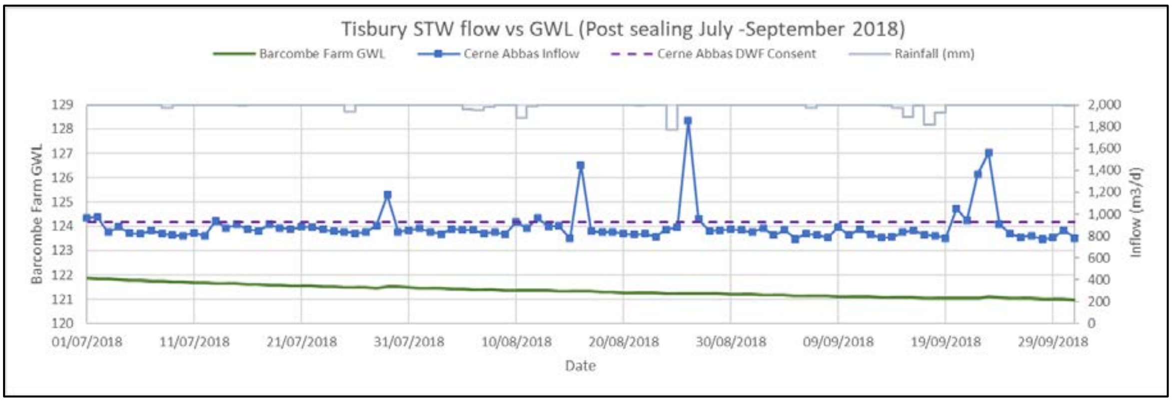


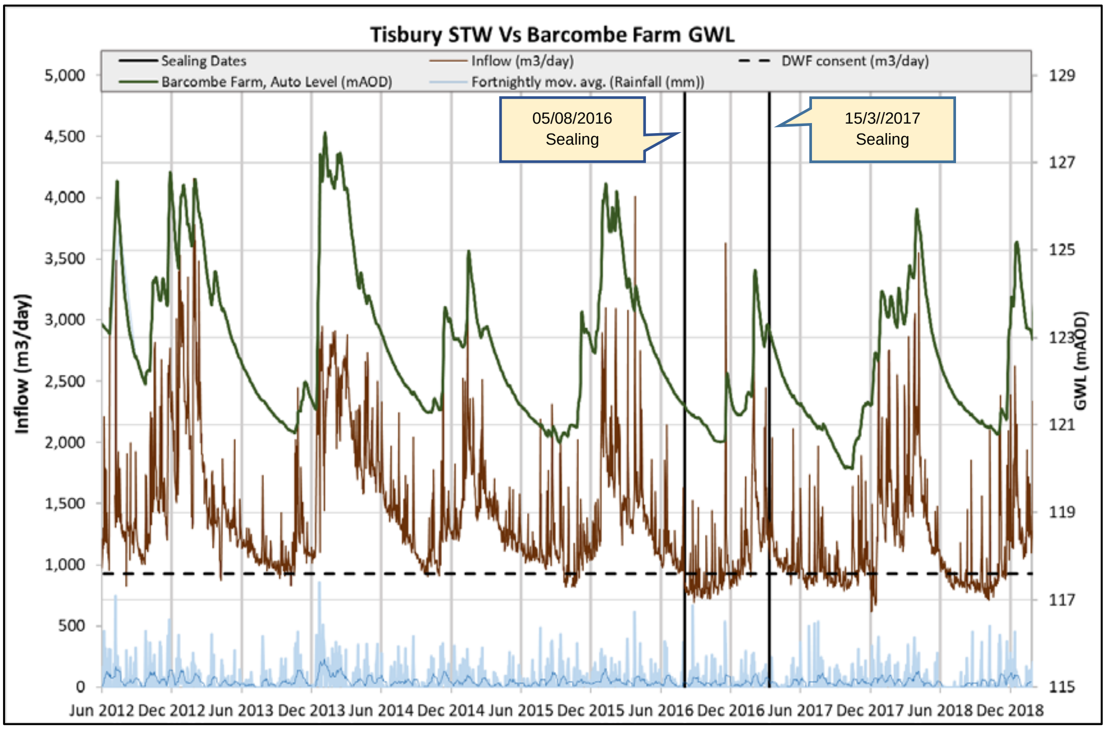
Tisbury STW catchment infiltration sealing effectiveness

Before sealing (2013)



After sealing (2018)





7. Annex C – Modelling survey costs

The following lists the 270 STW catchments that require some survey works to improve knowledge of our surface water assets. The total survey cost is £5.2m, as included in Section 4.2 above. These survey costs are calculated using the catchment characteristic to suggest how complex the surveying in each catchment will be depending on parameters such as length of sewers, number of ancillaries including outfalls.

