

# DRAINAGE AND WASTEWATER MANAGEMENT PLANS (DWMP)

## INTEGRATED DELIVERY ALLIANCE (IDeA)

# OPTION DEVELOPMENT AND APPRAISAL METHODOLOGY

### ***Intended Use***

*For reference by technical staff involved in undertaking and checking/reviewing the Option Development and Appraisal (ODA) process within the DWMP framework.*



## DWMP

### OPTION DEVELOPMENT AND APPRAISAL

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# DWMP

## OPTION DEVELOPMENT AND APPRAISAL

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### INTRODUCTION

This document provides an overview of the methodology that is to be followed to undertake the Option Development and Appraisal (ODA) stage of the Drainage and Wastewater Management Plan (DWMP).

This document covers only the option development and appraisal that is to be completed for the DWMP Planning Objectives.

### Overview

The ODA stage of the DWMP follows on from the Baseline Risk and Vulnerability Assessment (BRAVA) and Problem Characterisation (PC) stages. The BRAVA and PC stages of the DWMP provide an understanding of the current modelled performance and level of risk within catchments and how this is projected to change in the future.

This methodology document provides an overview of;

- The approach to be adopted to identify the Needs of catchments with regards to current performance and performance in the future against the DWMP Planning Objectives.
- The options screening and development process to be applied to enable the scoping of options to resolve catchment Needs.
- The methodology to be applied to assess costs and benefits/dis-benefits of options to support the identification of Least Cost and Best Value options.

### Reference to Other Documentation

This document should be read and used in conjunction with other guidance related to the Northumbrian Water DWMP.

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## OPTION DEVELOPMENT AND APPRAISAL

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### NEEDS IDENTIFICATION

A detailed overview of the methodology to be followed to determine Needs within catchments is provided in the Problem Characterisation (PC) Methodology. A summary of the Needs that are addressed by the options developed as part of the DWMP, i.e. related to the Planning Objectives, is given here.

#### Storm Overflow Discharge Reduction Plan

The prioritisation of storm overflow improvements is to be completed in accordance with the Storm Overflow Discharge Reduction Plan (SODRP) documentation issued by the Environment Agency (EA). This process is followed to determine whether a storm overflow requires improvement in terms of spill frequency reduction and/or 6mm screening provision.

Options are to be defined to achieve the spill frequency reduction targets that have been outlined in the SODRP.

Options for storm overflow spill frequency reduction and screening are related to Planning Objectives 'PO4 Bathing Water Quality' and 'PO5 River Water Quality'.

#### Wastewater Treatment Works

Options are to be developed to ensure that Wastewater Treatment Works (WwTW) remain compliant with dry weather flow and effluent discharge quality permits throughout the planning period covered by the DWMP.

#### DWF Compliance

An assessment is to be made to determine if, as a result of catchment growth, a WwTW is projected to exceed the current permit criteria for the treatment of dry weather flow (DWF). An option would be required during the Asset Management Period (AMP) when the exceedance is projected to occur at the latest.

Options for WwTW DWF compliance are related to Planning Objective 'PO8 WwTW DWF Compliance'.

#### Discharge Effluent Quality Compliance

An assessment is to be made to determine if a WwTW is projected to exceed the current permit criteria for the discharge quality of treated effluent against current standards. An option would be required during the Asset Management Period (AMP) when the exceedance is projected to occur at the latest.

#### Long-Term Delivery Strategy

NWL have a long-term delivery strategy (LTDS) to reduce hydraulic property flood risk by 60% of the current risk number by 2055. Interventions will be included in the DWMP to contribute to achieving this long-term strategy. Additionally, levels of hydraulic pollution risk are to be maintained across the planning period covered by the DWMP.

Options for long-term flood risk reduction are related to Planning Objectives 'PO1 Internal Flood Risk', 'PO2 External Flood Risk' and 'PO3 1 in 50 Year Population at Risk'. Options for hydraulic pollution risk reduction are related to Planning Objective 'PO6 Pollution'.

### STORM OVERFLOW DISCHARGE REDUCTION PLAN

#### Overview

Options are to be identified to resolve the demand at the L4 Drainage Community level.

