Future Proofing Deal's Water Systems:

Protect - Sustain - Clean and green

Deal Pathfinder: May 2022 Technical Report

DEAL Working together for a sustainable future

Water Taskforce

Office of Natalie Elphicke MP

Southern Water

Kent County Council

WATER for LIFE

DOVER DISTRICT COUNCIL

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Revision	Purpose	Originated	Reviewed	Authorised	Date
V1.0	Issue for comments	PMG	RMcT	NM	31/01/22
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Introduction

Natalie Elphicke OBE MP, Member of Parliament for Dover & Deal and Ian MacAulay, Chief Executive of Southern Water

For too many years, flooding in Deal - especially in Albert Road - has been a real source of community concern. There has been some action taken but the frequency of the flooding has continued to be a serious problem. After years of technical wrangling over what could be done and who by, a fresh approach was needed. An approach that had at its very heart a full review of how the water system was working across the area, and a proper understanding of the technical issues and possible solutions. In short, a proposal on how best to tackle a situation that has gone on far too long.

That's why we agreed to set up and jointly chair the Deal Water Action Task Force – a task force to find lasting solutions. In addition to the work of Southern Water and the Office of Natalie Elphicke MP, officer and councillor representatives from Kent County Council and Dover District Council have also taken part, with DDC and KCC also providing detailed technical advice and support to the project.

Southern Water inevitably take the lead on sewage management. Yet Kent County Council are responsible for highways drainage. Dover District Council are essential as the planning authority and owners of many vital assets, including some waterways. Solving our water issues we have in Deal requires everyone to play their part and we are really pleased with the way everyone has come together, with each member working to fix issues that have been identified during the detailed technical work. The work of the taskforce has revealed three key priorities:

To better **Protect** residents from flooding. Especially the long-suffering residents of Albert Road. This report proposes improvements that will help, and outlines changes that have already happened while this work has been ongoing.

To **Sustain** our water resources, enabling water to be held by homeowners in water tanks and recycled, or released once it has stopped raining. This will reduce pressure on our drainage system.

To **Clean and green** our waterways is essential. Storm overflows - where untreated sewage is discharged into rivers and the sea to prevent further flooding - are a source of public concern. This report sets out serious proposals as to how these overflows can be significantly reduce, which in turn improves the environment and cleanliness of our local waterways.

Deal is one of Southern Water's pioneering Pathfinder projects and will demonstrate that by working in partnership with the community and its representatives, the use of storm overflows can be reduced.

Deal's water system and drainage matters to us all. Everyone has a part to play - whether it is installing a water butt to catch rainwater to use on the garden, or making sure wet wipes go in the bin, not down the toilet.

The problems have gone on for too long. This is our chance to protect Deal from flooding, increase water sustainability, and make our rivers and seas cleaner and greener in the years to come.

Executive summary

The Deal Water Action Task Force was formed to work together to understand the drainage network of Deal. The group's purpose was to meet, agree and support different ways of working to better control and manage surface water in the catchment. In particular to consider ways to alleviate the regular flooding that occurs in Albert Road, Deal.

This document is a technical report providing an overview of the initial investigations into the causes of flooding in Albert Road and the opportunities available, to the Deal Water Action Task Force, to better manage and control surface water.

A shorter summary version of this report, focussing on Albert Road has also been produced.

Albert road flooding and surface water management

A section of Albert Road in Deal has now suffered from repeated flooding incidents for over a decade, this results in sewage and surface water flooding to homes. Albert Road appears to be particularly vulnerable as it is one of the lowest points in the catchment before flow is transferred to the Golf Road pumping station.

Surface water management is a complex task; over history drainage systems have developed in different ways. Different parts of the system are also owned and maintained by separate organisations e.g. County councils, local councils, water and sewerage companies, highway authorities and drainage boards. Added to this complex arrangement of infrastructure, a number of other issues are causing additional pressure to these systems including, urban creep and climate change. One measure to release this pressure is via a storm overflow whereby, during rainfall, flow is released from the sewer system into the environment. These permitted releases have been questioned by many and a recent amendment to the Environment Bill will drive action to reduce their use. Southern Water and the Deal Water Action Task Force fully support the Environment Bill amendment and the reduction in storm overflow use.

Pathfinder projects

Southern Water has set up a Storm Overflow Taskforce with several aims, the key one being to reduce the use of storm overflows by 80% by 2030. To investigate how this can be achieved several pathfinder projects have been set up and the Deal catchment is one of those. These pathfinders have a staged approach as follows:

Stage 0 – study and surveys
Stage 1 – low risk interventions and trials
Stage 2 – More complex interventions and large scale pilots
Stage 3 – Larger scale investments to deliver the outcome

The interventions identified are likely to be a mix of types of innovative and traditional solution such as:

- Upstream source control (removing and slowing the flow of rainwater)
- System optimisation (making better use of the existing infrastructure)
- Infrastructure enhancements (build new or larger infrastructure)

The mechanism that will deliver these interventions is likely to be innovative, with Southern Water working in partnership with Kent County Council, local councils and community groups to provide solutions that provide multiple benefits.

Understanding the issues

To date, we have undertaken a number of surveys within the Deal catchment and specifically at Albert Road. Some of these surveys have been completed (e.g. CCTV, Closed Circuit Television Video, and connectivity of houses and drainage around Albert Road) whilst others are in progress

(flow monitoring) or are planned (storage tank surveys). Whilst we have a good understanding of the pipework in and around the Albert Road area, there are still areas where drainage connections need to be confirmed.

There has been recent work to increase the capacity of Golf Road Pumping Station by replacing Dry Weather Flow pumps, with more work planned to improve the resilience of the pumping station, such as refurbishing the storm screen washwater system (to reduce the risk of blockages) and modernising and optimising the control system for the site.

We have an existing network model of the combined sewer network, and are undertaking additional surveys to improve that model, we also plan to build a new model to better understand the surface water system in Deal. Both these models will enable us to run scenarios to understand the risk and benefit of possible interventions. Updates and refinements of the models will be a continuous requirement. This is because the complexity of the drainage system means that changes in the system (rainfall intensities or development in the catchment) require the model to be calibrated and reverified. However, these models will only be part of the decision-making process.

We are also working with Kent County Council to jointly improve our understanding of the highway drainage system and, where investigations identify, potential mitigation opportunities.

Partnership approach & the next steps

The complexity of the drainage system and the significant contribution of flow from the impermeable areas in the catchment mean that, community and partnership engagement is critical to the success of surface water management, in the Deal catchment.
So far, we have already made improvements to the resilience of Golf Road Pumping Station and have replaced a flap valve on the Albert Road surface water sewer. Further interventions will likely be focused on:

1. Working with partners to improve the local Surface Water management
    a. New kerb inlets and gullies (KCC)
    b. Remove road gullies from the combined sewers (KCC)
    c. Larger surface water sewer (SWS)
2. Golf Road Pumping Station resilience activity
    a. Storm pump ancillary systems improvements
    b. Control system improvements
    c. Install additional instrumentation
3. Investigate the benefit of smart water-butts and other domestic solutions.
4. Working with partners to improve impermeable area removal across the catchment

Further survey work and modelling will be required, to confirm if other potential interventions will provide the benefit required. We will continue to identify and, where appropriate, enact these interventions whilst we collate the results of the rest of the surveys.

A sustainable drainage system

This report is only the start of the journey towards achieving a sustainable drainage system in Deal. We will work as partners with the other local stakeholders to investigate and better understand the existing drainage systems, to identify and deliver opportunities for improvement, and plan together for the sustainable growth of the town of Deal.

What we ask of our partners and the community is to continue to support that journey, with photos and data, ideas and enthusiasm. We can then together agree how decisions can be made, now and in the future for our mutual benefit.

1. Introduction and document purpose

The Deal Water Action Task Force was formed to allow the participants to work together to understand the drainage network of Deal. It consists of representatives from Southern Water, Kent County Council, local councillors and the local Member of Parliament, see Appendix A for the members of the Taskforce and also the members of the Technical working group that has recently been formed to support the taskforce. The purpose of the Taskforce is to come together, to agree and support different ways of working to better control and manage surface water in the catchment and, in particular, to look at ways to alleviate regular flooding that occurs in Albert Road, Deal.

This document is a study report, issued to provide an overview of the current status of the investigations into the causes of flooding in Albert Road, and the opportunities available to the group, to better manage and control surface water.

2. The problem

2.1 Flooding in Albert Road

A section of Albert Road in Deal has suffered from repeated flooding incidents for over a decade, this results in sewage and surface water flooding to homes, as well as persistent flood alerts requiring residents to take mitigating actions. To try and mitigate the risk of internal flooding, at all instances of rain, a pump is deployed to Albert Road, and sometimes the road is closed. This forms part of a contingency plan. This is highly stressful and inconvenient for the residents. Most recently, severe incidents in 2020 and 2021 resulted in sewage flooding. Throughout 2021 there have also been regular flood warnings and other localised flooding.