SITEID	NAME	Modelling	Storm system modelled	SPS_ Count	CSO_ Count	SewLen_ Tot	Survey costs (£k)	
23159	HURN STW CATCHMENT	Hurn	No	1	0	486	1.4	
23019	BERWICK ST JAMES STW CATCHMENT	Berwick St James	No	1	0	1283	2.7	
23150	HINTON BLEWETT STW CATCHMENT	Hinton Blewett	No	1	0	1877	1.5	
23191	MAIDEN BRADLEY STW CATCHMENT	Maiden Bradley	No	2	2	3041	5.5	
23106	EAST HARPTREE STW CATCHMENT	East Harptree	No	0	0	5617	1.2	
23015	BARFORD ST MARTIN STW CATCHMENT	Barford St Martin	No	1	0	2617	1.5	
23076	COMPTON DANDO STW CATCHMENT	Compton Dando	No	1	0	7704	1.5	
23198	MARNHULL STW CATCHMENT	Marnhull	No	1	0	6875	1.8	
23087	CROSCOMBE STW CATCHMENT	Croscombe	Yes	0	2	3685	4.6	
23239	PILTON STW CATCHMENT	Pilton	No	0	0	5680	1.8	
23074	COMBWICH STW CATCHMENT	Combwich	No	2	0	3881	2.5	
23319	UBLEY STW CATCHMENT	Ubley	No	2	0	9387	3.5	
23025	BLAGDON STW CATCHMENT	Blagdon	No	1	0	13771	1.8	
23288	STOGURSEY STW CATCHMENT	Stogursey	No	4	1	8726	5.8	
23121	FARMBOROUGH STW CATCHMENT	Farmborough	No	0	0	5597	1.6	
23017	BECKINGTON STW CATCHMENT	Beckington	No	0	0	6992	1.7	
23286	STANTON DREW STW CATCHMENT	Stanton Drew	No	2	0	9552	2.7	
23358	WOOKEY STW CATCHMENT	Wookey	No	5	1	11118	7.1	
23157	HULLAVINGTON STW CATCHMENT	Hullavington	No	3	0	7424	3.7	
23129	FOVANT STW CATCHMENT	Fovant	No	3	0	11012	5.5	
23329	WEDMORE STW CATCHMENT	Wedmore	Yes	4	0	10566	4.6	
23230	OSMINGTON MILLS STW CATCHMENT	Osmington Mills	Yes	1	1	1951	3.5	
23250	PUNCKNOWLE STW CATCHMENT	Puncknowle, West Be	No	3	0	14867	3.6	
23295	STUDLAND STW CATCHMENT	Studland	No	5	0	8013	5.6	
23282	SPARKFORD STW CATCHMENT	Sparkford	No	2	1	12428	4.9	
23086	CROMHALL STW CATCHMENT	Cromhall, Tytheringtc	No	9	1	22704	13.1	
23275	SHREWTON STW CATCHMENT	Shrewton	No	3	0	12220	5.7	
23353	WISHFORD STW CATCHMENT	Wishford	No	9	0	15962	14.2	
23022	BISHOPS LYDEARD STW CATCHMENT	Bishops Lydeard	Yes	3	1	20287	5.9	
23070	COLERNE STW CATCHMENT	Colerne	No	3	0	13708	3.8	
23364	WRINGTON STW CATCHMENT	Wrington	Yes	1	1	25931	7.5	
23211	MILBORNE PORT STW CATCHMENT	Milborne Port	Yes	2	0	18790	4.6	
23254	REDWICK STW CATCHMENT	Redwick, Pilning	Yes	12	0	24007	12.1	
23118	EVERCREECH STW CATCHMENT	Evercreech	Yes	3	0	17330	4.7	
23158	HURDCOTT STW CATCHMENT	Hurdcott	No	8	0	31840	10.8	
23039	BRUTON STW CATCHMENT	Bruton	Yes	1	0	17422	3.7	
23048	CASTLE CARY STW CATCHMENT	Castle Cary	Yes	4	1	21763	7.0	
23056	CHARMOUTH STW CATCHMENT	Charmouth	No	4	1	14020	7.7	
23223	NORTH PETHERTON STW CATCHMENT	North Petherton	Yes	5	0	20814	5.9	