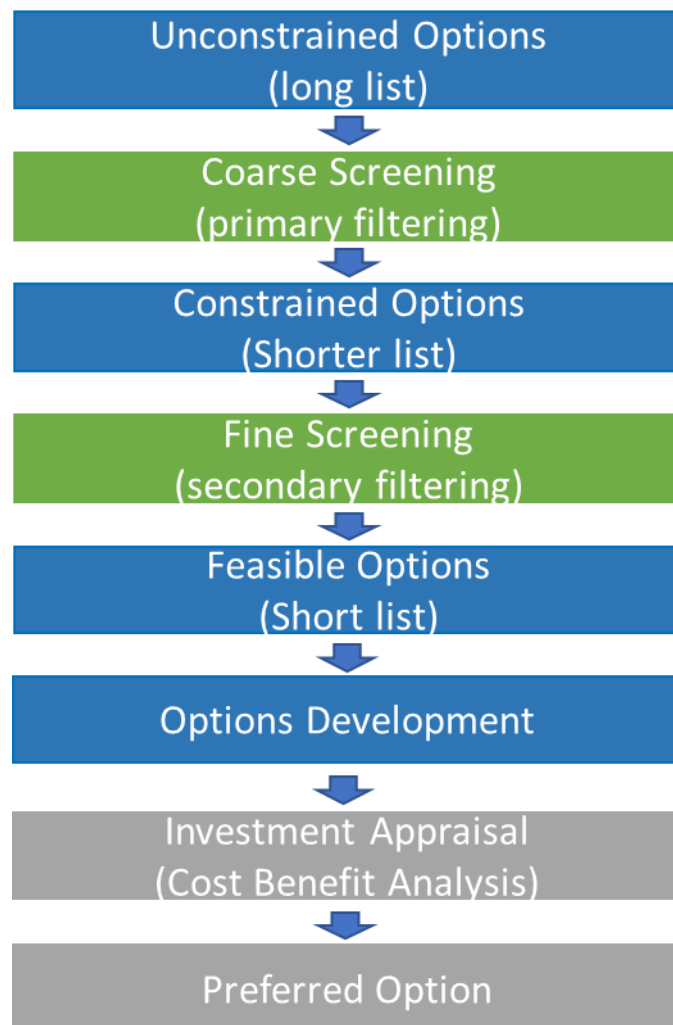
Costs and benefits of options will also be calculated at the L4 Drainage Community level. Options that include elements of surface water management have the potential to provide benefits against multiple Planning Objectives. For example, surface water separation within a Drainage Community to reduce storm overflow spill frequencies will also have the potential to reduce hydraulic flood risk within the Drainage Community. For some other option types, e.g. below-ground storage at storm overflows, the benefits will be limited. As discussed later in this methodology, the calculation of costs and benefits allows the 'best value' options to be identified, i.e. those that have the best cost-benefit ratio.

#### Option Constraining

Figure 1 summarises the process for identifying options and is based on the principles of the HM Treasury, The Green Book: Central Government Guidance on Appraisal and Evaluation. This process is also in line with the guidance provided in the DWMP Framework documentation.

A more detailed description of each of the steps, and the outputs from each step, is contained in the following sections.

**FIGURE 1: PROCESS FOR DEVELOPING AND FILTERING OPTIONS**



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## OPTION DEVELOPMENT AND APPRAISAL

### Generic Options

The full list of generic options that are to be considered in the development of the DWMP are shown in the following table. The options are categorised into four management areas:

- Customer side management options
- Combined and foul sewer systems
- Surface water management
- Wastewater treatment

Examples of the generic options within each management area are outlined in the following table.

**TABLE 1: GENERIC OPTIONS**

Management Area	Generic Option Example
Customer side management options	Water efficient appliances
	Rainwater harvesting
	Customer incentives
	Domestic and business customer education
Combined and foul sewer systems	Active management
	Rehab/Renewal/replacement
	Surface water separation and removal
	Capacity
	Intelligent operation
	Storage
Surface water management	Flow transfer
	Exceedance management (source control, conveyance, storage)
	Mitigation
Wastewater treatment	Strategic blue-green corridors
	Active management
	Rehab/Renewal/replacement
	Catchment Management Initiatives
	Capacity
	Intelligent operation
	Flow transfer
De-centralisation	

### Catchment Screening

Each catchment is to undergo an initial screening process to determine if a particular option is applicable, practical and effective in terms of achieving the storm overflow Needs that have been identified within the Drainage Community.

Available GIS data is to be utilised to analyse the opportunities for the various generic options.

#### Unconstrained Options

The broad range of options that have been considered have differing levels of costs and benefits and have been categorised as follows:

- Eliminate – identification of monitoring or changes to policy or permits which may remove the need for investment. Eliminate options are likely to have the lowest costs to deliver the benefit. They may be used in combination with other options.
- Collaborate – work with stakeholders to re-assign the issue or co-fund. Costs can be shared with third parties either to deliver the same or an additional level of social and environmental benefit.
- Operate – improved operational management practices to enhance existing capacity. This includes the provision of smart networks.
- Invigorate – invest in the existing infrastructure to improve performance. These options will provide an increased level of benefit but may be of a lower cost than fabricate options.
- Fabricate – new assets to augment or replace existing. These options are likely to have the highest costs. Green options will have lower carbon and potentially higher biodiversity and amenity benefits. Traditional grey options are likely to have highest certainty that service-related benefits will be realised. Innovative options have the potential for greater benefits and lower costs but have the lower certainty that benefits will be realised.

The options that are listed within Table 2 were assessed during a number of option development workshops.

A hierarchy approach is to be adopted in the identification of options. Depending on the Needs that are identified within a Drainage Community, developed through DWMP with NWL and considered sequentially for each drainage community and 'Need'.



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### OPTION DEVELOPMENT AND APPRAISAL

TABLE 2 – UNCONSTRAINED OPTIONS

Option Element	Hierarchy	Generic Option Type	Generic Option Detail	Screening Guidance
1	Eliminate	Further investigation and monitoring to eliminate Need	Understand root cause and risk.	This option will progress to secondary screen by default.
2	Eliminate	Influencing policy	Growth, planning and urban creep.	This option will progress to secondary screen by default.
3	Eliminate	Modify consents or permits	Review the permit with the Environment Agency and meet new permit conditions.	This option will progress if a WwTW is failing DWF consent up to 2065, or if there are any storm overflows that are failing that could go through consent review.
4	Collaborate	Water efficient appliances (domestic)	Supplying customers with household appliances which are designed to reduce water consumption. Reduced per capita consumption (PCC) can also benefit the wastewater system by reducing the DWF to be conveyed through the sewer network and through to WwTWs.	This option is only going to be significant if it is within a catchment draining to a WwTW that is going to fail DWF consent within the planning period.
5	Collaborate	Water efficient measures (non-domestic)	Water efficiency measures can be installed within buildings with the purpose of reducing water consumption.	This option is only going to be significant if it is within a catchment draining to a WwTW that is going to fail DWF consent within the planning period.

