STORM OVERFLOWS EVIDENCE PROJECT – 2022 ADDENDUM

This report furthers the analysis reported in the November 2021 Storm Overflow Evidence Project with regard to additional policies that address the avoidance of harm from storm overflows

29 March 2022

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Revision	Description	Author	Date	Quality Check	Date	Review	Date
1	Draft	EJG	03/03/22	CJD	03/03/22	N/A	N/A
6	Final	EJG	29/03/22	CJD	29/03/22	CJD	29/3/22

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Executive Summary

This analysis is an addendum to the Storm Overflows Evidence Project (SOEP) produced in November 2021 for the Storm Overflows Taskforce. It builds on that analysis to calculate, for the first time, the costs of targeting the elimination of river ecological harm due to overflows whilst also limiting the number of times they operate annually in response to rainfall. It also calculates the proportion of expenditure associated with improvements to waterbodies considered sensitive and hence a priority.

The principles of the methodology are shared with the previous analysis but are enhanced to present solutions which target the elimination of ecological harm due to overflows operating in response to rainfall. The policy targets analysed in this report align with the core ecological targets set out in the government's storm overflows consultation document.

Three different delivery scenarios were examined in the achievement of targets:

1) Water companies make improvements to their drainage infrastructure by only increasing capacity (e.g.by constructing network storage tanks or storm tanks at wastewater treatment works).

2) A hybrid scenario where capacity improvements are made in combination with retrofit sustainable drainage solutions implemented to control 10% of impermeable area contributing runoff to the combined sewer system.

3) A hybrid scenario, similar to scenario 2, where capacity improvements are made in combination with retrofit sustainable drainage solutions implemented to control 50% of impermeable area contributing runoff to the combined sewer system.

Four different policy targets were considered and these are presented here with the range of capital costs calculated for the preferred central water quality uncertainty estimate:

1. Eliminating all ecological harm due to storm overflows by 2050 (but not controlling the frequency of spills due to rainfall). Costs vary between £25bn (lower estimate, delivery scenario 1) and £107bn (high estimate, delivery scenario 3).

2. Applying a universal maximum annual average spill frequency due to rainfall of 10 and then eliminating ecological harm where this is still present by 2050. Costs vary between £40bn (lower estimate, delivery scenario 1) and £178bn (high estimate, delivery scenario 3).

3. Applying a universal maximum annual average spill frequency due to rainfall of 20 and then eliminating ecological harm where this is still present by 2050. Costs vary between £32bn (lower estimate, delivery scenario 1) and £164bn (high estimate, delivery scenario 3).

4. Applying a universal maximum annual average spill frequency due to rainfall of 40 and then eliminating ecological harm where this is still present by 2050. Costs vary between £27bn (lower estimate, delivery scenario 1) and £132bn (high estimate, delivery scenario 3).

Improvements in relation to sensitive waterbodies account the majority of cost, between 73% and 92% of the total estimated costs depending on policy target. This is due to the high prevalence of underperforming overflows impacting on sensitive waterbodies.

1 Introduction

1.1 Background

In November 2021, the Department for Environment, Food and Rural Affairs (Defra) published a project report commissioned by Water UK for the Storm Overflows Taskforce[1]. The purpose of this report was to examine the costs and benefits of different storm overflow control policies for inland rivers in England. The policies tested considered the control of spill frequency due to rainfall only.

The report is published on the Defra website Storm overflows evidence project - GOV.UK (www.gov.uk) and was authored by technical specialists from the environmental and engineering consultancy Stantec UK Ltd[2].

1.2 Scope

In January 2022, Defra commissioned Stantec to prepare an addendum to the analysis which sought to understand the capital costs of achieving policy targets intended to both limit the number of spills due to rainfall and eliminate river ecological harm where standard spill frequency controls alone were insufficient to achieve this goal.

The policy targets tested were as follows:

1. Eliminate all ecological harm due to storm overflows (while allowing spill frequencies to vary as required to achieve this goal) (NOHARM)

2. Apply a universal maximum annual average spill frequency due to rainfall of either 40, 20 or 10 spills and reduce this only where necessary to eliminate all ecological harm (F40-NOHARM, F20-NOHARM, F10-NOHARM)

Two programmes for delivery were modelled with a prioritisation on inland river waterbodies deemed sensitive[3] by 2045 and for all waterbodies by 2050.

Three potential delivery scenarios were modelled (as in the original storm overflows evidence project) to achieve the policy targets through either:

1. Wastewater network storage additions alone (W),

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031216/storm-overflows-taskforce-tor.pdf
[2] https://www.stantec.com/uk
[3] Sensitive waterbodies were defined in the Storm Overflows Evidence Project as ones designated as, or close to, SSSI and SAC. In addition chalk streams, sensitive areas eutrophic and waterbodies not achieving good because of intermittent discharges were included in the definition.