23105	EAST COKER STW CATCHMENT	East Coker	Yes	2	1	29199	6.0	
23351	WINSCOMBE STW CATCHMENT	Winscombe	Yes	3	0	33142	5.9	
23047	CANNINGTON STW CATCHMENT	Cannington	Yes	3	1	20055	7.6	
23054	CHARFIELD STW CATCHMENT	Charfield	No	1	0	42508	4.9	
23297	STURMINSTER NEWTON STW CATCHME	Sturminster Newton	Yes	7	1	27841	10.8	
23313	TISBURY STW CATCHMENT	Tisbury	No	8	1	39586	12.3	
23099	DOWNTON STW CATCHMENT	Downton	Yes	13	0	28331	16.2	
23281	SOUTH PETHERTON STW CATCHMENT	South Petherton	Yes	11	2	42374	16.2	
23199	MARNHULL COMMON STW CATCHMENT	Marnhull Common	Yes	11	0	54157	13.2	
23361	WOTTON UNDER EDGE STW CATCHMEN	Wotton Under Edge	No	3	4	27980	12.1	
23307	TETBURY STW CATCHMENT	Tetbury	Yes	5	0	28482	7.7	
23350	WINCANTON STW CATCHMENT	Wincanton	Yes	10	2	63317	15.1	
23058	CHEW STOKE STW CATCHMENT	Chew Magna, Chew S	No	5	1	46617	9.7	
23237	PEWSEY STW CATCHMENT	Pewsey	Yes	17	0	72116	19.8	
23161	ILMINSTER STW CATCHMENT	Ilminster	Yes	15	2	63998	22.9	
23045	CAM VALLEY STW CATCHMENT	Peasedown St John,	Yes	12	3	81485	17.4	
23078	CORFE MULLEN STW CATCHMENT	Corfe Mullen	Yes	6	0	78641	9.2	
23028	BOWERHILL STW CATCHMENT	Bowerhill	Yes	10	0	83561	15.3	
23201	MARTOCK STW CATCHMENT	Martock	Yes	15	6	69057	25.9	
23190	LYTCHETT MINSTER STW CATCHMENT	Upton, Lytchett Minst	Yes	10	0	34209	13.0	
23090	DEVIZES STW CATCHMENT	Devizes	Yes	10	1	56795	15.3	
23008	AMESBURY STW CATCHMENT	Amesbury	Yes	7	0	40102	11.0	
23253	RATFYN STW CATCHMENT	Ratfyn, Durrington	Yes	5	0	33612	10.1	
23235	PAULTON STW CATCHMENT	Paulton	No	14	2	80467	21.9	
23057	CHEDDAR STW CATCHMENT	Cheddar	No	16	2	46861	25.0	
29705	WATCHET STW CATCHMENT	Watchet	Yes	5	7	80140	20.8	
23031	BRADFORD ON AVON STW CATCHMENT	Bradford On Avon	Yes	11	5	63732	23.5	
23267	SHEPTON MALLET STW CATCHMENT	Shepton Mallet	Yes	6	4	66962	15.5	
23193	MALMESBURY STW CATCHMENT	Malmesbury	No	26	7	106167	40.0	1

SITEID	NAME	Modelling	Storm system modelled at 2017	CSO_ Count	SewLe n_Tot	SewLen_ Tot	Survey costs (£k)	
23268	SHERBORNE STW CATCHMENT	Sherborne	Yes	1	8	72936	17.5	
23244	POTTERNE STW CATCHMENT	Potterne	Yes	11	2	122196	18.6	
23132	GILLINGHAM STW CATCHMENT	Gillingham	Yes	14	1	101040	22.6	
23309	THORNBURY STW CATCHMENT	Thornbury	Yes	3	0	131943	10.1	
23360	WOOTTON BASSETT STW CATCHMENT	Royal Wootton Bass	No	9	2	117344	17.6	
29156	CHARD NEW STW CATCHMENT	Chard	Yes	10	1	117345	16.1	
23308	THINGLEY STW CATCHMENT	Corsham	Yes	6	1	143145	18.3	
23330	WELLINGTON STW CATCHMENT	Wellington	Yes	10	2	122076	18.5	
