Drainage and Wastewater Management Plans

Technical Summary: Problem Characterisation

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Version 2

from Southern Water

1. Background

The Problem Characterisation (PC) stage of the Drainage and Wastewater Management Plan (DWMP) follows the Baseline Risk and Vulnerability Assessment (BRAVA).

Water UK guidance says that the Problem Characterisation (PC) stage of the DWMP is for:

> *"assessing a company's vulnerability to various strategic issues, risks and uncertainties, to allow the development of a proportional response in terms of the effort and cost devoted to adopting the selected decision-making tool. Its purpose is thus to help guide planners to the most appropriate decision-making tools given the planning problem that they face. This stage will guide companies towards the appropriate level of optioneering complexity for the next stage of the DWMP, which is the Option Development and Appraisal (ODA) stage".*

The PC stage, therefore, is a key step that enables the drivers and causes of the risks in our wastewater systems to be understood before moving on to the next stage of the DWMP - to develop and appraise the options for managing and reducing those risks. Our approach to the PC involves three main components:

- Understanding the Drivers and Causes of the Risks,
- Determining an Investment Strategy for each of our wastewater systems and
- Applying the Problem Characterisation matrix.

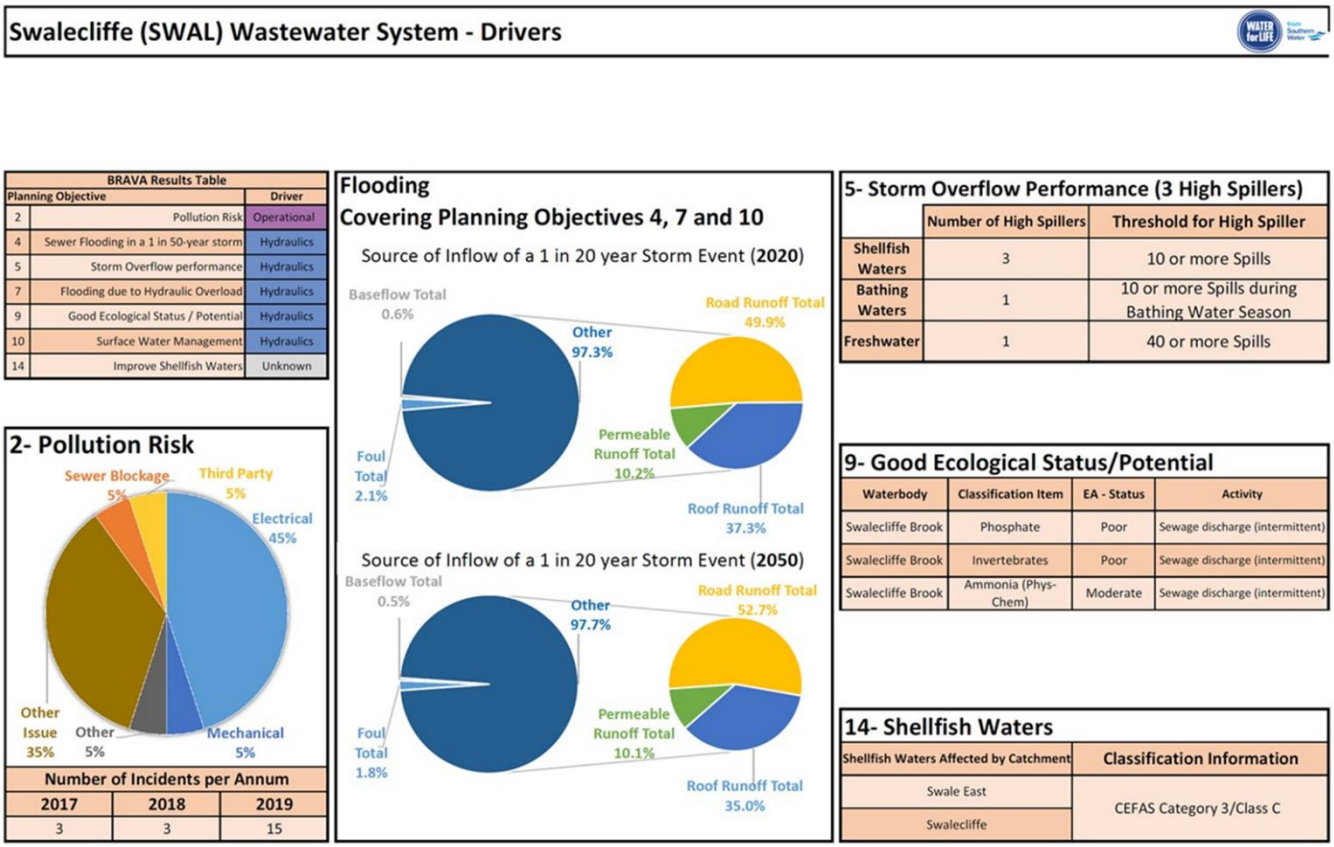
This technical summary describes our approach to these three components of the PC for all 381 of our wastewater systems across the 11 River Basin Catchments within our region.