**OPTION DEVELOPMENT AND APPRAISAL**

Option Element	Hierarchy	Generic Option Type	Generic Option Detail	Screening Guidance
6	Collaborate	Rainwater harvesting	<p>Removing surface water from the system and making it available for re-use. By installing measures which collect and store the rainfall before it lands and is lost as runoff. Rainwater harvesting reduces the amount of flow that needs to be conveyed through the sewer network, thus reducing the likelihood of sewer flooding or spills to watercourse. Includes smart management of surface water before flow enters the system (e.g. smart water butts).</p>	<p>This option will progress to secondary screen by default.</p>
7	Collaborate	'Grey' water and 'black' water treatment and re-use	<p>Install systems to treat and re-use household grey water (excluding toilets) and black water (including toilets) for flushing toilets and gardening use. Either at property level or larger scale to reduces both flow and load to the system. The treatment levels considered vary from treatment for potable use to pre-treatment for discharge into the combined or foul sewer network.</p>	<p>This option will progress to secondary screen by default.</p>
8	Collaborate	Collaboration with other customers and catchment stakeholders	<p>Supporting schemes that are being, or planned to be, progressed by catchment partners. For example, Lead Local Flood Authority or Environment Agency projects.</p>	<p>This type of option will be progressed in catchments where an opportunity exists, either through the Northumbria Integrated Drainage Partnership (NIDP) or other opportunities that have been identified through engagement.</p>
9	Collaborate	Cross boundary flow transfer	<p>Utilise available capacity elsewhere by transferring flows to a neighbouring Water and Sewerage Company (WaSC) operating area.</p>	<p>This option will progress if the catchment is located adjacent to another WaSC's operating area.</p>

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Option Element	Hierarchy	Generic Option Type	Generic Option Detail	Screening Guidance
10	Collaborate	Internal transfer	Transfer flows from one catchment into an adjacent catchment.	This option will progress if the catchment is located adjacent to another which has capacity to accept additional flow.
11	Operate	Smart Network and intelligent operation	Controlling flows in reaction to the current situation. Allows the system to be operated pro-actively, maximising the use of existing assets. These options cover a range of different approaches e.g. modifying the start and stop levels at strategic pumping stations and the creation of new network control points which allow for flow to be temporarily held back in the network.	This option will progress if there are opportunities within the catchment.
12	Operate	Removal of infiltration and inflows	Option includes removal of any excessive infiltration or inflows from the system	This option will progress if the catchment has infiltration identified as a problem.
13	Operate	Enhanced operational maintenance regimes	Pro-active and targeting operation and maintenance rehab programmes.	This option will progress if the catchment has been identified as having known operational issues.
14	Operate	Rationalization of overflows	Rationalization of overflows within a catchment to improve management of spills without providing additional storage or increasing capacity	This option could progress if there are multiple storm overflows within close proximity to each other.

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Option Element	Hierarchy	Generic Option Type	Generic Option Detail	Screening Guidance
15	Invigorate	Surface water source control measures	Managing surface water and maximising its potential for re-use. Opportunities for large-scale source control installation such as retrofitting in highways and around buildings.	This option will progress to secondary screen by default.
16	Invigorate	Surface water exceedance pathways	The need to provide safe conveyance (as opposed to storage) for floodwater during an extreme rainfall event (when the capacity of the sewer network is exceeded). Could significantly mitigate the risk of considerable damage to public and private property and even loss of life that could result from an extreme rainfall event	This option will progress to secondary screen by default.
17	Invigorate	Strategic blue green corridors	Combine the management of blue and green spaces in urban environments with a focus on place making.	This option will progress if there are opportunities within the catchment.
18	Invigorate	Surface water separation	Separate surface water from combined systems by constructing new surface water networks.	This option will progress if there are any opportunities identified within the catchment.
19	Invigorate	Surface water removal	Removing existing separately drained surface water systems from the combined sewer system by diverting to watercourses or other surface water systems.	This option will progress if there are any opportunities identified within the catchment.