23332	WELLS STW CATCHMENT	Wells	Yes	9	3	96753	17.5	
23255	RINGWOOD STW CATCHMENT	Ringwood	Yes	23	0	88550	29.3	
23338	WESTBURY STW CATCHMENT	Westbury	No	15	4	152493	27.2	
23204	MELKSHAM STW CATCHMENT	Melksham	Yes	16	5	120826	37.1	
23165	KEYNSHAM STW CATCHMENT	Keynsham	Yes	12	3	130098	25.9	
23044	CALNE STW CATCHMENT	Calne	Yes	10	8	177833	28.0	
23346	WICK ST LAWRENCE STW CATCHMENT	West Wick, St Georg	Yes	26	0	152748	29.1	
23325	WARMINSTER STW CATCHMENT	Warminster	Yes	15	2	107879	27.0	
23349	WIMBORNE STW CATCHMENT	Wimborne	Yes	25	1	189652	32.4	
23252	RADSTOCK STW CATCHMENT	Radstock	No	9	14	185418	39.6	
23215	MINEHEAD STW CATCHMENT	Minehead	Yes	13	5	140823	28.0	
29541	SWANAGE STW CATCHMENT	Swanage	No	6	1	72984	19.0	
23134	GLASTONBURY STW CATCHMENT	Glastonbury, Street	Yes	27	6	159807	38.9	
29539	BRIDPORT STW CATCHMENT	Bridport, Beaminster	Yes	31	7	155468	43.9	
23243	PORTBURY WHARF STW CATCHMENT	Portishead, Portbury	No	27	6	278673	39.9	
23131	FROME STW CATCHMENT	Frome	No	11	13	197496	39.4	
23096	DORCHESTER STW CATCHMENT	Dorchester	Yes	32	7	153798	49.4	
23064	CHIPPENHAM STW CATCHMENT	Chippenham	Yes	12	10	339200	37.6	
23232	PALMERSFORD STW CATCHMENT	Verwood, Ferndown,	No	32	1	384940	48.1	
23172	KINSON STW CATCHMENT	Kinson	Yes	23	1	330860	44.7	
23336	WEST HUNTSPILL STW CATCHMENT	Burnham, Highbridge	No	78	3	275677	100.1	
23318	TROWBRIDGE STW CATCHMENT	Trowbridge	Yes	20	4	410337	59.2	
23366	YEOVIL STW CATCHMENT	Yeovil	No	20	7	386389	41.7	
23034	BRIDGWATER STW CATCHMENT	Bridgwater	Yes	75	1	293956	80.3	
23171	KINGSTON SEYMOUR STW CATCHMENT	Kingston Seymour	No	33	2	521648	48.0	
23258	SALISBURY STW CATCHMENT	Salisbury	Yes	33	5	276766	54.7	
23066	CHRISTCHURCH STW CATCHMENT	Christchurch	No	54	0	379845	63.1	
23305	TAUNTON STW CATCHMENT	Taunton	Yes	47	9	513137	83.0	
23342	WEYMOUTH STW CATCHMENT	Weymouth	Yes	34	23	584934	94.3	
23016	BATH STW CATCHMENT	Bath	Yes	40	103	691730	225.0	
23242	POOLE STW CATCHMENT	Poole	Yes	81	7	953095	134.9	
23152	HOLDENHURST STW CATCHMENT	Bournemouth	Yes	29	7	702609	81.3	
23278	SOMERTON STW CATCHMENT	Somerton	No	12	1	59164	16.4	
23128	FORDINGBRIDGE STW CATCHMENT	Fordingbridge	No	6	1	50663	11.8	
23359	WOOL STW CATCHMENT	Wool	No	25	1	46713	28.3	
23168	KILVE STW CATCHMENT	Kilve	No	2	0	10909	11.2	
23162	ILTON STW CATCHMENT	Ilton	No	1	0	9024	8.9	
23196	MARDEN STW CATCHMENT	Marden	No	7	0	8198	28.0	
23269	SHERSTON STW CATCHMENT	Sherston	No	5	1	7266	27.3	
23354	WIVELISCOMBE HILLSMOOR STW CATCH	Wiveliscombe Hillsm	No	2	0	11240	14.5	