2. Understanding the Drivers and Causes of Risk

The first step of our approach was to review the multiple data sources that were used in the BRAVA risk assessments to identify the causes of the significant risks, which are those in band 2 (very significant) and band 1 (moderately significant).

We produced a storyboard to set out these risks on a page, an example for the Swalecliffe wastewater system is shown in Figure 1. We have written a narrative to explain each of the significant risks in each wastewater system for publication as part of our DWMP. All the narratives are published on our website under the relevant River Basin Catchment within the Problem Characterisation section.

Figure 1: Drivers and Causes of Risks for the Swalecliffe wastewater system



We used incident data records and available evidence to identify the causes of the risks for each Planning Objective and categorised these into four key areas:

- Hydraulic – which means that risks are caused by too much flow in the wastewater system, either through excessive storm flows, combined sewer systems carrying both foul and surface waters or infiltration by ground waters, or a combination of these factors.
- Operational – usually caused by electrical or mechanical failure.
- Customer – customers using the wastewater system to dispose of inappropriate items such as nappies, wet wipes, and fats, oils and grease causing blockages and sometimes sewer bursts or rising main failures.
- Quality – where the quality of our effluent is negatively impacting the receiving waters.

This process allowed us to identify the dominant drivers and primary causes of the risks. It has the added benefit of providing further clarity on the types of options that will be most effective in tackling these issues.

Understanding what is driving the risks helps ensure that we will be able to target the dominant contributor(s) for each Planning Objective. It also provides a mechanism we can use to help us target the significant risks, rather than all the risks, ensuring we identify and deliver effective and efficient solutions.

3. Determining an Investment Strategy

Purpose of the Investment Strategies

We considered that it would be helpful to our customers and partner organisations if we set out clearly our long-term management strategy for each wastewater system, so we developed the concept of setting an Investment Strategy for each of our systems. This is so that customers and stakeholders can see whether we understand the risks that they are experiencing/facing and have a plan for addressing them, and it will help them know what to expect.

The investment strategies also inform colleagues in different teams across our business to help them work together to achieve a common goal. The strategies enable us to be clear where we need to maintain the performance of our system or, at the other end of the scale, where a system is not sustainable in its current form and therefore needs a fundamental change in the future.

The strategies are formed around a risk-based approach to managing the performance of our wastewater systems. Seven different investment strategies were established. These are set out in figure 2.

Figure 2: Investment Strategies

Do Nothing	• No investment. • Baseline upon which to judge the cost effectiveness of doing 'something'
Maintain	• Current performance within acceptable limits and no major concerns for future. • Continue to maintain. Replace assets like for like when needing replacement. • Accept that climate change and growth may cause slight deterioration in levels of performance
Sustain	• Current performance acceptable, but risks will increase in the future. • Continue to maintain, but as assets need replacing look to increase capacity to keep pace with climate change, development and asset condition to sustain the existing level of performance into the future
Enhance	• Current performance is unacceptable. The causes are mostly operational. • Enhance current maintenance programmes (opex with some capital maintenance) to improve performance e.g. asset replacement/upgrades to improve reliability. No significant new assets or infrastructure required.
Prepare	• Current risks and performance are acceptable at the current time. • Maintain existing system and performance levels, but actively invest now to ***plan and prepare*** for future risks and performance issues (e.g. where significant growth planned, or future tightening of permits). Invest in data collection, surveys, model build and feasibility studies (not design).
Defer	• Current performance acceptable at current time, but concerns about future risks in longer term. Risks expected to be easy to resolve. • Continue to maintain, but defer decision and our consideration of options for capital investment for future rounds of the DWMP
Improve	• Current performance unacceptable. Need to reduce the current risks • Actively look to invest capital funding in the short term to address current performance issues (and allow for future changes when implementing improvements)
Change	• Current or future risk are/will be unacceptable, and the causes mean that the current system is not sustainable • Changes to the wastewater system needed i.e. new technology, discharge to alternative water body / transfer, additional treatment, re-use. Potential requirement for WINEP investment.