Albert Road appears to be particularly vulnerable; it is one of the, if not the, lowest points in the catchment before flow is transferred to Golf Road pumping station. All water routes which contribute to flooding in the Albert Road location need to be assessed; in recognition that the area is one of high risk, given its low lying location. We need to identify options to reduce or eliminate flows to Albert Road, whilst considering the opportunities and benefits of a holistic view of the Deal drainage catchment, see section 5 for further details.

2.2 The management of surface water

Managing surface water is making sure that water drains safely from homes and gardens, roads, fields, businesses and public spaces. Good surface water management is about making sure that rain can drain effectively straight through our environment, using a combination of natural and manmade drainage networks.

Sometimes rainwater falling on impermeable surfaces such as roofs and roads can be contaminated by surface contaminants; it can also enter the sewer system and be contaminated by foul sewage. This contaminated water also needs to be pumped & treated.

Storm Overflows, also known as combined sewer overflows (CSOs) are a pressure relief valve for the drainage system to prevent the devastating impact of sewer flooding. However when a storm overflow activates dilute sewage is discharged into the environment e.g. at Golf Road Pumping Station.

3. Particulars about Deal Drainage

Appendix B provides some background information on how drainage systems have developed and includes the contribution that legacy housing (houses where the roof drainage and sewage drainage combine) makes to surface water management.

This section gives details on how the drainage within the Deal catchment is managed.

3.1 Topography

Deal is located along the Kent coastline where the North Sea and the English Channel meet; and is located approximately 13 km to the northeast of Dover. The catchment of Deal has a strongly defined watershed and can clearly be shown to fall from the southwest to the north east.

Figure 1– Deal Topography[1]

Figure 2 – Deal Topography EA LiDAR[2]

3.2 Geology

The near surface geological deposits of Deal, of particular interest when looking at surface water drainage, are:

Beach and Tidal Flat Deposits (East Deal) These are expected to be essentially shingle, sand and gravel, and occupy a narrow strip aligned north/south along the coast. Infiltration into

[1] Southern Water Asset Miner OS copyright
[2] 2020 2m DTM LIDAR Composite model, Environment Agency

these is expected to be high as sand and gravel has a high permeability, although this also depends on local ground water levels.

Head Deposits (central Deal) These comprise mainly of clay and silt, and in this area are expected to be derived from the chalk. Head are poorly stratified, angular rock debris, comprising of gravel, sand and clay depending on upslope source and distance from source. Locally there may be areas of silt, clay or peat and organic material. As it is derived from the chalk, fine material is expected to dominate, meaning low or only moderate permeability.

Seaford Chalk (West Deal). Chalk is exposed at the ground surface in this area and is expected to be weathered at the surface, grading down into better chalk with depth. Chalk generally has a high permeability even when weathered and so infiltration is expected to be reasonable.

The entire area is underlain by a solid geology of Seaford Chalk. If the superficial deposits are thin in a particular area, then the Sustainable Urban Drainage (SuD) features may encounter chalk, so in those circumstances infiltration would be expected to be reasonable.

3.3 Southern Water Drainage system

Drainage systems can be made up of single pipe systems (combined) and two pipe system (foul and surface water), for more detail see Appendix B. The drainage system within Deal consists of a mix of surface water, combined, and foul only sewers which are owned and maintained by Southern Water. Within Deal the older section of the town including the Albert Road area are made up of combined sewers, whereas the new areas to the north and south were designed as separate systems. Figures 17 & 20 in Section 6 provide more detail of the extent of the sewer systems.

3.4 The Highway drainage system

Highway drainage can consist of road gullies connected to the surface water and combined sewers system. For Deal, the highway drainage/public surface water sewers are owned and maintained by Kent County Council (KCC) as the Highway Authority.

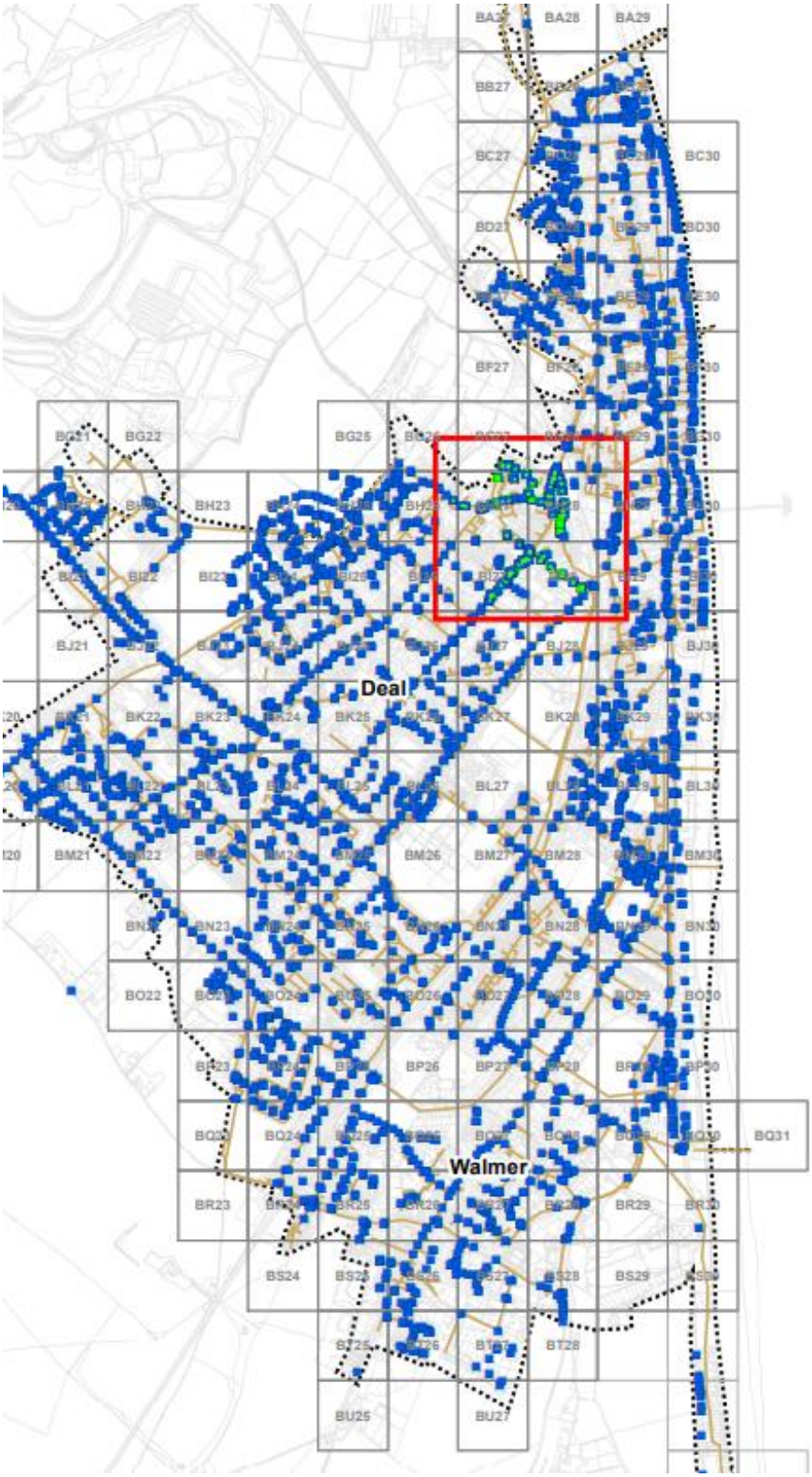


Figure 3 – The spread of highway gullies across the Deal catchment[3]

[3] KCC highways department, 2021.

3.5 Internal Drainage Board

The River Stour (Kent) Internal Drainage Board (IDB) is a public sector organisation, responsible for flood protection and land drainage in North East Kent. The extent of the Drainage District can be seen in Figure 4. Each IDB has permissive powers to undertake work on behalf of their local community to carefully manage water levels and reduce the risk from flooding within its drainage district. Much of this vital work involves the maintenance of rivers and the related infrastructure. IDBs also advise on planning applications and facilitate the drainage of new developments to help reduce future flood risks.