23315	TOCKINGTON STW CATCHMENT	Olveston, Tockingtor	No	2	3	14189	32.0	
23248	PUCKLECHURCH STW CATCHMENT	Pucklechurch	No	1	1	22270	18.7	
23006	ALMONDSBURY STW CATCHMENT	Almondsbury	No	2	0	23971	19.3	
23257	ROWDE STW CATCHMENT	Rowde, Bromham	No	4	0	27340	26.0	
23207	MERE STW CATCHMENT	Mere	No	4	4	16386	48.2	
23075	COMPTON BASSETT STW CATCHMENT	Compton Bassett	Yes	11	1	46041	53.7	
23024	BLACKHEATH STW CATCHMENT	Bere Regis, Lytchett	No	20	0	48945	79.9	
23084	CREWKERNE STW CATCHMENT	Crewkerne	No	6	1	47897	40.0	
23175	LANGPORT STW CATCHMENT	Langport	No	17	5	72018	109.0	
23298	SUTTON BENGER STW CATCHMENT	Sutton Benger	No	19	1	62850	99.4	
23264	SHAFTESBURY STW CATCHMENT	Shaftesbury	No	11	2	56758	69.8	
23304	TARRANT CRAWFORD STW CATCHMENT	Blandford Forum, Ch	No	24	0	79925	132.4	
23238	PIDDLEHINTON STW CATCHMENT	Piddlehinton	No	0	2	16435	21.5	
23226	NORTON ST PHILIP STW CATCHMENT	Norton St Philip	No	1	0	10535	10.0	
23312	TINTINHULL ASH STW CATCHMENT	Tintinhull Ash	No	1	0	13807	10.2	
23345	WICK STW CATCHMENT	Wick	No	1	2	12902	21.6	
23027	BOURTON STW CATCHMENT	Bourton	No	4	0	18947	23.7	
23029	BOX STW CATCHMENT	Box	No	2	2	23617	30.4	
23324	WAREHAM STW CATCHMENT	Wareham	No	19	2	60362	103.4	2

SITEID	NAME	Modelling	Storm system modelled at 2017	SPS_ Count	CSO_ Count	SewLen_ Tot	Survey costs (£k)	
29155	WESTON SUPER MARE STW CATCHMEN	Weston Super Mare	Yes	42	3	563024	268.2	
23013	AVONMOUTH STW CATCHMENT	Bristol	Yes	160	246	4787260	167.8	
23186	LUXBOROUGH STW CATCHMENT	Luxborough	No	1	0	431	3.4	
23294	STUBHAMPTON STW CATCHMENT	Stubhampton	No	1	0	957	3.6	
23203	MEARE GREEN STW CATCHMENT	Meare Green	No	1	0	476	3.4	
23344	WHITSBURY STW CATCHMENT	Whitsbury	No	1	0	0	3.4	
27258	MONKTON DEVERILL STW CATCHMENT	Monkton Deverill	No	1	0	601	3.4	
23102	DUNBALL STW CATCHMENT	Dunball	No	1	0	624	3.7	
23279	SOUTH BARROW STW CATCHMENT	South Barrow	No	1	0	668	3.5	
27273	ALDERTON STW CATCHMENT	Alderton	No	1	0	1686	3.5	
27291	CHARLTON MUSGROVE STW CATCHMEN	Charlton Musgrove	No	1	0	1836	3.4	
23241	PODIMORE STW CATCHMENT	Podimore	No	1	0	854	3.5	
27081	SANDFORD ORCAS STW CATCHMENT	Sandford Orcas	No	1	0	2269	3.5	
23369	BABCARY STW CATCHMENT	Babcary	No	2	0	2311	5.8	
23119	EVERLEIGH STW CATCHMENT	Everleigh	No	1	0	1572	3.6	
23169	KINGS STAG STW CATCHMENT	Kings Stag	No	0	0	1677	2.9	
23117	ETCHILHAMPTON STW CATCHMENT	Etchilhampton	No	1	0	1327	3.5	
23287	STANTON ST BERNARD STW CATCHMEN	Stanton St Bernard	No	2	0	1264	5.8	