LEVEL OF EFFORT

The benefit of establishing an investment strategy is that we can identify wastewater systems where there are no immediate concerns about the performance of the system, so business as

usual operations and maintenance can largely continue. Also, where the performance risks will not materialise until the medium to longer term, then investigation into the options to manage those risks can be deferred until nearer the time, or preparations can be made for future investment. Developing options to address all risks, especially those risks that are in the longer-term, is not an efficient use of our resources and is not proportionate to the risks that we identified in the BRAVA stage.

Each of the 7 strategies establishes an associated programme of work:

> **Improve and Change** strategies involve the greatest degree of effort during the Options Development and Appraisal (ODA) development, as the complex and urgent nature of the associated risks are likely to require a range of options to be considered. Where we know we need to improve the performance of a system, but we do not yet have enough information to sufficiently understand the problem to plan capital investment, a study or investigation may initially be proposed.
>
> **Enhance** strategy means that the risks are unacceptable at present, but they are most likely to be resolved through enhanced maintenance and operational activities.
>
> **Maintain and Sustain** strategies are less time-consuming and reflect a business-as-usual approach. This means the performance of our wastewater system is currently acceptable and is predicted to remain so in the near future. Our Operations staff should keep doing what they are doing to operate and maintain the system. The Sustain approach recognises future climate or growth pressures and suggests that our operational staff should seize opportunities to incrementally improve the system as and when assets need replacing to keep pace with climate change and growth in the catchment.
>
> **Prepare and Defer** strategies are where future investment is needed. Prepare suggests a medium-term investment need so we may need to consider the need for a study, investigation, data collection or model development so that we are in a good position to plan the investment in the medium term. This is because large, complex projects may take several years of work prior to implementation. Defer applies to where the investment is in the longer term and there is no need to have any early investigations to commence the journey towards that future investment.

All our wastewater systems have been assessed in this way across each of the 14 planning objectives and have had an appropriate investment strategy assigned.

Applying the Catchment Investment Strategies

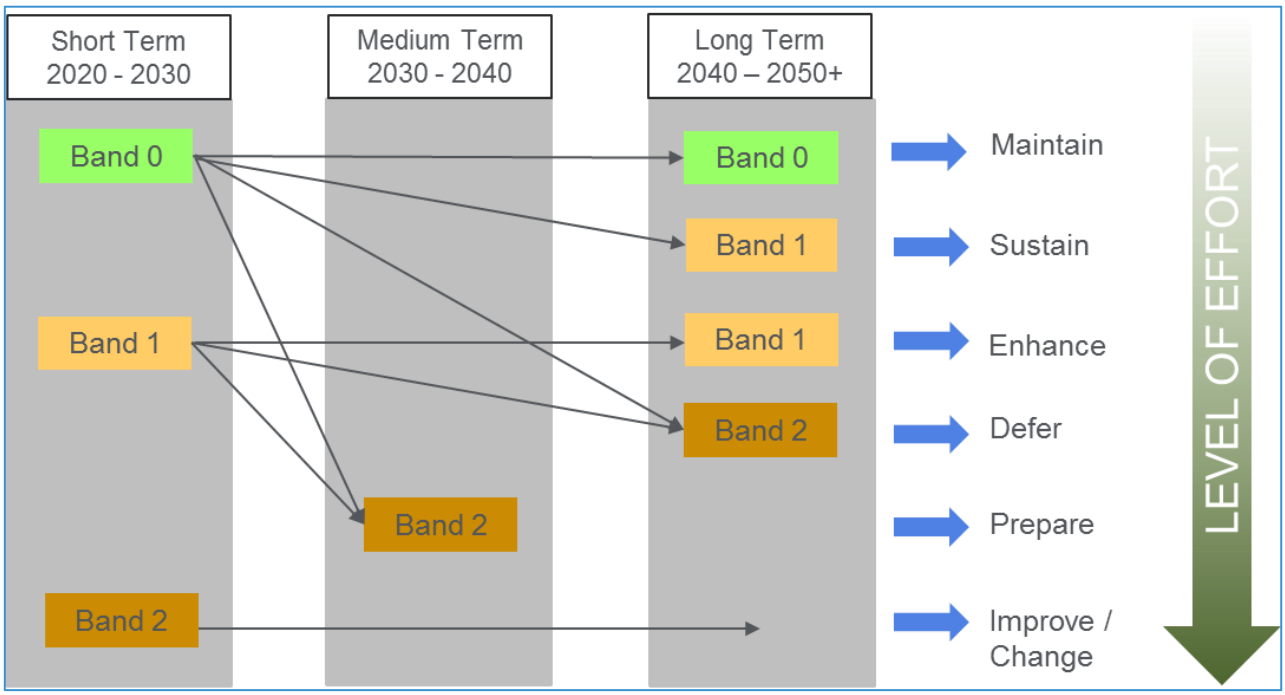
An appropriate investment strategy for each wastewater system was determined using the BRAVA results. We reviewed the BRAVA 2020 baseline results alongside the future risk forecasts to identify how the risks might change through time taking future risks such as climate change, growth, urban creep and asset deterioration into account. This showed:

- risks that are not significant now and are unlikely to become more significant in the medium to longer term,
- risks that are not significant now, but which are likely to become more significant through time,
- risks that are of concern now and will either stay the same without intervention of some sort, or which will become more significant as time passes,

- risks that are highly significant now and need addressing in the short term.

We developed an automated process to use the risk scores and the timing and drivers of those risks to assign the appropriate investment strategy for that wastewater system. The principle is based on the scale and timing of the risks, as illustrated in figure 3.

Figure 3: Assignment of an Investment Strategy for each wastewater system



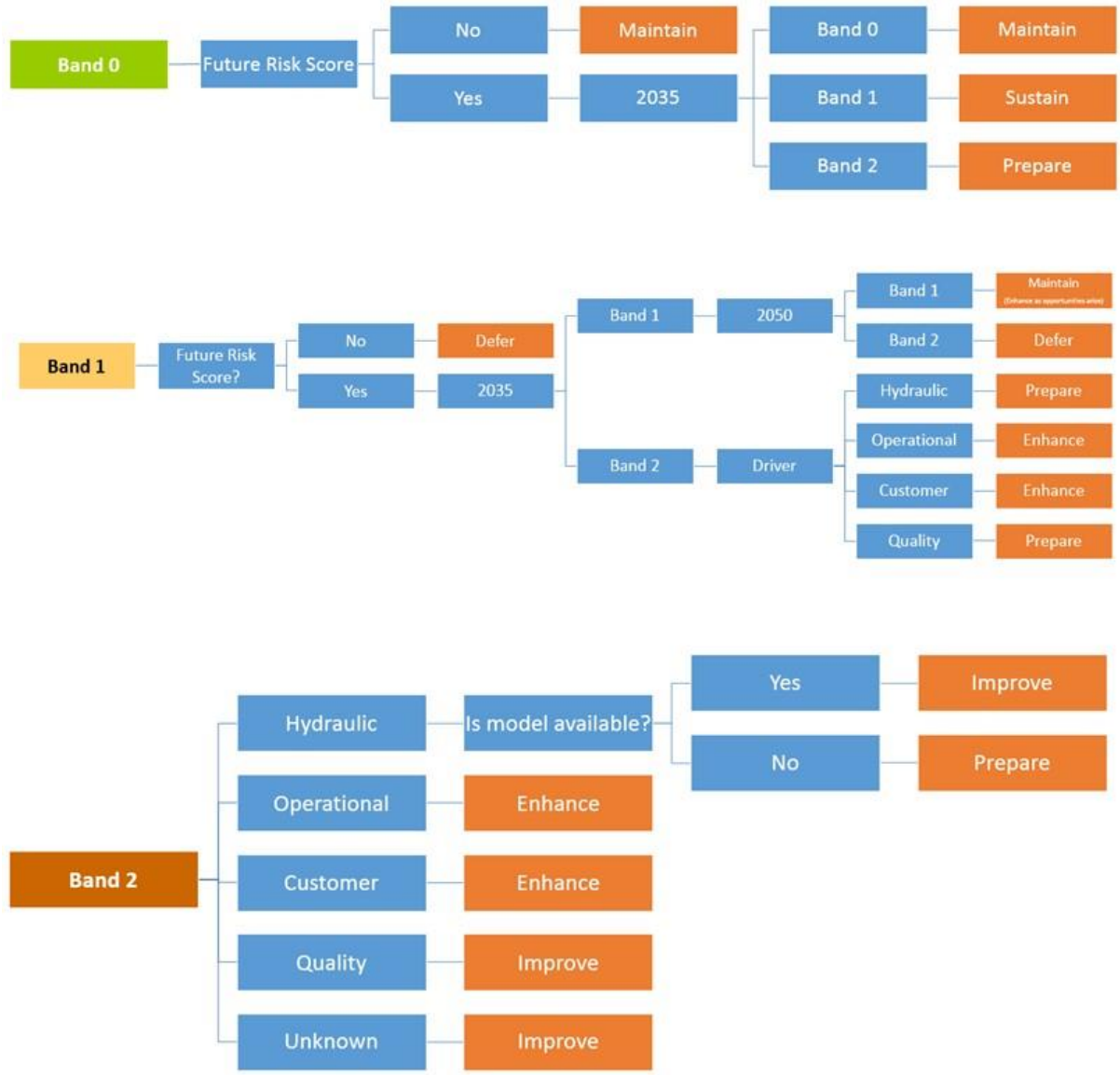
The first step was to apply these principles for each of the risks for the 14 Planning Objectives. For the first round of DWMP, not all Planning Objectives have both the 2020 and 2050 risk assessment. This limits the opportunity to identify systems with no significant performance risks now but where the risks may increase to significant in the future. The development of the BRAVA methodologies to incorporate future assessments for all 14 Planning Objectives will help us to refine the selection of an appropriate investment strategy.

A decision tree has been developed for each Planning Objective to identify the most appropriate investment strategy based on:

- the BRAVA results.
- Predicted change in risk over time.
- The drivers (causes of risk).

An example of a decision tree is shown in figure 4. These decision trees are embedded into the Problem Characterisation Matrix assessment to automatically identify the appropriate investment strategy for each of our wastewater systems.

Figure 4: Planning Objective 1 Decision Trees