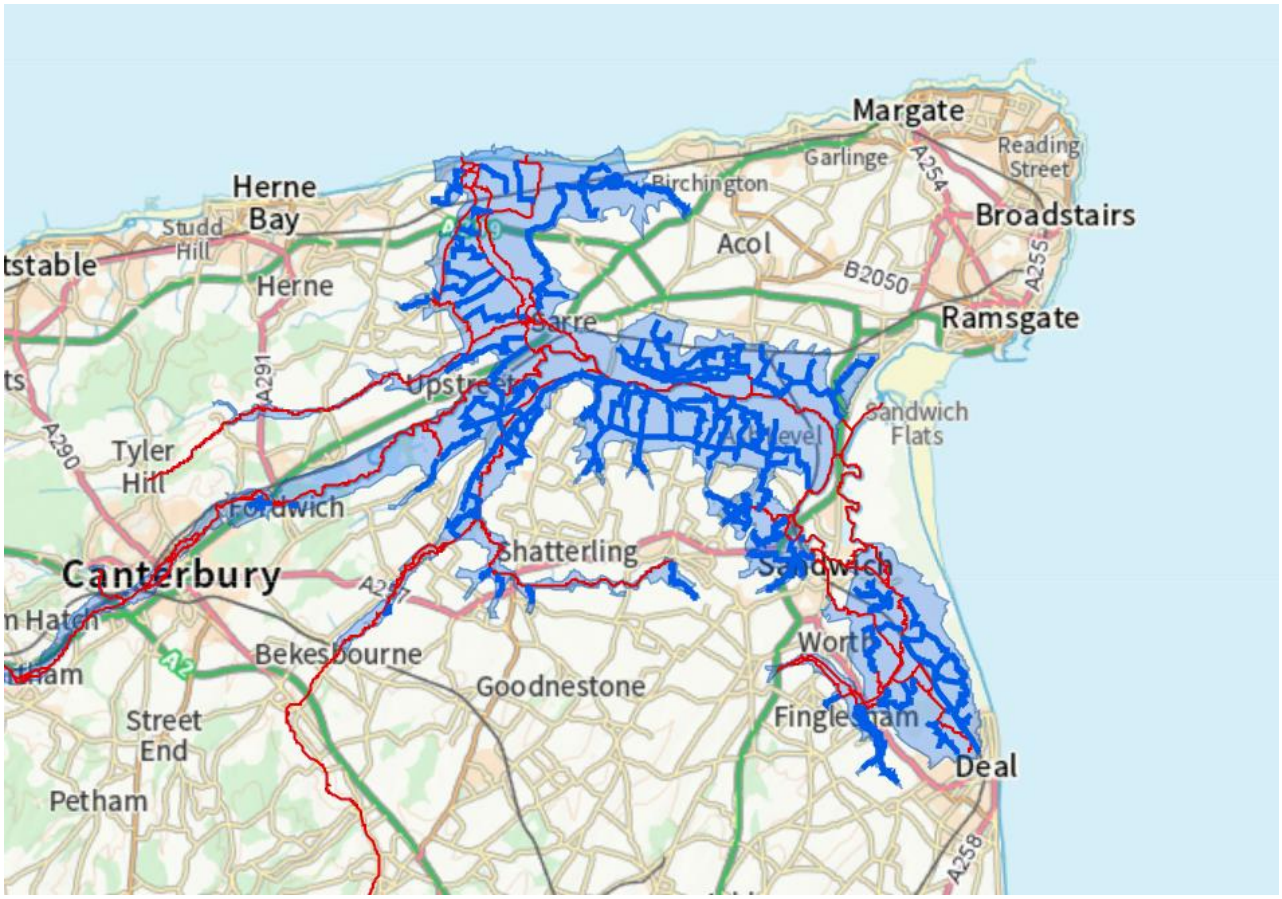


Figure 4 – River Stour Drainage District[4]

[4] River Stour Internal Drainage Board (rsidb.org.uk)

3.6 River and Coastal flooding

The north and east edges of Deal, including Albert Road are located within the low-risk zone. However, some parts of the northern region of Deal are located within the medium-risk and high-risk Flood Zones.

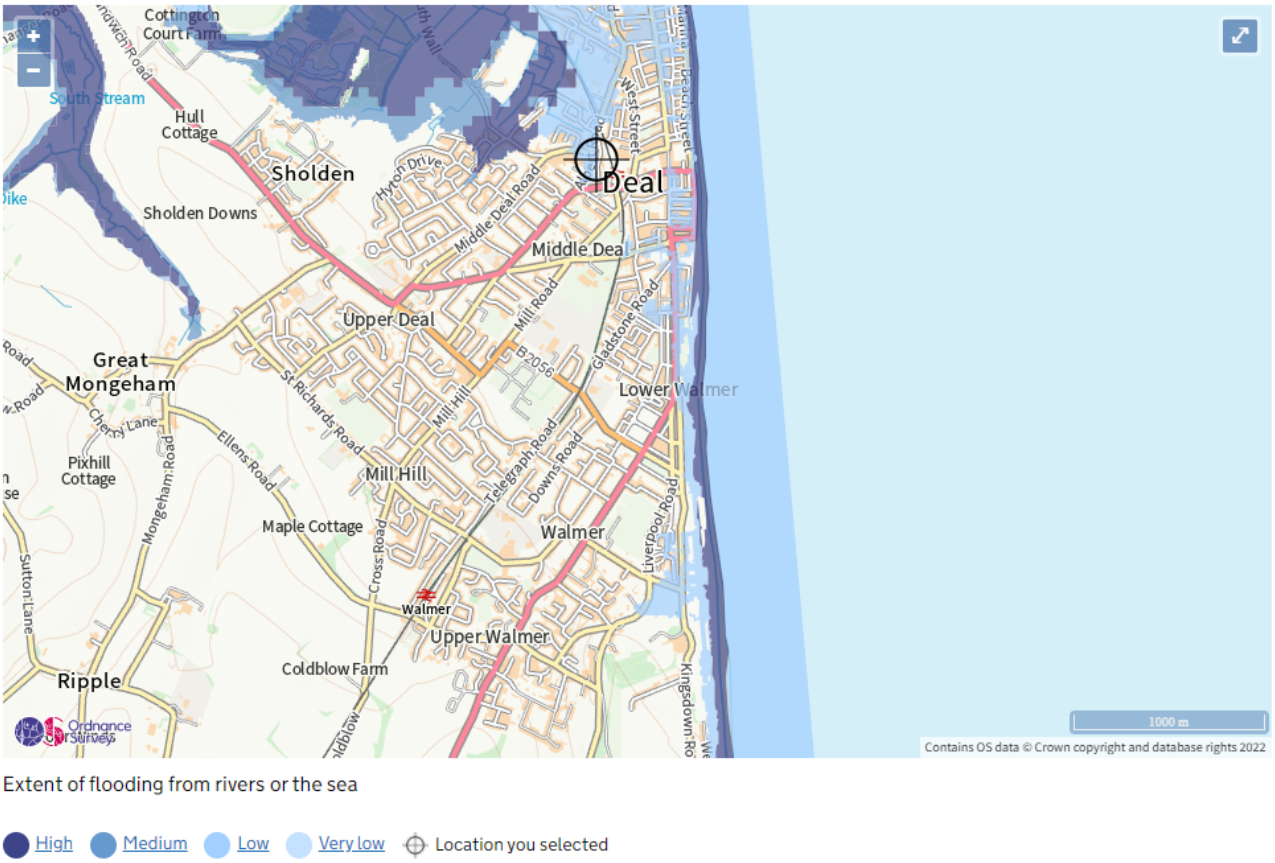


Figure 5 – Environment Agency Flood Map[5]

[5] Your long term flood risk assessment - GOV.UK (check-long-term-flood-risk.service.gov.uk)