27375	HOLT STW CATCHMENT	Holt	No	4	0	4366	9.5	
23245	POWERSTOCK STW CATCHMENT	Powerstock	No	0	0	1811	2.9	
23127	FONTMELL MAGNA 2 STW CATCHMENT	Fontmell Magna 2	No	2	0	1988	6.0	
27062	RINGSTEAD STW CATCHMENT	Ringstead	No	1	0	809	3.6	
23095	DONYATT STW CATCHMENT	Donyatt	No	1	0	2251	3.7	
27430	GAUNTS COMMON STW CATCHMENT	Gaunts Common	No	4	0	5123	9.3	
23228	NYNEHEAD STW CATCHMENT	Nynehead	No	1	0	2024	3.7	
23100	DOYNTON STW CATCHMENT	Doynton	No	0	0	2939	3.4	
23041	BURTON STW CATCHMENT	Burton	No	1	0	1977	4.0	
23316	TOLLER PORCORUM STW CATCHMENT	Toller Porcorum	No	1	0	2293	3.7	
23120	EVERSHOT STW CATCHMENT	Evershot	No	0	1	1827	6.0	
23323	WANSTROW STW CATCHMENT	Wanstrow	No	1	0	1996	4.1	
23088	CROWCOMBE STW CATCHMENT	Crowcombe	No	1	0	2170	3.9	
23174	LANGFORD BUDVILLE STW CATCHMENT	Langford Budville	No	1	0	2105	4.0	
23231	OVERSTRATTON STW CATCHMENT	Overstratton	No	0	0	2179	2.9	
23062	CHILTHORNE DOMER STW CATCHMENT	Chilthorne Domer	No	0	0	2478	2.9	
23140	HALSTOCK STW CATCHMENT	Halstock	No	1	0	2089	3.7	
23187	LYDFORD STW CATCHMENT	Lydford	No	3	0	4726	7.2	
23079	CORSCOMBE STW CATCHMENT	Corscombe	No	2	0	2313	6.0	
23292	STOURTON CAUNDLE STW CATCHMENT	Stourton Caundle	No	0	0	2038	3.0	
23205	MELLS STW CATCHMENT	Mells	No	1	0	2986	3.8	
23184	LUCKINGTON STW CATCHMENT	Luckington	No	1	0	4711	3.7	
23021	BISHOPS CAUNDLE STW CATCHMENT	Bishops Caundle	No	2	0	4289	6.0	
23303	SYDLING ST NICHOLAS STW CATCHMEN	Sydling St Nicholas	No	1	0	2640	5.7	
23276	SHROTON STW CATCHMENT	Shroton	No	2	0	2871	6.6	
29031	BUCKLAND NEWTON STW CATCHMENT	Buckland Newton	No	0	0	7986	3.1	
23083	CRANMORE STW CATCHMENT	Cranmore	No	0	0	4726	3.1	
23178	LEIGH ON MENDIP STW CATCHMENT	Leigh On Mendip	No	0	0	4104	3.1	
23142	HARDINGTON MANDEVILLE STW CATCHI	Hardington Mandevill	No	1	0	7633	3.9	
23182	LONGBURTON STW CATCHMENT	Longburton	No	0	0	4373	3.1	
23111	EAST STOUR STW CATCHMENT	East Stour	No	0	0	4624	3.3	
23104	EAST CHINNOCK STW CATCHMENT	East Chinnock	No	1	0	3192	3.9	
23331	WELLOW STW CATCHMENT	Wellow	No	1	0	3187	3.9	
23362	WORTH MATRAVERS STW CATCHMENT	Worth Matravers	No	0	0	4569	3.2	
23145	HATCH BEAUCHAMP STW CATCHMENT	Hatch Beauchamp	No	1	1	4929	8.4	
23148	HILMARTON STW CATCHMENT	Hilmarton	No	1	0	6669	8.7	
23055	CHARLTON HORETHORNE STW CATCHM	Charlton Horethorne	No	1	0	5761	4.0	
23094	DITCHEAT STW CATCHMENT	Ditcheat	No	2	0	6242	6.1	
23173	LACOCK STW CATCHMENT	Lacock	No	2	0	4735	6.2	
23149	HINDON STW CATCHMENT	Hindon	No	1	0	3195	4.2	