Comparing the resulting investment strategies for each Planning Objective, we then selected the highest priority strategy, in accordance with the hierarchy in Figure , as the overall catchment-wide "investment strategy". For example, where there is a need to 'improve' the performance of the wastewater system due to any of the planning objectives being a significant risk, then that strategy was applied to the whole system.

4. Applying the Problem Characterisation Matrix

We refined the principals for using the matrix based approach to problem characterisation as described in the Water UK's National Guidance , Annex C. For each of our wastewater systems. We assessed the "strategic need" (how big is the problem?) and compared it to the "complexity factor" (how difficult is it to solve?) using the matrix shown in "Table C4" from the national guidance Annex C below.

Table C-4 - Problem characterisation matrix

		Strategic needs score ("How big is the problem?")			
		Negligible	Small	Medium	Large
		1-2	3-4	5-6	7-8
Complexity factors score ("How difficult is it to solve")	High (8+)				
	Medium (5-7)				
	Low (<4)				

The scale of the current issues identified by the BRAVA alongside the lack of relevance of the Supply / Demand model suggested by the national guidance, meant we developed our own methodologies for assessing the current strategic needs and complexity factors. We considered the two elements of the problem characterisation matrix:

Assessing the Strategic Needs score

How big is the current problem? This was a high-level assessment of the scale of the strategic need for interventions to manage the current issues. For each wastewater system, we counted all the planning objectives that had achieved Band 2 BRAVA assessment and allocated them the following strategic needs scores:

- Score of 0 to 2: Negligible Strategic Needs
- Score of 2 to 4: Small Strategic Needs
- Score of 5 to 6: Medium Strategic Needs
- Score of 7 +: Large Strategic Needs

Note: "negligible" does not mean there are no BRAVA issues associated with a specific wastewater treatment system. It is a measure of the likely scale of the problem for strategic planning purposes.