3.7 Simplified Deal drainage system

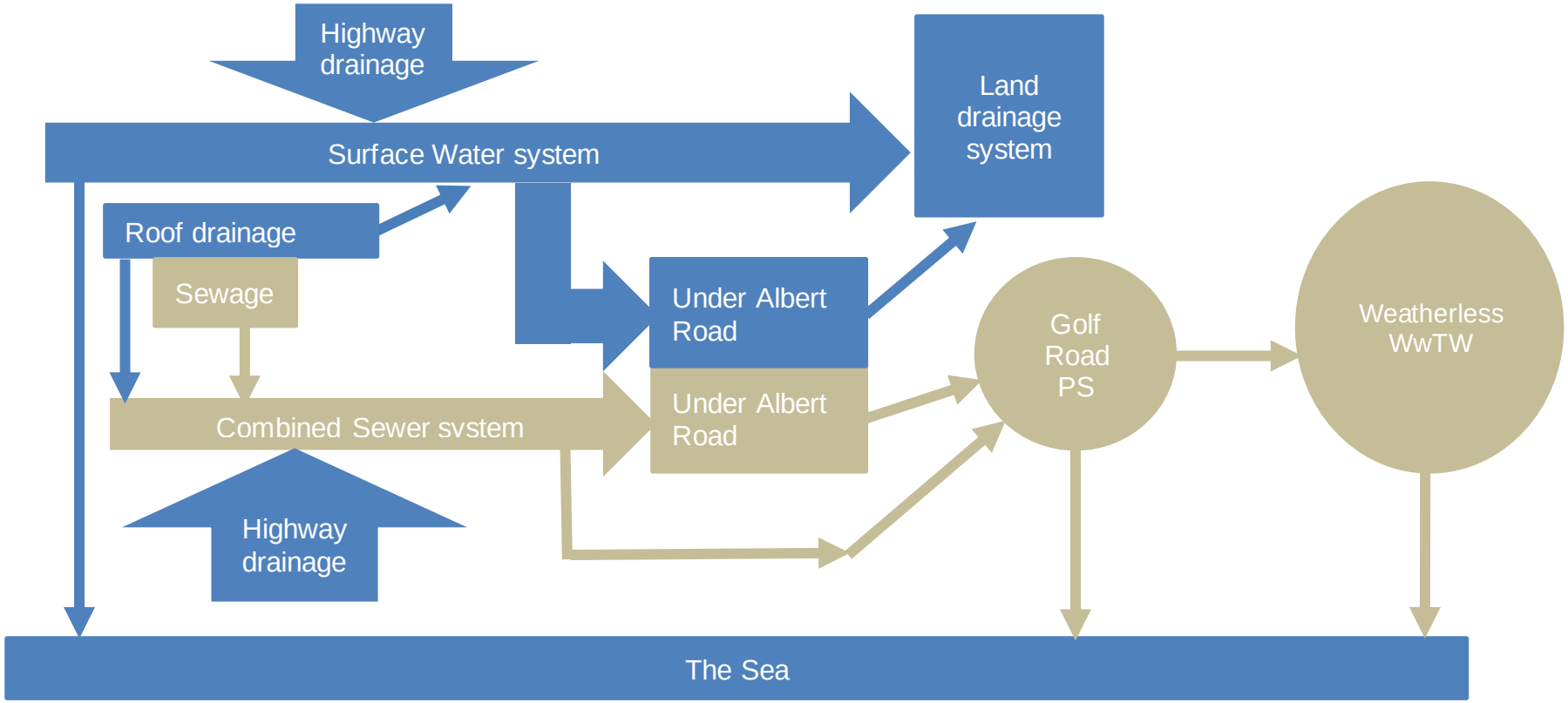


Figure 6 – Simplified diagram of the Deal drainage system around Albert Road

4. Why change is required and what are we doing.

4.1 Why change is required

The next few paragraphs describe some of the reasons why we need to make a change now. It is to everyone's benefit if rainwater can be channelled safely back into the ground or environment at a local catchment level rather than being pumped, treated and discharged to rivers or the sea.

Flooding

As described in Section 2, areas of Deal and in particular Albert Road have suffered from repeated flooding events. Section 3 begins to describe the various rainwater (surface water) drainage pathways and how they are interconnected. To solve this problem we need a different approach to rainwater (surface water) management.

Urban creep

The UK's built environment is constantly changing and "urban creep" – home extensions, conservatories and paving over front gardens for parking – can all impact the volume of water going into our sewers and drains. Green spaces that would absorb rainwater are covered over by concrete and tarmac which adds more intense flows to the existing drainage systems. Studies show that "urban creep" results in a significantly larger (50 fold) increase in predicted peak runoff for a legacy designed house than a new house design[6]

Climate change

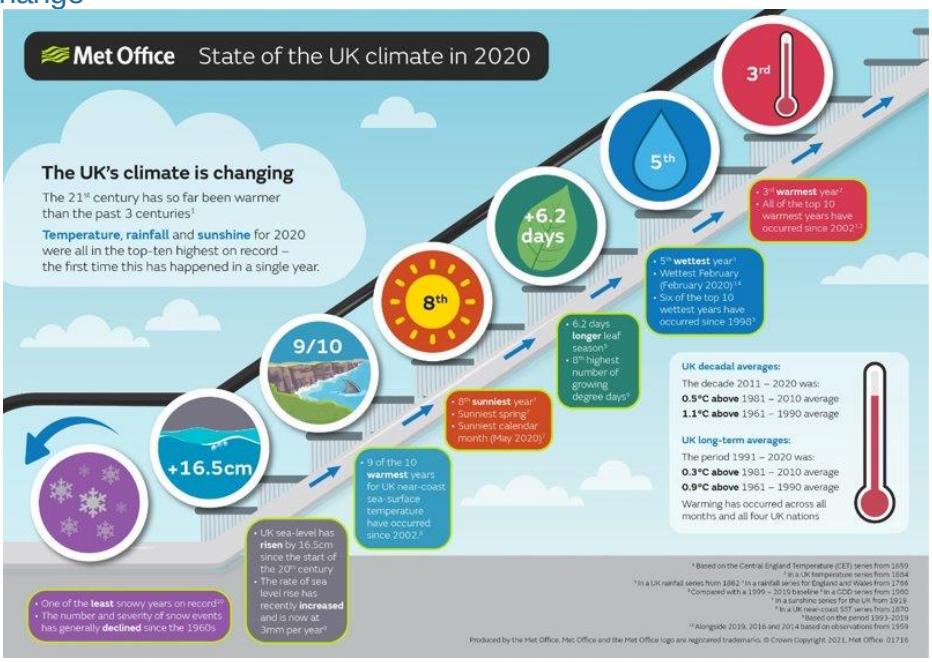


Figure 7 – Climate change drivers[7]

[6] 21st Century Drainage Programme – the context, Water UK
[7] Met office, 202020202020

"More people, bigger towns and cities and the effects of climate change will mean a greater demand for water when it is hot and dry, and fewer green spaces to absorb rainwater when it is wet and more unpredictable weather"[8]. As global temperatures rise, the number of extreme rainfall days is expected to increase with increased intensity short duration storms. These may exceed the capacity of the surface water and combined systems and risk more frequent flooding.

Figure 8 shows the Met office classification of rainfall intensity in mm/hr, which has been matched, for these purposes, to an appropriate type of storm to aid understanding.

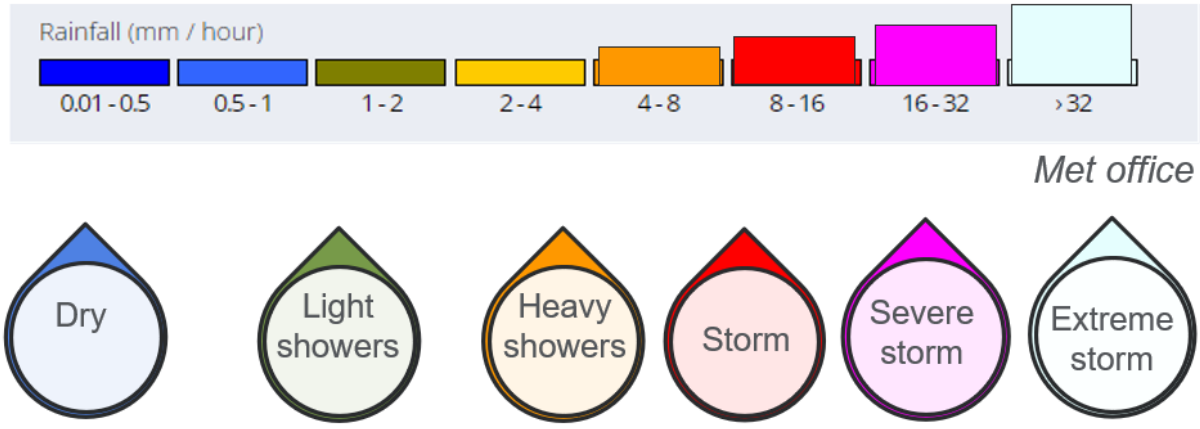


Figure 8 – Rainfall intensity/storm size diagram

As the South East is already water-stressed it may be particularly susceptible to the impacts of climate change. Water resources are already scarce, and rising temperatures will reduce them further, leading to more frequent droughts[9]

Greenhouse gases and energy use

Water industry operations require large amounts of energy for treating drinking water, processing wastewater, and pumping large volumes around an extensive network. Wastewater treatment processes use about half of the total operational energy across the water sector. Greenhouse gas emissions from the operational side of the water industry are around 0.7% of UK emissions (Ofwat, 2010). In 2011-12 companies reported that they emitted the equivalent of about 4 million tonnes of carbon dioxide[8]. It is therefore very important that the impact on carbon emissions is carefully considered and holistic catchment solutions are likely to drive the most sustainable solutions.

Storm Overflows to rivers and the sea

Storm Overflows, previously known as Combined Sewer Overflows are a pressure relief valve for the system to prevent the devastating impact of sewer flooding. However, these cannot be blocked off as this could cause/increase flooding.