23091	DIDMARTON STW CATCHMENT	Didmarton	No	2	0	5655	6.2	
23136	GREAT BADMINTON STW CATCHMENT	Great Badminton	No	4	0	9589	9.8	
23107	EAST KNOYLE STW CATCHMENT	East Knoyle	No	3	0	10654	8.8	
23317	TRENT STW CATCHMENT	Trent	No	1	0	9110	4.2	
23260	SANDHILL PARK STW CATCHMENT	Sandhill Park	No	2	0	1839	6.4	
23222	NORTH NIBLEY STW CATCHMENT	North Nibley	No	2	0	12416	6.2	
23035	BRINKWORTH STW CATCHMENT	Brinkworth	No	2	1	9577	10.9	
23082	CRANBORNE STW CATCHMENT	Cranborne	No	1	0	4484	4.3	
23146	HAZELBURY BRYAN STW CATCHMENT	Hazelbury Bryan	No	4	0	8536	11.6	
23291	STOURPAINE STW CATCHMENT	Stourpaine	No	2	0	5487	6.7	
23221	NORTH CADBURY STW CATCHMENT	North Cadbury	No	1	0	9882	5.6	
23012	AUST STW CATCHMENT	Aust	No	2	0	3865	6.4	
23137	GREAT SOMERFORD STW CATCHMENT	Great Somerford	No	6	0	8821	14.6	
23144	HASELBURY PLUCKNETT STW CATCHME	Haselbury Plucknett	No	3	1	7328	12.3	3

SITEID	NAME	Modelling	Storm system modelled at 2017	SPS_ Count	CSO_ Count	SewLen_ Tot	Survey costs (£k)	
23050	CERNE ABBAS STW CATCHMENT	Cerne Abbas	No	1	0	4512	8.2	
23116	ERLESTOKE STW CATCHMENT	Erlestoke	No	2	0	1309	6.6	
23293	STRATTON ON THE FOSSE STW CATCHI	Stratton On The Foss	No	0	0	4789	3.8	
23073	COMBE ST NICHOLAS STW CATCHMENT	Combe St Nicholas	No	0	0	8151	4.3	
23125	FIVEHEAD STW CATCHMENT	Fivehead	No	4	0	16866	9.8	
23320	UPAVON STW CATCHMENT	Upavon	No	3	0	6292	10.9	
23277	SIXPENNY HANDLEY STW CATCHMENT	Sixpenny Handley	No	2	0	6262	6.8	
23311	TILSHEAD STW CATCHMENT	Tilshead	No	1	0	5536	5.8	
23256	RODE STW CATCHMENT	Rode	No	4	0	8569	9.9	
23341	WESTWOOD STW CATCHMENT	Westwood	No	3	0	12894	9.4	
23001	ABBOTSBURY STW CATCHMENT	Abbotsbury	No	1	0	9581	5.8	
23322	URCHFONT STW CATCHMENT	Urchfont	No	4	0	11797	12.1	
23339	WESTBURY-SUB-MENDIP STW CATCHME	Westbury-Sub-Mendi	No	2	0	7787	6.9	
23180	LONG DEAN STW CATCHMENT	Long Dean	No	4	0	14001	12.1	
23227	NUNNEY STW CATCHMENT	Nunney	No	2	0	8998	6.9	
23181	LONGBRIDGE STW CATCHMENT	Longbridge	No	2	0	15653	8.3	
23032	BRADFORD ON TONE STW CATCHMENT	Bradford On Tone	No	8	0	17845	22.5	
23004	ALL CANNINGS STW CATCHMENT	All Cannings	No	9	1	13307	27.5	
23112	LEYHILL STW CATCHMENT	Falfield, Leyhill	No	1	0	3454	6.1	
23355	WIVELISCOMBE STYLES STW CATCHME	Wiveliscombe Styles	No	1	0	10996	6.4	
23262	SEEND STW CATCHMENT	Seend	No	4	0	7885	11.6	
23163	IWERNE MINSTER STW CATCHMENT	Iwerne Minster	No	3	0	7224	9.6	
23229	OAKHILL STW CATCHMENT	Gurney Slade, Oakhil	No	5	0	11560	12.6	
23071	COLLINGBOURNE DUCIS STW CATCHME	Collingbourne Ducis	No	2	0	10562	9.6	