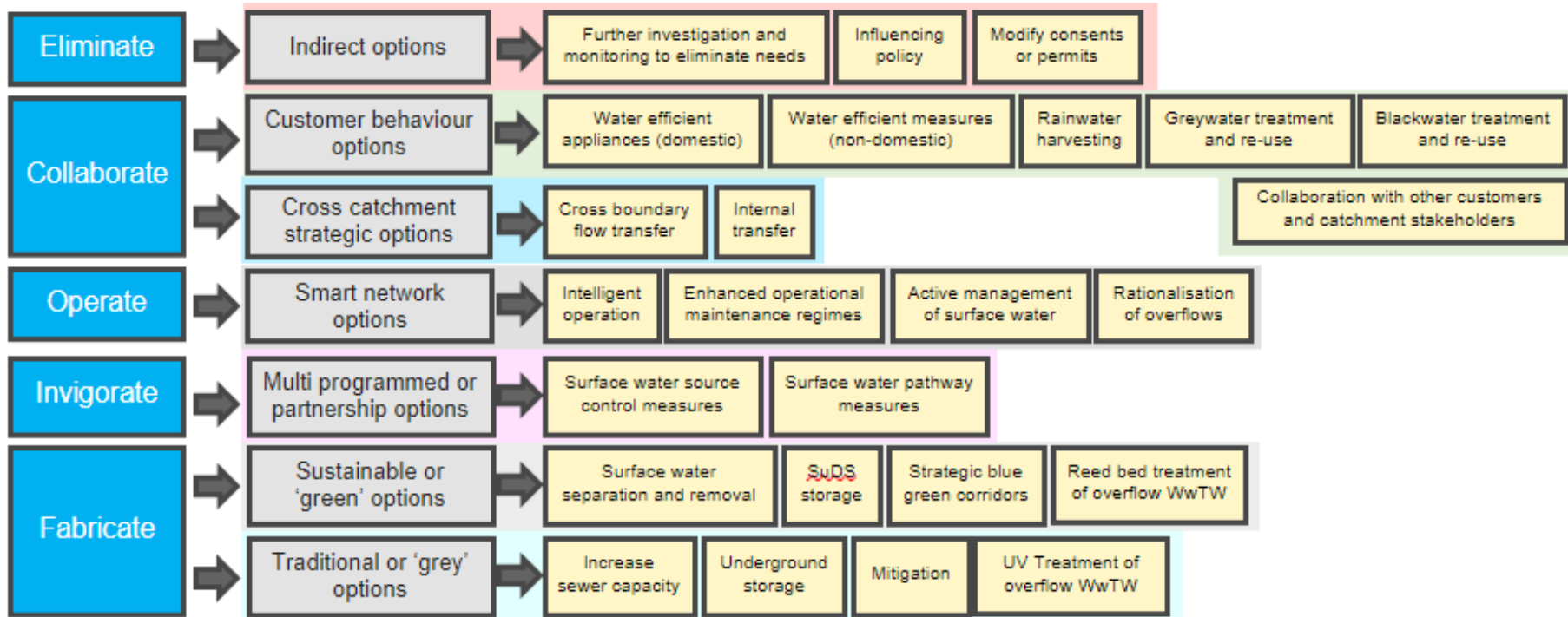
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Option Element	Hierarchy	Generic Option Type	Generic Option Detail	Screening Guidance
20	Fabrication	Green or SuDS storage	SuDS storage such as ponds, basins or swales.	This option will progress if there are any opportunities identified within the catchment for runoff area separation.
21	Fabrication	Increase sewer capacity	Replace sewer with a large diameter sewer to increase capacity.	This option will progress to secondary screen by default. Note – an assessment is to be made to evaluate whether a catchment would be able to accommodate network storage without causing a significant impact on WwTW DWF compliance.
22	Fabrication	New storm overflow	Constriction of a new storm overflow.	This option will progress unless it is located within a catchment that has been linked to a watercourse not currently achieving 'Good' status under the Water Framework Directive (WFD).
23	Fabrication	Below-ground storage	Provision of additional capacity within the network through off-line storage tanks.	This option will progress to secondary screen by default. Note – an assessment is to be made to evaluate whether a catchment would be able to accommodate network storage without causing a significant impact on WwTW DWF compliance.
24	Fabrication	Mitigation	Surface water receptor measures. Keep floodwater away from buildings and strategic infrastructure in event of a storm. This would include property level protection (e.g. flood gates).	This option will progress to secondary screen by default.

A summary of the unconstrained options list considered as part of the DWMP for the SODRP Needs can be seen in **Error! Reference source not found.**

FIGURE 2: UNCONSTRAINED OPTIONS HIERARCHY



The unconstrained options list was reviewed to determine the viability of each option against the defined SODRP Needs.

A summary of the constraining exercise is provided in Table 3.

**Constrained Options**

**TABLE 3: PRIMARY SCREENING OF OPTIONS AGAINST NEED AND TECHNICAL FEASIBILITY**

Option	Meets Need?	Technically Feasible?	Screening Outcome
Further investigation and monitoring to eliminate Needs	Partly (PO4 and PO5 only)	Yes	<b>Carried Forward</b> Investigations (ENVAct_INV4) to understand the impact of harm and the monitoring requirements set out in our business case for monitoring which sets out the investigation and improvement of monitoring to understand the impact of storm overflows on receiving waterbodies. These will inform our interventions but not remove the Need for investing in reducing spills from storm overflows as this is a new statutory requirement.
Influencing policy	No	Yes	<b>Discarded</b> This is a new statutory requirement so options for eliminating/reducing the need for investment are limited. Reducing flows by restricting flows from new development and growth are not acceptable to customers and stakeholders. Opportunities for influencing policy around sustainable urban drainage exist and have been carried forward below.
Modify consents or permits	No	Yes	<b>Discarded</b> Reviewing permits and consents is not consistent with SODRP guidance, which is intended to reduce spills. Any change in permit would not alter the number of spills and is unlikely to be accepted by the regulator.
Water efficient appliances/water efficient measures (non-domestic)	No	Yes	<b>Discarded</b> Even though the option is technical feasible, the inclusion of any domestic water efficiencies is not expected to result in sufficient flow reduction that would alleviate a storm overflow spill frequency reduction Need.
Rainwater harvesting	Partly	Yes	<b>Carried forward</b>
Greywater/blackwater treatment and re-use	Partly (PO8 only)	Yes	<b>Carried forward</b> This option will progress if any NIDP schemes are proposed within the catchment.
Cross boundary flow transfer	No	No	<b>Discarded</b> This option was considered for Berwick, which is located adjacent to Scottish Water's operating area; however, it was discarded because it wasn't technically feasible. There is no suitable network in the largely rural Scottish Water operating area which could accept flows from Berwick. Would require an extensive pumped transfer scheme.