Determining the Complexity Factor Score

How difficult is the current problem likely to be to solve? This was an assessment of the relative size of the wastewater system and how many current issues identified in our BRAVA assessment affect the system. The Complexity Factor Score was determined for each wastewater system by adding a 2020 population component and a 2020 BRAVA Band 2 component:

2020 Population Component:

- Score of 1: Population less than 1999.
- Score of 3: Population between 2000 and 10000.
- Score of 4: Population greater than 10,001.

2020 BRAVA Band 2 Component: we grouped the Planning Objectives into three "Category Groups": Flooding (PO1, 4, 7, 10); Pollution (PO2, 3, 5, 12); and Water Quality (PO6, 8, 9, 11, 13, 14).

- Score of 1: 0 or 1 Category Groups include a "Band 2" BRAVA score.
- Score of 3: 2 Category Groups include a "Band 2" BRAVA score.
- Score of 4: All 3 Category Groups include a "Band 2" BRAVA score.

The Strategic Needs Score and the Complexity Factor Score for each wastewater system were then used in the matrix shown in table C-4 above to determine the likely level of time and effort that would be required for us to complete the Options Development and Appraisal (ODA).

The three "levels of concern" (Green/Standard, Yellow/Extended and Red/Complex), and an explanation of the likely impact are summarised in Table 1.

The number of wastewater systems in each of these categories are shown in Table 2.

The 13 wastewater systems that we have categorised as "red/complex" are listed in Table 3.**Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.**

Table 1: Required complexity of optioneering and decision-making approaches.

Level of concern	Optioneering and decision-making approach	
Low	Standard	Generally, 'current' approaches should be adequate to determine and justify interventions and resultant investment proposals to ensure planning objectives are met (noting earlier guidance on the usage of additional future scenarios, as defined within the CAF).
Medium	Extended	'Extended' approaches to optioneering may add considerably to a company's understanding. 'Extended' refers to methods not previously widely used in drainage and wastewater planning, but which have been utilised previously on specific catchment investigations that are deemed to be at the 'leading edge' of current planning approaches, or tested to at least the 'proof of concept' stage for actual UK drainage and wastewater systems and have outputs that can be readily understood by planners.
High	Complex	Consider whether it would be useful to go beyond the 'extended' approaches to decision making (referred to a 'complex'), as this could add considerably to the company's understanding. Here, 'complex' approaches refer to more advanced, conceptually complex methods not yet applied to the UK drainage and wastewater planning context, although these may be under current investigation in academia/currently developed by companies.

Table 2: Number of catchments in each PC Matrix band

Level of Concern	Catchment Investment Strategy	No of catchments	Population served	% total population
High	Improve	13	1,253,360	26.5%
Medium	Improve	34	2,027,250	42.9%
Low	Improve	197	1,370661	29.0%
	Prepare	52	39,100	0.8%
	Enhance	3	11,193	0.2%
	Sustain	3	1,797	0.0%
	Maintain	79	27,385	0.6%
Totals		**381**	**4,730,746**	**100%**

Table 3: Wastewater System with "High" (red / complex) level of concern

River Basin Catchment	System ID	Wastewater System	No. of Planning Objectives in Band 2 (2020)
Isle of Wight	SAND	SANDOWN	7
Stour	WEAT	WEATHERLEES HILL	7
Stour	SWAL	SWALECLIFFE	7
East Hampshire	BUDD	BUDDS FARM HAVANT	6
North Kent	QUEE	QUEENBOROUGH	6
East Hampshire	PEEL	PEEL COMMON	5
Cuckmere & Pevensey Levels	EALP	EASTBOURNE	5
Test and Itchen	WOOL	WOOLSTON	5
New Forest	SLOW	SLOWHILL COPSE MARCHWOOD	5
Stour	HERN	MAY STREET HERNE BAY	5
Medway	TUWS	TUNBRIDGE WELLS SOUTH	5
Stour	CHAR	CHARTHAM	5
Rother	RYEW	RYE	5

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