23202	MEARE STW CATCHMENT	Meare	No	7	0	12269	20.2	
23037	BROADWAY STW CATCHMENT	Broadway	No	2	0	13689	8.7	
23249	PUDDLETOWN STW CATCHMENT	Puddletown	No	2	0	6442	7.1	
23156	HORNSEY BRIDGE STW CATCHMENT	Hornsey Bridge	No	8	0	13300	19.4	
23280	SOUTH PERROTT STW CATCHMENT	South Perrott	No	0	0	4142	4.5	
23036	BROADMAYNE STW CATCHMENT	Broadmayne	No	2	1	12204	11.4	
23347	WICKWAR STW CATCHMENT	Wickwar	No	2	0	22475	8.4	
23101	DRAYCOTT STW CATCHMENT	Draycott	No	0	0	9238	5.6	
23192	MAIDEN NEWTON STW CATCHMENT	Maiden Newton	No	2	0	8380	8.5	
23130	FRESHFORD STW CATCHMENT	Freshford	No	4	1	18517	16.8	
23306	TEMPLECOMBE STW CATCHMENT	Templecombe	No	3	1	9734	13.6	
23200	MARSHFIELD STW CATCHMENT	Marshfield	No	2	0	7706	8.3	
23214	MILVERTON STW CATCHMENT	Milverton	No	3	1	15493	14.1	
23212	MILBORNE ST ANDREW STW CATCHMEN	Milborne St Andrew	No	3	0	12244	11.6	
23113	EDFORD STW CATCHMENT	Edford	No	2	0	16990	9.6	
23092	DILTON MARSH STW CATCHMENT	Dilton Marsh	No	4	1	12870	19.1	
23290	STOKE ST GREGORY STW CATCHMENT	Stoke St Gregory	No	7	2	22226	26.9	
23368	YEOVIL WITHOUT STW CATCHMENT	Yeovil Without	No	5	1	15271	17.7	
23061	CHILCOMPTON STW CATCHMENT	Chilcompton	No	2	0	16010	8.9	
23274	SHOSCOMBE STW CATCHMENT	Shoscombe	Yes	1	0	15451	6.8	
23352	WINSLEY STW CATCHMENT	Winsley	No	1	0	15175	8.6	
23220	NETHERAVON STW CATCHMENT	Netheravon	No	5	0	13278	14.1	
23160	ILCHESTER STW CATCHMENT	Ilchester	No	5	0	15738	14.3	
23069	COLEFORD STW CATCHMENT	Coleford	No	2	1	15488	12.1	
23077	CORFE CASTLE STW CATCHMENT	Corfe Castle	No	6	0	10888	16.3	
23060	CHIDEOCK STW CATCHMENT	Chideock	No	3	0	6192	9.5	
23007	ALVESTON STW CATCHMENT	Alveston	Yes	0	0	19519	6.8	
23043	BUTLEIGH STW CATCHMENT	Butleigh	No	10	1	33208	30.5	
23310	THORNFORD STW CATCHMENT	Thornford	No	8	0	25720	22.7	
23271	SHILLINGSTONE STW CATCHMENT	Shillingstone	No	4	0	21663	17.3	
23219	NETHER STOWEY STW CATCHMENT	Nether Stowey	No	2	0	21011	9.4	
23209	MICHAELWOOD STW CATCHMENT	Michaelwood	No	4	0	6944	16.9	
23515	PORLOCK STW CATCHMENT	Porlock	No	4	1	26189	16.8	
23164	KEEVIL STW CATCHMENT	Keevil, Great Hinton	No	7	0	40826	22.9	
23208	MERRIOTT STW CATCHMENT	Merriott	No	4	1	28495	18.8	
23177	LAVINGTON WOODBRIDGE STW CATCHI	Lavington Woodbridg	No	3	3	34236	28.1	
23266	SHARPNESS STW CATCHMENT	Sharpness	No	12	0	30019	32.6	
23522	LYNEHAM STW CATCHMENT	Lyneham	No	15	0	42057	38.2	
23040	BURROWBRIDGE STW CATCHMENT	Burrowbridge	No	1	0	387	3.4	4 of 4
				TOTAL SURVEY COST			**£ 5,233 k**	