**OPTION DEVELOPMENT AND APPRAISAL**

Option	Meets Need?	Technically Feasible?	Screening Outcome
Internal transfer	No	No	<b>Discarded</b> Limited opportunities exist to transfer flows from one area to another.
Collaboration with other customers and catchment stakeholders	Partly (All POs except PO8)	Yes	<b>Carried forward</b>
Smart Network and Intelligent operation	Partly (All POs except PO8)	Yes	<b>Carried forward</b> Considered in conjunction with other options.
Enhanced operation maintenance regimes	Partly	Yes	<b>Carried forward</b> On its own, this would not be sufficient to address storm overflow Needs but may be used to ensure that operational problems do not exacerbate spills, and which would not be addressed under routine maintenance regimes.
Active management of surface water	Partly	Yes	<b>Discarded</b> May be used as part of a wider strategic option.
Rationalisation of storm overflows	No	Yes	<b>Discarded</b> Does not meet storm overflow Need on its own.
Surface water source control measures	Yes	Yes	<b>Carried forward</b>
Surface water exceedance pathways	No	Yes	<b>Discarded</b> Would not meet storm overflow spill frequency reduction Need.
Strategic blue green corridors	Partly	Yes	<b>Carried forward</b>
Surface water separation	Yes	Yes	<b>Carried forward</b>
Surface Water Removal	Partly	Yes	<b>Carried forward</b>
Green or SuDS storage	Partly	Yes	<b>Carried forward</b>
Increase sewer capacity	Yes	No	<b>Discarded</b> Not considered without assessing downstream impacts at the same time. Likely to shift problems within catchments.
New storm overflow	Partly	No	<b>Discarded</b> Considered that it is preferable to reduce spills at existing storm overflows rather than construct new assets.
Below-ground storage	Yes	Yes	<b>Carried forward</b>
Mitigation	No	Yes	<b>Discarded</b> Would not meet storm overflow spill frequency reduction Need.

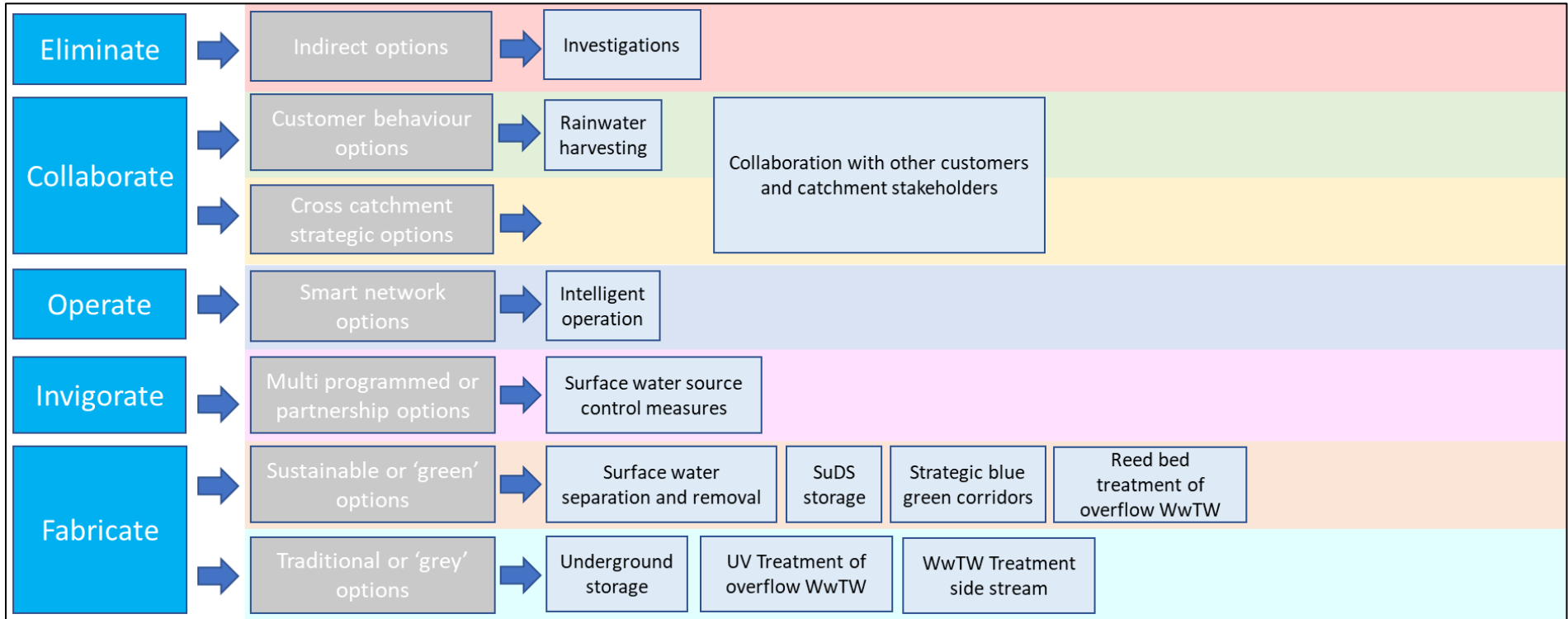


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A summary of the unconstrained options list considered as part of the DWMP can be seen in **Error! Reference source not found.3.**