[8] 21st Century Drainage Programme – the context, Water UK
[9] Southern Water climate change adaptation 2021

Figure 9 – Why do we need Storm Overflows?

4.2 The Southern Water Storm Overflow taskforce

Southern Water have set up a Storm Overflow task force. There are 4 streams to the Storm Overflow taskforce:

1 The pathfinder projects.
2 Developing a regional plan to reduce the use of storm releases by 80% by 2030.
3 Complaints & Engagement – create and communicate a common narrative.
4 Beachbouy and transparency.

4.2.1 The pathfinder projects

The first workstream of the Storm Overflow task force are the pathfinder catchment projects. The pathfinder projects have been set up to develop and trial a better more collaborative approach to rainwater (surface water) management.

The initial 5 pathfinder project catchments are:

- Deal, Kent
- Margate, Kent
- Swalecliffe, Kent
- Sandown, Isle of Wight
- Seven Parishes (Pan Parish) near Andover, Hampshire

4.2.2 A staged approach

We are undertaking a staged approach to the pathfinder projects which allows us to identify and deliver some low risk interventions and pilot schemes quickly; whilst we undertake further modelling to provide confidence and ensure we understand and manage risk for larger interventions.

Learnings and outcomes from the pathfinders will also feed into the Southern Water five yearly funding request process with Ofwat.

Stage	Description

Stage 0	Initial surveys and study with identification of early low risk interventions and any additional surveys and modelling requirements
Stage 1	Further low risk interventions and small trials (SWS and partner organisations)
Stage 2	More complex interventions and scaled pilots (SWS and partner organisations)
Stage 3	Larger scale investments to achieve pathfinder outcomes (SWS and partner organisations) - Model updates - Large Scale interventions

The staged approach being used for the pathfinders is described below:

Appendix C shows how the additional data that we want to capture around the catchment will be combined to provide a holistic view for storm water management. This is an ongoing process. Early small interventions with a low risk of unintended consequences can be enacted quickly. As we gain a more detailed understanding of the catchment then our understanding of the risks associated with a larger scale more complex intervention improves, which provides confidence in a successful outcome.

4.3 Surface Water management, Storm overflows and Albert Road

The Albert Road flooding is a critical issue however the interventions to improve that issue have many things in common with those that impact Storm Overflow spills. In fact Golf Road Pumping Station has a Storm overflow and therefore catchment measures in Deal will improve both the Albert Road flooding but also the discharges from Golf Road Pumping Station to the sea.

5. Potential solutions and the wider benefits

As mentioned in section 4, floods and Storm Overflow spills are caused by rainwater in the sewer overwhelming it. The key to reducing these risks are either by reducing the volume of rainwater getting into the sewers or by increasing the sewer's ability to cope with it. To that end we have split this into 3 main types of intervention to reduce the risk of flooding and storm overflow use:

- *Upstream source control (removing and slowing the flow of rainwater)*
- *System optimisation (making better use of the existing infrastructure)*
- *Infrastructure enhancements (build larger infrastructure)*

5.1 Upstream source control - removing and slowing the flow of rain water

Types of solution

- Rainwater harvesting

Water butts can be retrofitted easily to existing downpipes, they hold back the peak run off from roofs and adjust the amount of water drained to the drainage system. They also provide rainwater for domestic garden use.

- Permeable paving

Impermeable Footpaths and driveways, car parks and parking bays can be converted to a surface which allows water to soak into porous ground, or where the ground is less porous into a gravel filled base. This slows the flow into the drainage system or into the ground.

- Green roofs

Green roofs are generally made up of a shallow layer of material planted with low-growing, stress-tolerant grasses, mosses and sedum. These lightweight systems require little maintenance. They not only attenuate run off i.e. 'slow the flow' but have other benefits such as providing insulation in winter, and cooling in summer by absorbing heat from the sun.

- Bioretention - tree pits

Bioretention areas/tree pits are designed to collect, attenuate and/or infiltrate runoff by providing both storage volume and infiltration areas within the underlying structure. The soils around the trees can also be used to directly filter out pollutants from runoff. These are particularly useful in urban roads and pavements to help manage rainwater (surface water) from highways.

- Bioretention - planters

Planters are typically raised above ground features or repurposing of existing raised areas to attenuate run off, i.e. 'slow the flow'. Above ground planters can be easily retrofitted to accept diverted flows from downpipes where there is space.

- Rain garden (swales)

These are vegetated channels which are used to convey, treat and infiltrate rainwater (surface water); and disconnect conventional roofs and paved areas from the combined and surface water drainage. Swales can be retrofitted into existing systems by re-purposing existing landscaped or grassed areas to contain swale features.

Natural and social capital impact

Southern Water defines natural capital as the element of nature that provides value to society. Social capital is defined as Southern Water's relationships and others' trust in the business. In addition to the drainage benefits that the above solutions provide, they also give many other benefits, some of which are listed below.

Water resource and water quality benefits

- Water butts can reduce the volume of mains water used for gardening.
- Infiltration supports aquifer recharge and can improve raw water quality by filtering water through the soil.
- 'Slowing the flow' measures intercept flows containing sediment and other pollutants washed from fields, roads etc and can improve water quality by trapping these in situ.

Urban environment benefits

- Planted vegetation can contribute to a reduction in the urban heat island effect by providing shade and reducing local temperatures. Green roofs can reduce the need to heat and cool buildings.
- Vegetation helps to absorb carbon and helps to remove pollutants from the air resulting in improved public health and reduced costs associated with treating health issues (e.g. asthma).
- Removing rainwater from the system avoids the carbon costs of pumping effluent across catchments and to wastewater treatment works. Chemical carbon costs associated with treating this diluted sewage are also reduced.

Natural environment and wellbeing benefits

- Vegetation can provide habitats for pollinators and other wildlife.
- Vegetation can sequester carbon.
- Green spaces improve the aesthetics of local communities and enable people to connect more with nature.

5.2 System optimisation – making better use of existing infrastructure

If we cannot remove or slow the flow of water before it gets into the drainage system then we would look at our existing infrastructure, pumps, storage tanks and instrumentation to enable us to control the system better, i.e. Smart network control with increased digitalisation. Examples of the types of solution include:

Improvements in storage tank use and control

By being able to adjust how a storage tank fills and releases then there is more flexibility to manage the variable types of storms that could hit a catchment. e.g. intense short summer storms after a period of dry weather or prolonged winter rain storms.

Improvements in pumping station use and control

Optimising the use of pumping stations across the catchment can also mean we utilise the catchment storage better, reduce wear, and improve resilience of the assets. This can also result in reduced energy and hence carbon use.

Better data availability

Level monitoring in the catchment and at storage tanks and flow meters on pumping stations means that more data is available to identify issues proactively, plan maintenance, optimise the system and design solutions.

Natural and social capital impact

Whilst system optimisation may require some additional instrumentation it enables us to make full use of existing assets as well as potentially providing energy and carbon benefits.

Optimisation of existing assets also avoids the disruption of large construction projects. More data can also aid real time reporting to the public, enabling trust with local communities and impacted groups such as recreational bathers.

5.3 Infrastructure enhancements – build larger infrastructure

In some instances, we may not be able to remove enough rainwater (surface water) or optimise a system sufficiently to avoid constructing new assets. These may be:

Types of solution

- Larger sewers & pumping stations – to transfer the rainwater and/or diluted sewage more quickly away from an affected area.
- Larger storm tanks – to store more of the volume of rain during storms.
- Larger treatment works – to treat the rainwater and/or diluted sewage before it is discharged back to the environment.

Natural and social capital impact

- There will be high carbon costs (embedded and emissions) associated with the construction and operation of these new assets.
- There is the potential for the direct loss of vegetation and habitat during construction which could lead to the loss of a range of ecosystem services (e.g. biodiversity, air quality, health and wellbeing etc).
- There will be disruption to the local community whilst these assets are being constructed (traffic, noise, air quality impacts etc).

6. Our surveys and investigations in Deal

As described in Section 3.0 the management of surface water is complex, particularly in the Deal catchment. We believe that many of these factors contribute to the flooding experienced at Albert Road, Deal. This section talks about the progress of our investigations and surveys, in particular what we know and what we still need to investigate.