2. a combination of storage and retrofitted sustainable drainage (SuDS) managing 10% of impermeable area (S10)

3. a combination of storage and retrofitted sustainable drainage (SuDS) managing 50% of impermeable area (S50)

The following 12 combinations of policy targets and delivery scenarios were hence tested for sensitive waterbodies and waterbodies without this designation.

NOHARM-W	*NOHARM-S10*	*NOHARM-S50*
F40-NOHARM-W	*F40-NOHARM-S10*	*F40-NOHARM-S50*
F20-NOHARM-W	*F20-NOHARM-S10*	*F20-NOHARM-S50*
F10-NOHARM-W	*F10-NOHARM-S10*	*F10-NOHARM-S50*

1.3 Method, assumptions and uncertainties

The method, simplifications and assumptions inherent within the original Storm Overflows Evidence Project are carried over into the analysis reported in this addendum. The assessment provides the most comprehensive and reliable assessment of national requirements currently undertaken.

Analysis undertaken for this addendum differs in that it calculates costs to purposefully eliminate ecosystem harm instead of merely reporting the change in harm resulting from the targeting of spill frequency limits alone. The overall approach was to start with the predicted 2050 equivalent ecosystem classification for different spill frequency policy targets and compute the spill reduction necessary to eliminate any residual forecast ecological harm.

Water and Sewerage Companies (WaSCs) will be able to repeat the analysis for their regions taking account of local data on river impacts, engineering feasibilities and costs. Moreover, they will better understand the opportunities arising locally for co-creation and co-financing of blue-green infrastructure (sometimes termed ‘nature based’) solutions as part of a retrofit sustainable drainage philosophy. It is anticipated that WaSCs will undertake this analysis as part of Drainage and Wastewater Management Plans and in the preparation of their period review business plans for investment in the period 2025 to 2030.

Three types of uncertainty are included in the analysis and reflected in the range of costs estimated. The first is around the unit costs for implementing network storage and sustainable drainage retrofits. These assumptions were reported and evidenced in the earlier main report. Each of the policy scenarios were, therefore tested against a low and high unit cost assumption.

The second is because the number of overflows included in the analysis is not 100% of the national total because not all overflows have hydraulic modelling results available to predict future spill volumes and frequencies. As previously, all calculated costs are increased by 30% to account for the 30% of overflows excluded from the analysis.

The third is around uncertainty in what is required to eliminate ecological harm from storm overflows. The analytical approach predicts the 2050 equivalent ecosystem classification for each waterbody based upon its flow regime and the frequency and volume of untreated flows being discharged into it. Ecological harm is measured in a simple way and the approach might be overly pessimistic or optimistic depending on local conditions. Therefore, when assessing the interventions necessary to eliminate ecological harm three costs are presented: central (the recommended value), low (the minimum plausible cost), high (the maximum plausible cost). In the central estimate, the achievement of elimination of ecological harm is defined by a dilution ratio of overflow spill to the product of the 70 percentile river flow, the volume weighted spill frequency and average spill duration is 0.5. For the low estimate the ratio is 1.0, and for the high estimate the value is 0.15.

It should be emphasised that the equivalent ecosystem classification approach applied only addresses the ecological harm caused to waterbodies through storm overflow spills. Elimination of this harm does not guarantee that other harms will not still result in unsatisfactory water quality outcomes. Other polluting impacts include continuous discharges from wastewater treatment, diffuse urban pollution from runoff, industrial discharges and runoff from agricultural land.

It should also be noted that the type of storm overflow spills considered in this analysis are those directly related to rainfall and the capacity of the wastewater system. It is acknowledged that some observed spills occur for operational or maintenance reasons or during periods of groundwater inundation, sometimes in dry weather, in breach of permit conditions. The prevalence, impact and cost to control of these spills are not included in the analysis.

2 Results

Results are presented in the tables below for the 12 policy and delivery scenarios and the 6 assumptions for cost and ecological harm uncertainty.

Table 2-1 indicates the estimated capital investment required (CAPEX) rounded to billions of pounds, to deliver each policy target for each delivery scenario by 2050. Data are presented for each of the unit costs and ecological harm uncertainty assumptions described in Section 1.3. Four different policy targets were considered and these are summarised here with the range of capital costs calculated for the preferred central water quality uncertainty estimate:

1. Eliminating all ecological harm due to storm overflows by 2050 (but not controlling the frequency of spills due to rainfall). Costs vary between £25bn (lower estimate, delivery scenario 1- W) and £43bn (high estimate, delivery scenario 2 – S10) increasing to £107bn (high estimate, delivery scenario 3 – S50).
2. Applying a universal maximum annual average spill frequency due to rainfall of 10 and then eliminating ecological harm where this is still present. Costs vary between £40bn (lower estimate, delivery scenario 1 - W) and £73bn (high estimate, delivery scenario 2 – S10) increasing to £178bn (high estimate, delivery scenario 3 – S50).
3. Applying a universal maximum annual average spill frequency due to rainfall of 20 and then eliminating ecological harm where this is still present. Costs vary between £32bn (lower estimate, delivery scenario 1 - W) and £61bn (high estimate, delivery scenario 2 – S10) increasing to £164bn (high estimate, delivery scenario 3 – S50).
4. Applying a universal maximum annual average spill frequency due to rainfall of 40 and then eliminating ecological harm where this is still present. Costs vary between £27bn (lower estimate, delivery scenario 1 - W) and £51bn (high estimate, delivery scenario 2 – S10) increasing to £132bn (high estimate, delivery scenario 3 – S50).

Table 2-2 reports the equivalent data but with a prioritisation on sensitive waterbodies intended for delivery by 2045. This assessment was only completed in full for the NOHARM and F10-NOHARM policies because the Storm Overflow Evidence Project restricted its assessment of sensitive waterbodies to the F10 policy.

Estimates are provided for other policies (F40-NOHARM and F20-NOHARM) by applying the average percentage of costs (73%) associated with sensitive waters in the NOHARM policy. These values are greyed out in the table. The share of costs to implement these policies in sensitive waterbodies is between 73% and 92% of the total depending on the target. Table 2-3 shows the residual CAPEX remaining once the sensitive waterbodies are completed.

Table 2-1 CAPEX (£bn) to deliver policies through different delivery scenarios (all water bodies)

			CAPEX (£bn)		
			High	Central	Low
NOHARM	W	low unit costs	40	**25**	18
		high unit costs	63	**40**	29
	S10	low unit costs	44	**27**	23
		high unit costs	69	**43**	35
	S50	low unit costs	82	**71**	68
		high unit costs	124	**107**	102
F40-NOHARM	W	low unit costs	41	**27**	20
		high unit costs	65	**42**	32
	S10	low unit costs	53	**33**	26
		high unit costs	82	**51**	40
	S50	low unit costs	118	**87**	74
		high unit costs	178	**132**	112
F20-NOHARM	W	low unit costs	44	**32**	26
		high unit costs	69	**50**	42
	S10	low unit costs	58	**39**	34
		high unit costs	90	**61**	53
	S50	low unit costs	139	**109**	96
		high unit costs	210	**164**	146
F10-NOHARM	W	low unit costs	49	**40**	36
		high unit costs	77	**63**	56
	S10	low unit costs	63	**47**	42
		high unit costs	97	**73**	66
	S50	low unit costs	143	**118**	106
		high unit costs	217	**178**	161

Table 2-2 CAPEX (£bn) to deliver policies through different delivery scenarios (sensitive water bodies by 2045).

			CAPEX (£bn)		
			High	Central	Low
NOHARM	W	low unit costs	31	18	11
		high unit costs	49	28	18
	S10	low unit costs	34	20	16
		high unit costs	53	31	25
	S50	low unit costs	62	53	50
		high unit costs	94	80	76
F40-NOHARM	W	low unit costs	32	19	15
		high unit costs	50	31	25
	S10	low unit costs	41	24	20
		high unit costs	63	37	31
	S50	low unit costs	91	64	57
		high unit costs	137	96	86
F20-NOHARM	W	low unit costs	34	23	20
		high unit costs	53	37	32
	S10	low unit costs	45	29	26
		high unit costs	69	45	40
	S50	low unit costs	107	79	74
		high unit costs	161	120	112
F10-NOHARM	W	low unit costs	44	36	32
		high unit costs	69	57	51
	S10	low unit costs	57	44	41
		high unit costs	88	68	63
	S50	low unit costs	131	111	102
		high unit costs	198	167	154

Table 2-3 CAPEX (£bn) to deliver policies through different delivery scenarios (non-sensitive water bodies by 2050)

			CAPEX (£bn)		
			High	Central	Low
GOOD	W	low unit costs	9	7	7
		high unit costs	15	12	11
	S10	low unit costs	10	8	7
		high unit costs	17	12	11
	S50	low unit costs	20	18	18
		high unit costs	30	28	27
F40 and GOOD	W	low unit costs	9	7	5
		high unit costs	15	11	7
	S10	low unit costs	12	9	6
		high unit costs	19	14	9
	S50	low unit costs	27	24	17
		high unit costs	41	36	26
F20 and GOOD	W	low unit costs	10	9	6
		high unit costs	16	14	10
	S10	low unit costs	13	11	8
		high unit costs	21	16	12
	S50	low unit costs	32	29	22
		high unit costs	48	44	33
F10 and GOOD	W	low unit costs	5	4	4
		high unit costs	8	7	6
	S10	low unit costs	6	3	2
		high unit costs	9	5	3
	S50	low unit costs	12	7	4
		high unit costs	19	11	6