**FIGURE 3: CONSTRAINED OPTIONS POST SCREENING**



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## OPTION DEVELOPMENT AND APPRAISAL

### WASTEWATER TREATMENT WORKS

#### Overview

Options are to be included in the DWMP to address future risks associated with non-compliance with DWF and discharge effluent quality permits as a result of catchment growth and climate change.

#### DWF Compliance

Where a WwTW is projected to exceed its current DWF permit limits across the planning period, firstly an investigation would be carried out in the AMP before the exceedance is projected to occur, followed by an intervention in the following AMP.

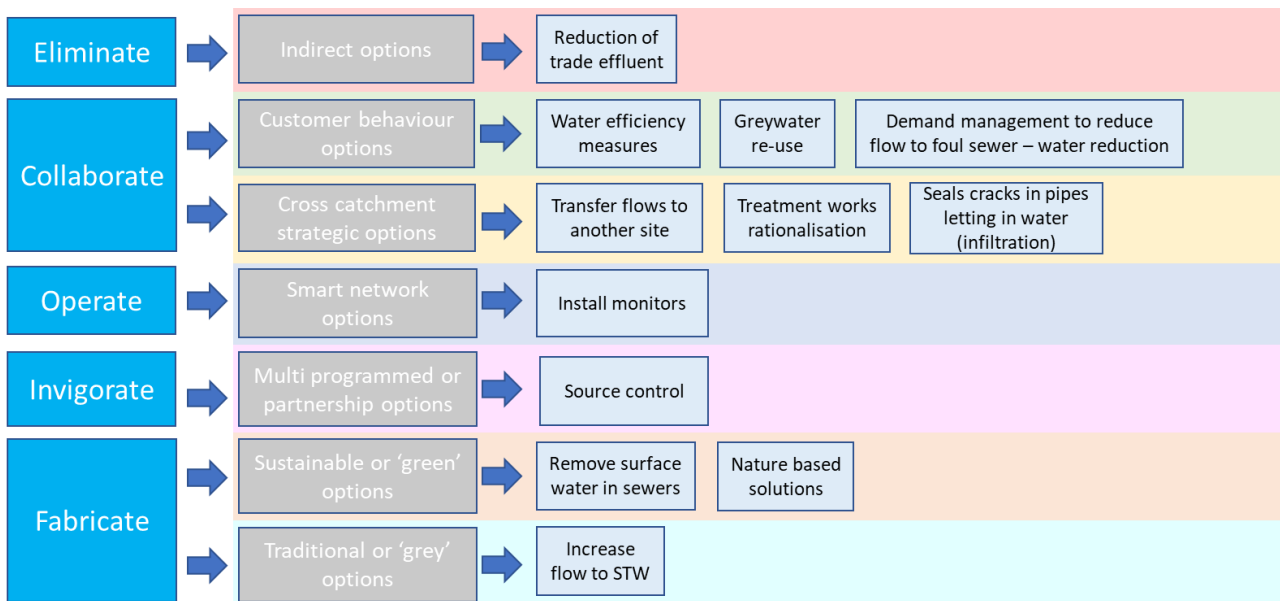
For example, a WwTW that is projected to exceed the current DWF permit in AMP10 would have an investigation scoped for AMP9 and a potential intervention scoped for AMP10.

#### Discharge Effluent Quality Compliance

Where a WwTW is projected to exceed the current permit limits for Ammonia, Phosphorous and Biological Oxygen Demand (BOD) across the planning period, firstly an investigation would be carried out in the AMP before the exceedance is projected to occur, followed by an intervention in the following AMP.

The options that are to be considered for WwTW upgrades are shown in Figure 4.

**FIGURE 4: CONSTRAINED OPTIONS POST SCREENING – WWTW COMPLIANCE**



#### LONG-TERM DELIVERY STRATEGY – FLOODING

##### Overview

To achieve the long-term delivery strategy of reducing hydraulic property flood risk by 60% (of the 2025 value) by 2050, it is considered that this is likely to require extensive surface water management within catchments.

To evaluate the effectiveness of options such as source control and surface water separation in terms of reducing flooding and pollution risk, a number of Drainage Communities were modelled. Increasing areas of surface water management were modelled and the benefits against Planning Objectives PO1, PO2, PO3 and PO6 were assessed. A relationship was then developed to determine the potential flood risk and pollution risk benefits associated with the removal of runoff from the combined sewer network. The process is summarised as follows:

- Identify the L4 Drainage Communities with the highest levels of flooding and pollution risk in terms of Planning Objectives PO1, PO2, PO3 and PO6.
- Undertake modelling of the removal of rainfall runoff from the combined sewer network with incremental increases in runoff removed from the network;
  - Scenario 1 – residential source control of roof runoff – 25% of the available area removed.
  - Scenario 2 – residential source control of roof runoff – 50% of the available area removed.
  - Scenario 3 – residential source control of roof runoff – 25% of the available area removed plus surface water separation of highway runoff – 25% of the available area removed.
  - Scenario 4 – residential source control of roof runoff – 25% of the available area removed plus surface water separation of highway runoff – 50% of the available area removed.
- Assess the benefits provided in each scenario in terms of Planning Objective risk.
- Determine the relationship between the runoff area managed and the benefits provided in terms of Planning Objective risk.
- Evaluate the area required to be managed to achieve the targets identified in the LTDS.