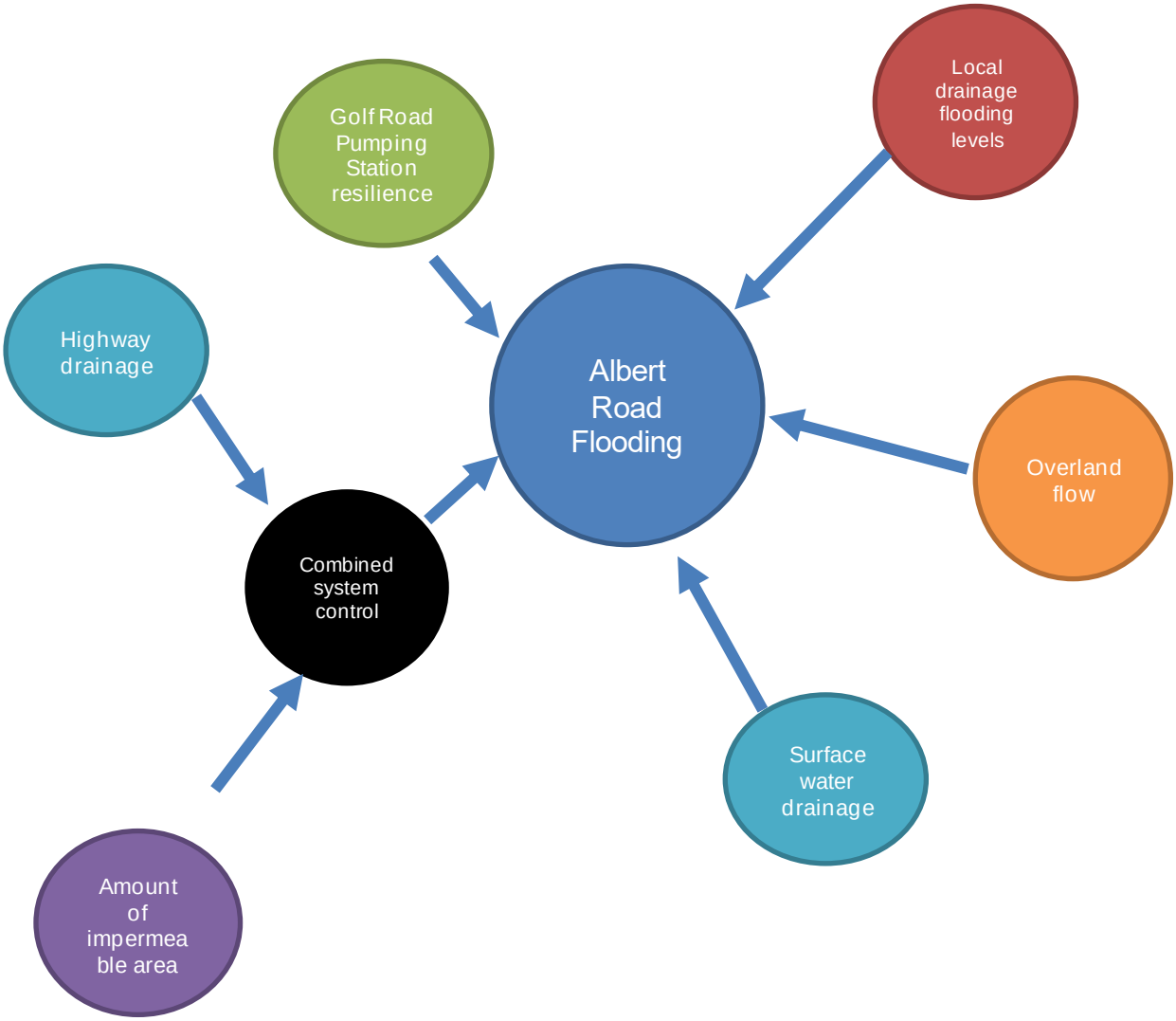


Figure 10 – Potential contributors to the flooding issues at Albert Road

6.1 Albert Road Investigations

What we know

Combined Sewer System around Albert Road

Around Albert Road surveys of the local sewers, manhole surveys and connectivity surveys, to confirm existing connections, were undertaken in December 2021 and

January 2022. This data is being added to the existing sewer record data and network model.

Within Albert Road are the sewers shown in figure 11, Surface water only sewers are light blue, Highway gullies and connections are dark blue and combined sewers are brown. These sewers were CCTV'd (Closed Circuit Television Video) in December 2021 and the size and condition of the sewers were confirmed.

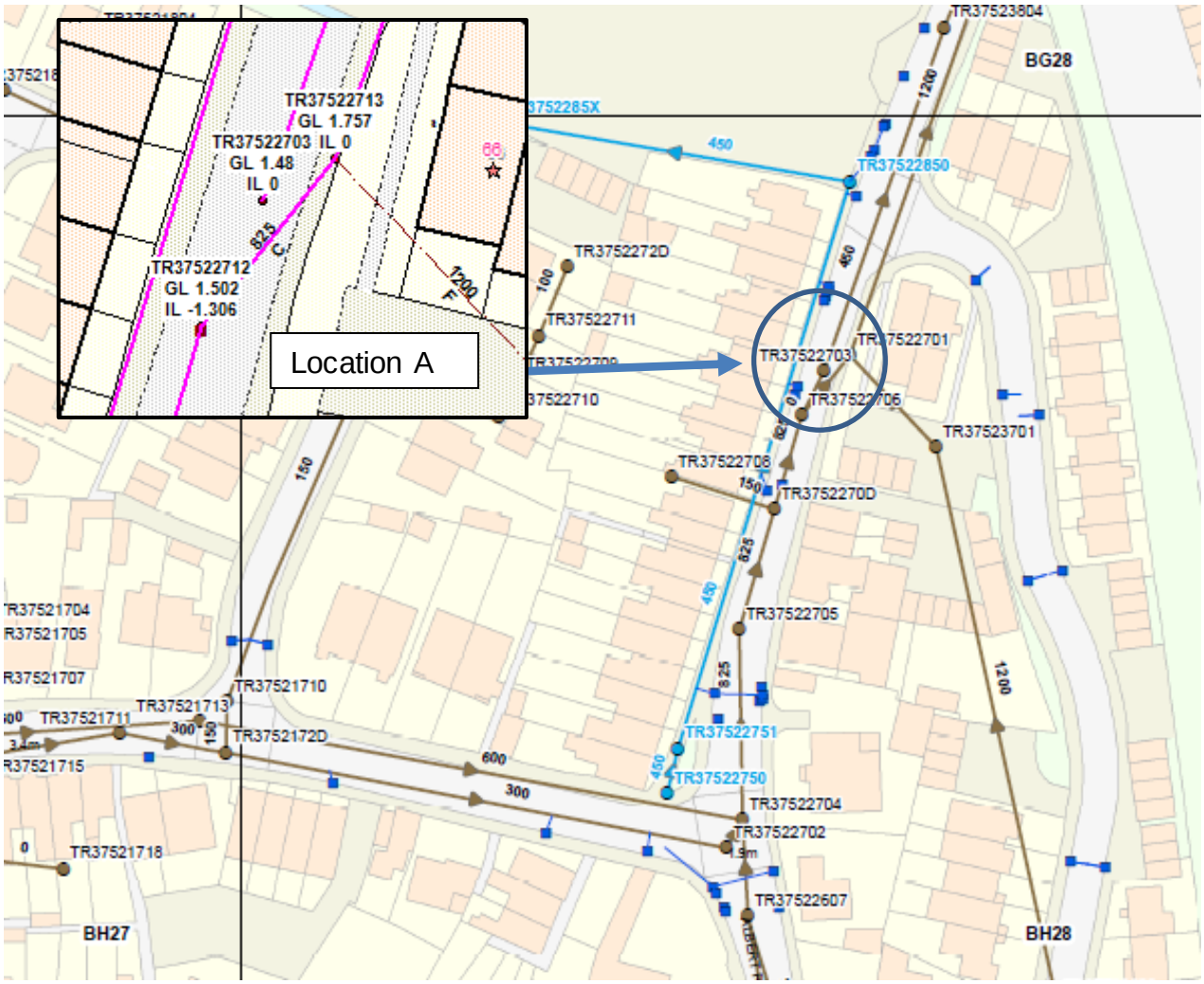


Figure 11 – Albert Road Sewers (GIS)

In Albert Road a combined sewer flows from the south under Albert Road from the junction with Middle Deal Road. This sewer is 825mm at the southern end of Albert Road. This sewer is joined by another 1200mm sewer from Bridgeside, and it continues under the railway line as a 1200mm sewer. Previously there was also a connection between the 825 sewer and a 450mm sewer that ran down Albert Road. This connection was removed and the 450mm sewer runs as its own separate sewer, and continues below the railway line, Location A. The GIS mapping for Location A has not yet been updated with this information, however the network model is correct.

CCTV

We have undertaken CCTV of the local pipes to Albert Road and we will be arranging for any repair work to be undertaken.

KCC have also CCTV'd their network in this area to confirm condition and connectivity. Any work identified in the recent CCTV survey will be reviewed and interventions will be scheduled.