##### Option Identification

The scale of the surface water management that is likely to be required is then to be estimated based on the risk reduction targets that are required per AMP.

### FEASIBLE OPTIONS AND OPTION DEVELOPMENT

#### Storm Overflow Discharge Reduction Plan

An Options Screening Tool (OST) was developed to determine the feasible options available to deliver the improvements required to achieve the SODRP spill frequency reduction targets.

Following a number of workshops, six option combinations were developed which look to achieve the spill frequency reduction at storm overflows through the provision of various option elements from the option hierarchy screening list.

#### Option 1 – DWMP Option Hierarchy

This option follows the Option Hierarchy approach of maximising the provision of sustainable infrastructure and minimising the provision of below-ground network storage. Option elements are to be selected from the option hierarchy in the following order of preference:

- Residential source control (rainwater harvesting of roof runoff).
- Commercial property source control (rainwater harvesting of roof runoff).
- Smart networks to intelligently operate the sewer network to utilise existing capacity within the network.
- Surface water removal by disconnection of existing separately drained catchments from the combined sewer network.
- Separation of highway runoff from the combined sewer network through the provision of new surface water networks.
- Provision of below-ground storage.
- 'Difficult to achieve' separation of highway runoff from the combined sewer network through the provision of new surface water networks.

In drainage areas where surface water removal and/or separation is scoped, there may also be a requirement for the provision of blue-green infrastructure to enable disposal of surface water into an appropriate receptor. This is not always required, for example, if the separation area is located within close proximity to a receptor.

Below-ground storage has been restricted based on the acceptability of the downstream sewage treatment works to accept additional dry weather flow without causing issues with compliance and/or technical feasibility.

#### Option 2 – Below-ground storage only

This option includes only the provision of below-ground network storage, where this has been deemed to be technically feasible.

#### Option 3 – Option Hierarchy, No 'Difficult to Achieve' Separation, plus Storage

This option follows Option 1; however, in catchments where there is deemed to be a requirement for 'difficult to achieve' surface water separation, this option element is removed from the scope and replaced with below-ground storage.

#### Option 4 – Smart Networks plus Storage

This option maximises the number of smart network installations and meets any remaining demand through the provision of below-ground storage.

#### Option 5 – Surface Water Separation plus Storage

This option maximises the surface water removal and separation within a catchment, then any remaining demand is provided through below-ground storage.

#### Option 6 – Smart Networks plus Surface Water Separation

This option maximises the number of smart network installations and meets any remaining demand through the provision of surface water removal and separation.

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#### **Wastewater Treatment Works**

For the DWMP, the options that are to be included for Wastewater Treatment Works compliance include investigations and schemes.

Where modelling indicates that a dry weather flow and/or effluent discharge quality compliance failure is projected to occur, an investigation should be included in the DWMP in the preceding Asset Management Period (AMP). A scheme should be included in the DWMP in the AMP when the failure is projected to occur.

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#### **OPTION COST ESTIMATION**

Option costs for DWMP are to be developed using NWL's in-house cost estimation tool "iMOD". This cost database has been developed using historic project cost data.

In line with requirements for programmes such as WINEP, a whole-life 30 -year total expenditure (TOTEX) cost is to be developed.

**ASSESSMENT OF BENEFITS**

Options that have elements of surface water management, e.g. residential and commercial source control, surface water separation and surface water removal, have been evaluated using the industry standard Benefits of SuDS Tool (B£ST). The benefits have been evaluated to support the determination of the 'Best Value' option for storm overflow spill frequency within a drainage community.

Benefits have been calculated over a 30-year time period and have been present valued using a start date of 2025.

The benefits values from B£ST that have been utilised are outlined in the following table.

**TABLE 4: CIRIA B£ST ADDITIONAL BENEFITS EVALUATION**

Benefit Type	Description	Scale of Impact (PV) 30 Years	Assumptions
Air Quality	Monetary value for pollutant removal by a small tree	£130 / small tree	The maximum area to drain to a bioretention system is 0.8ha, as per CIRIA report C753 (The SuDS Manual). Residential and commercial source control <ul style="list-style-type: none"> <li>One small tree per 0.8ha.</li> </ul> Surface water separation (SWS) <ul style="list-style-type: none"> <li>One small tree per 0.8ha.</li> <li>Value has been reduced by 50% as it has been assumed that not all streets will be suitable for bioretention features.</li> </ul> SuDs Basin <ul style="list-style-type: none"> <li>20 small trees per 1ha.</li> <li>Assumed attenuation basins will be 1m deep to estimate area from volume.</li> </ul>
Amenity	Estimated number of residents living on a street that is 'greened'	£426 / resident	For each drainage community, the area of SWS within the option has been compared to the total available surface water management opportunities and multiplied by the population. This value has been capped at a maximum of 50% of the drainage community population. The value has then factored using a confidence value of 0.1.
Biodiversity and Ecology	Area (ha) of changed land use type.	£685 / ha	Residential and commercial source control <ul style="list-style-type: none"> <li>Area of the bioretention feature used.</li> </ul> Surface water separation (SWS) <ul style="list-style-type: none"> <li>5% of the total area assumed to contain SuDS features.</li> </ul> SuDs Basin <ul style="list-style-type: none"> <li>Assumed attenuation basins will be 1m deep to estimate area.</li> </ul>
Carbon Sequestration	Number of trees - small	£75 / small tree	As per the Air Quality benefit.

Benefit Type	Description	Scale of Impact (PV) 30 Years	Assumptions
Flooding - Health Benefits of reducing flood risk e.g., reduced or avoided stress and anxiety	Estimated number of properties with a reduction in flood risk	£6002 / property	The number of properties predicted to benefit against PO1 Internal Flood Risk.
Health - number of visits per year for physical activity	Estimated number of visits by adults to green space per year	£56 / visit by adult	Where SWS is included in the option, estimated 10% of total population of each drainage community would visit the improved green space per year.

**Flooding Damages Avoided**

In addition to the environmental and societal benefits that have been calculated using B£ST, the Multi Coloured Manual Handbook has been used to evaluate annual average flooding damages avoided as a result of an option being implemented. This has been calculated using the weighted annual average Damages (WAAD) approach. The values calculated contribute to the overall benefit of an option, which is used to determine ‘Best Value’.

For the assessment, it has been assumed that properties have ‘No Warning’ for flooding and that all PO1 Internal Flood Risk benefitted properties are moved from a 1 in 10-year standard of protection (SoP) to a 1 in 25 year SoP with the option in place.

A PV for a 30 year period has been calculated for the damages avoided. The following table identifies the values that have been used.

**TABLE 5: WEIGHTED ANNUAL AVERAGE DAMAGES (WAAD) (2022/2023 PRICES)**

Existing SoP	No warning (£)	<8hour warning (£)	>8hour warning (£)
No protection	5,014	4,974	4,963
2 years	5,014	4,974	4,963
5 years	3,010	2,984	2,978
10 years	1,537	1,524	1,520
25 years	735	729	727
50 years	310	308	307
100 years	78	77	77
200 years	39	38	38



### Additional / Avoided Treatment Costs

For all options where runoff will be retained within the network and ultimately treated, i.e. below-ground storage, smart networks, an allowance is to be made for the additional treatment of storm sewage. Conversely, where rainfall runoff is to be removed from the combined sewer network as part of an option, an allowance should be made for the reduction in treatment costs.

Additionally, an allowance is to be made for upgrades at downstream WwTW required to upgrade Flow to Full Treatment Capacity.

**TABLE 6: ADDITIONAL / AVOIDED TREATMENT COSTS**

Description	Allowance
Additional treatment of sewage	25p per m3 treated annually
Avoided treatment of sewage	25p per m3 treated annually
CAPEX upgrade for Flow to Full Treatment Increase	£25 per m3 treated annually

### Carbon Accounting

The approach that has been adopted in the PR24 Business Plan preparation for carbon accounting is also to be adopted in the preparation of the DWMP.

## DWMP

### OPTION DEVELOPMENT AND APPRAISAL

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#### IDENTIFICATION OF FINAL STORM OVERFLOW OPTIONS

For each driver, an evaluation of the options was completed using the outputs from the cost estimation and additional benefits calculations.

##### Least Cost Storm Overflow Options

Following early engagement with Ofwat, we have produced an option that meets their requirements to deliver the Government's Storm Overflow Discharge Reduction Plan (SODRP) at the least cost as a comparison for other plans that deliver better value for customers.

After completing the cost estimation, a whole life cost was identified for each viable option, taking into consideration CAPEX and OPEX over a 30-year life. These values were evaluated to conclude the least cost option for each L4.

##### Best Value Storm Overflow Options

This considers the positive impacts on other planning objectives (such as flooding and pollution) and societal benefits from delivering the SODRP.

To determine the best value options, using the assessment of benefits and whole life cost, a cost-benefit ratio was calculated. This was used to select the best value option.

##### Alternative Storm Overflow Options Identification

Following identification of Least Cost and Best Value options, a manual review was completed to identify alternative green options where cost difference was minimal but green benefits increased and grey solutions decreased.

##### Preferred Option

The preferred option is the option chosen out of the Least Cost, Best Value and Alternative, to proceed with as part of NWL plan to address SODRP.

An example is outlined in Table 7.

**TABLE 7 – EXAMPLE DRAINAGE COMMUNITY PREFERRED OPTION IDENTIFICATION**

Drainage Community	Least Cost Option (Name – Cost – Storage Requirement)	Alternative Green Option (Name – Cost – Storage Requirement)	Preferred Option (Name – Cost – Storage Requirement)
Wear_LOW WADSWORTH STW_LOW WADSWORTH STW_DC_05	Option 4-Smart Networks and Storage – £6.6m – 1444m3	Option 6 – Surface Water Management and Smart Networks - £6.8m – 0m3	Option 6 – Surface Water Management and Smart Networks - £6.8m – 0m3