Connectivity Survey

We have undertaken a connectivity survey of the local area to Albert Road, see Appendix D for excerpts. There looks to be some remedial work such as jetting that can be done on some of the pipework. Further investigation is required to confirm if there is any roof drainage is connected to the foul sewer and or if there is an opportunity for it to be connected to a nearby surface water system.

Combined Sewer System around Albert Road to Golf Road Pumping station

In Western Road, the 1,200mm combined sewer splits into two, an 1,800 and a 1,080 sewer, also the 450mm sewer enlarges to a 850 mm sewer. A large proportion of the flow will go straight to the pumping station in the 1,800 mm pipe. This flows under Northwall Road and West Lea, across the marshes and continues ultimately to the terminal pumping station for Deal located in Golf Road. Once the 1800mm pipe has taken flow straight to Golf Road the other sewers reduce in size. A 1050mm sewer then runs through the north Deal catchment collecting any other foul and surface water drainage before discharging into the Golf Road Pumping Station as per figure 12.

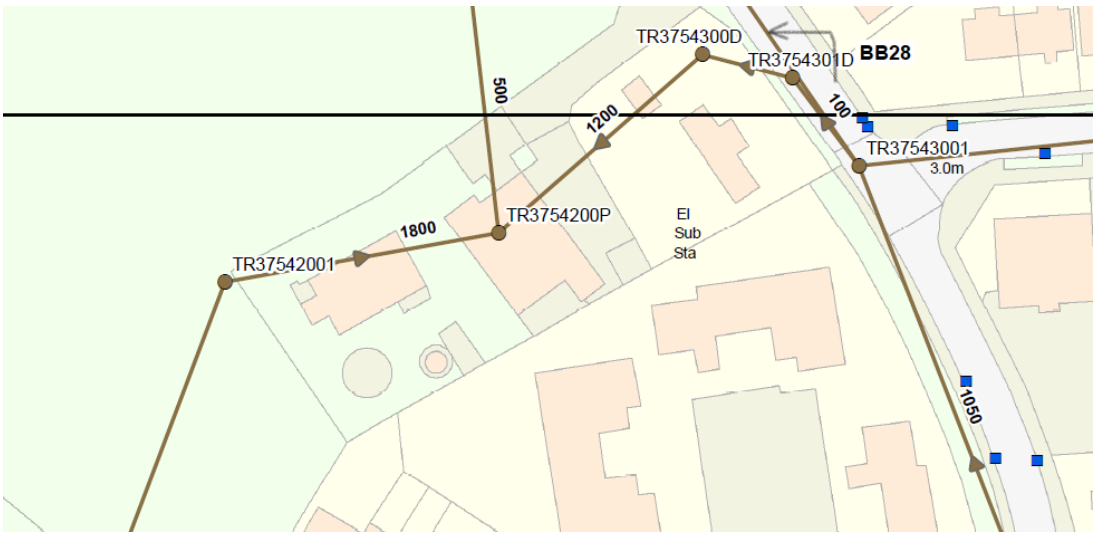


Figure 12– Sewers entering Golf Road Pumping Station (GIS)

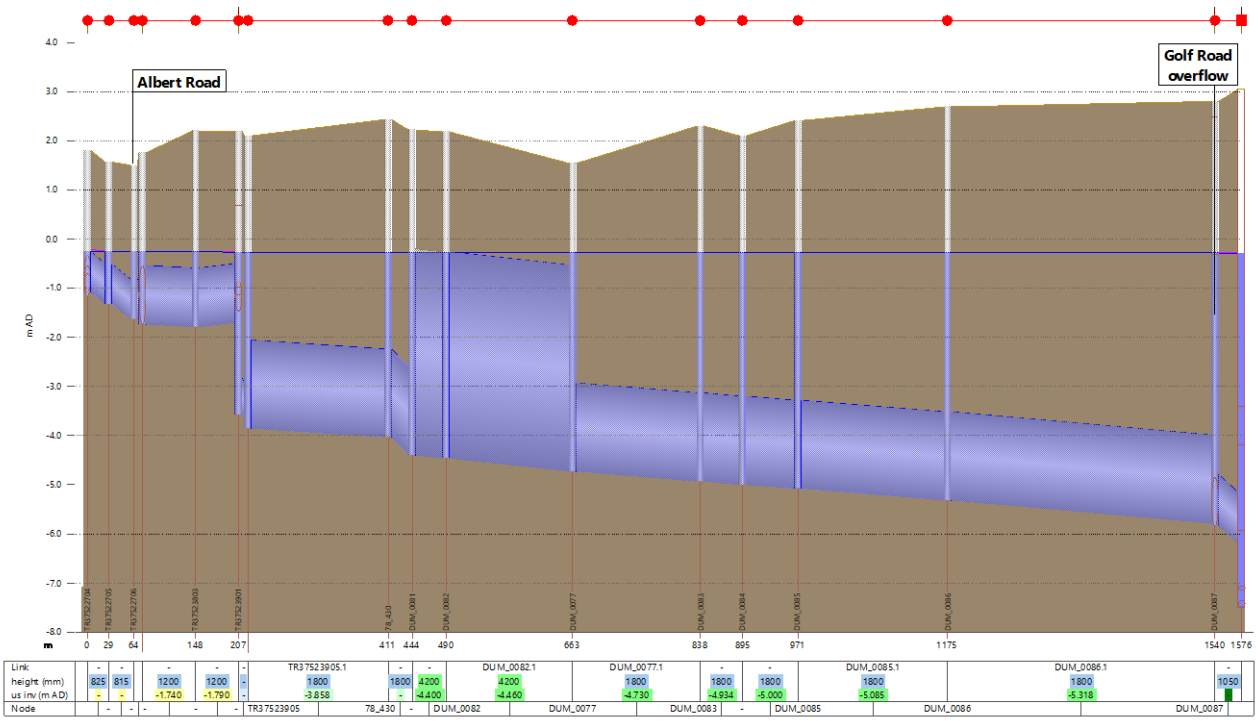


Figure 13 – Sewer sizing from Albert Road to Golf Road Pumping Station (following 1800mm pipe), Network Model

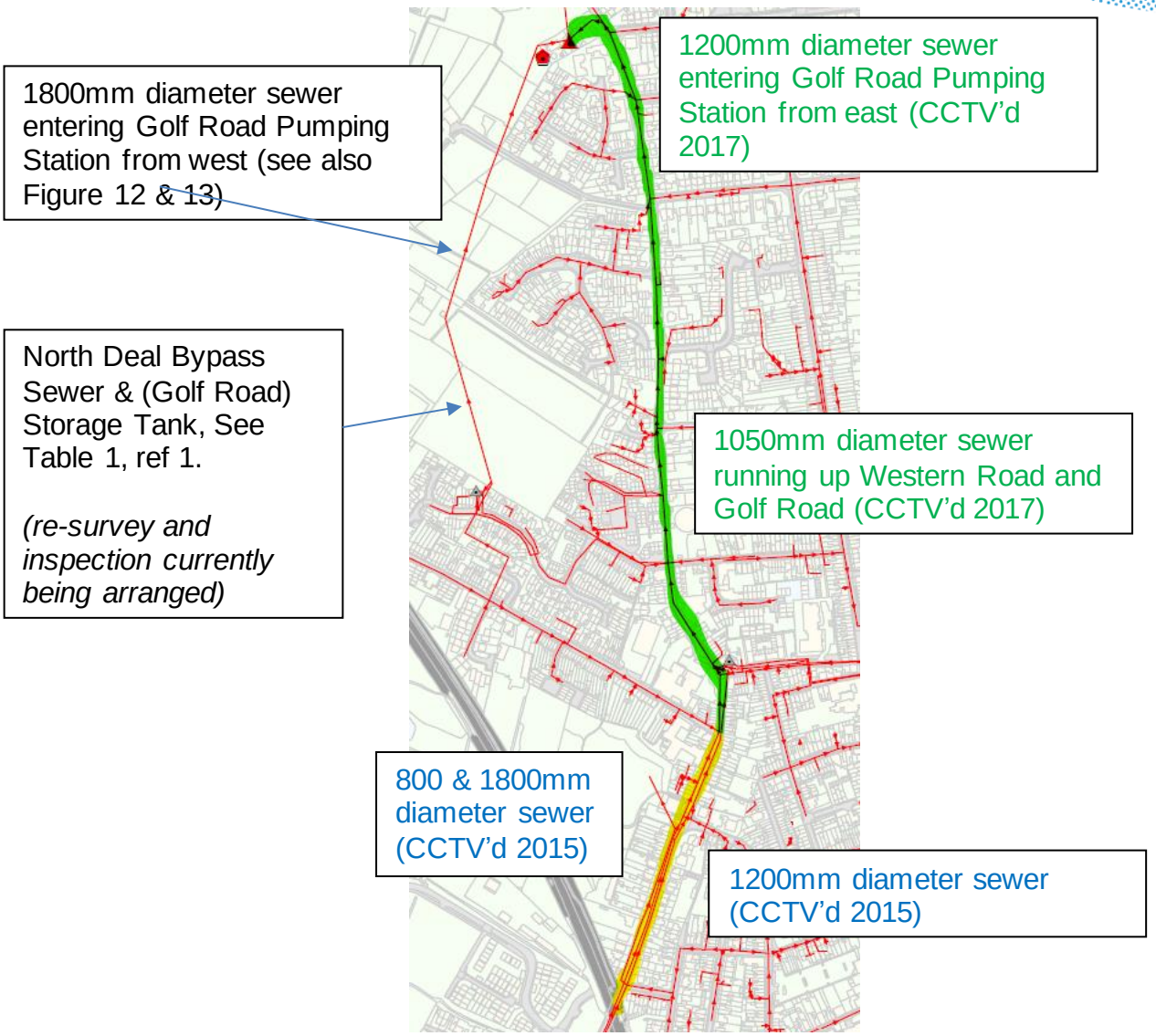


Figure 14 – Sewer sizing from Albert Road to Golf Road pumping station

These large diameter sewers were CCTV'd in 2015 & 2017 to confirm their size and condition. They were also checked for blockages in 2020 after the August 2020 flooding and no blockages were found.

Surface Water System

Bridgeside Highway Surface Water sewer

As you can see from Figure 11, the 1200mm combined sewer within the sewer record (GIS records) is not shown to run down Bridgeside. However road gullies have been identified that must connect into a pipe. We have worked with KCC and investigated the exact route of the sewer down Bridgeside and have confirmed that there is an additional Highway surface water pipe running down this road, see Figure 15.

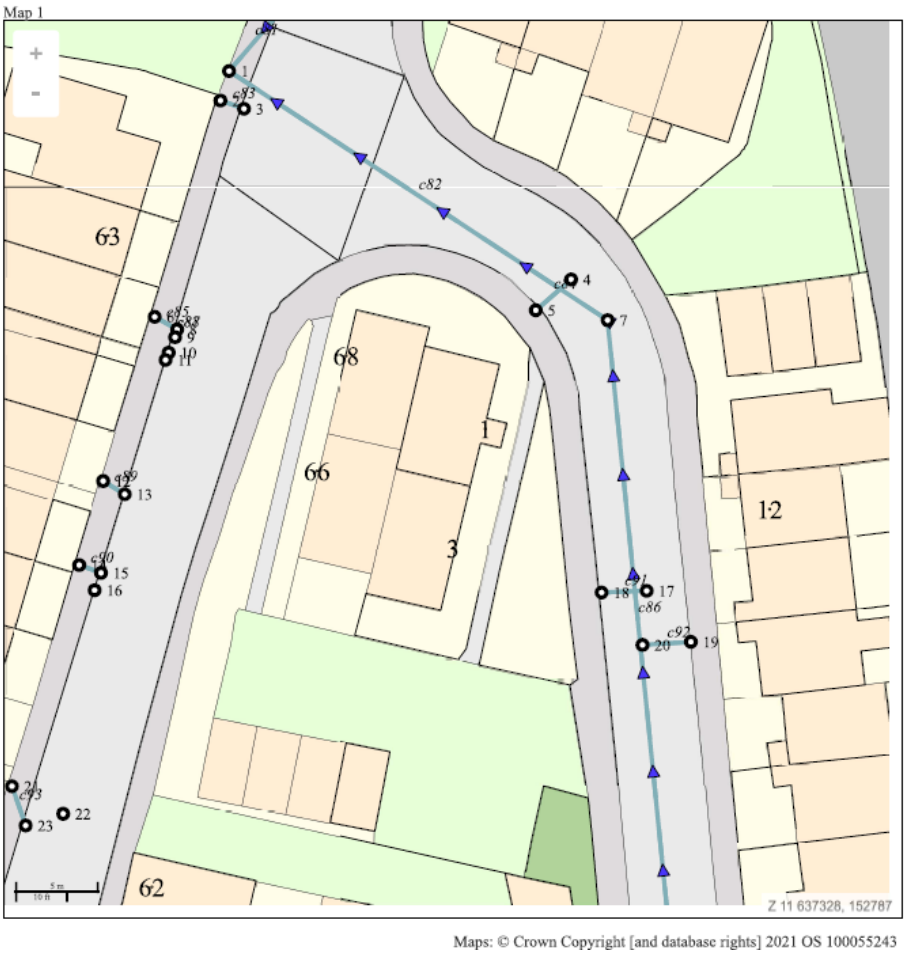


Figure 15 – Survey results for the surface water pipe down Bridgeside[10]

Figure 11 also shows there is a 450mm surface water sewer in Albert Road that collects the rainwater (surface water) runoff from houses, roads and pavements via the gullies in Albert Road. It joins with the sewer from Bridgeside (Figure 15), and turns 90 degrees to discharge into the ditch at the back of Matthews Close.

The diameter of the pipe at the outfall header wall appears to be reduced as it exits. A large heavy flap valve to prevent backflow from the ditch had been installed on to the outfall of the pipe, this has now been replaced with a lighter valve.

[10] KCC and Kaarbontech, 2022

Figure 16 – Flap valve to ditch: Blue original (cast iron) black new (plastic)

Southern Water Services owns and is responsible for the maintenance of the surface water and foul/combined sewers located in the vicinity of Albert Road. They also own and maintain the pumping station located on Golf Road.

The ditch that the surface water system connects to is maintained by Dover District Council.

Kent County Council is responsible for the maintenance of road drainage and public highway sewers.

Further investigations and surveys to be done

The outputs of the above surveys as well as further flow monitoring and manhole surveys, that we are procuring in the wider Deal catchment, will be used to update the Deal network model for the combined system and to build a new surface water network model.

These asset surveys will also be used to update errors in the GIS/Sewer record mapping, such as Location A, as well as improve the accuracy of the network model, see Appendix C.

6.2 Golf Road Pumping Station & Rising main

What we know

The foul and combined sewers in Deal terminate at a pumping station in Golf Road. An initial volume of flow is pumped using 3 number dry weather flow (DWF) pumps that work as Duty (always running) & Assist (comes on to provide additional capacity when required), with a Standby pump available should a pump fail. The flow is pumped via a 500 mm ductile iron rising main, approximately 12km long, to Weatherlees Wastewater Treatment Works, to the north of Sandwich. This rising main has suffered from bursts.

If the capacity of the DWF pumps is not sufficient then the additional flow spills to a chamber containing a screen and 3 storm pumps, again configured as duty, assist and standby. At this point, untreated, screened stormwater is pumped out to sea through a long-sea outfall.

Internal flooding from the combined sewerage system leading to Golf Road Pumping Station has occurred on a number of occasions. Whilst Golf Road Pumping Station has the required capacity, its controls would benefit from modernisation. In addition the resilience of the station i.e. its ability to withstand power outages, mechanical failure and sudden changes in flow, can be improved.

Golf Road Pumping Station is a critical component of the drainage system within Deal. A number of interventions have already been enacted over the last 2 years at Golf Road pumping station to increase its resilience and further activities are in progress, as listed below:

- A storm return loop has been installed to allow the storm pumps to be tested regularly without discharging out to sea.
- The Golf Road pumping station dry weather flow pumps have been replaced to ensure that they are resilient and available when required.
- The washwater system for the screen prior to the storm pumps is being refurbished, to provide resilience to the screens and reduce the risk of blockage and therefore a high water level in the upstream pipework.
- The non-return valves that stop sea or flood water from flowing backwards into the storm pump chamber are being replaced to ensure they seal properly; and thus the pumps provide full capacity for sewage flows.

Further investigations and surveys to be done

A full asset survey of Golf Road Pumping Station has been undertaken to ensure that the correct maintenance regime is in place and to ensure the resilience of the pumping station, to heavy sudden increases in flow and screenings load.

We will use this information to produce a plan for improving the resilience at Golf Road Pumping Station. Activities include:

- Building condition and security report
- Control panel checks.
- Plant operation inspections
- Lift DWF Pumps and inspect well
- Lift Launder Pumps and check for condition
- Lift Sump Pump and check for condition
- Confirm power failure restart process is resilient
- Check back up controls and operation of DWF well
- Check back up control on storm chamber and check Ultrasonic / floats to confirm signals are being received.

This information and further survey work of Golf Road Pumping Station will be used to update the network model to ensure that the most up to date information is included. This allows for more accurate modelling of the current network, but also to model the impact of future growth in the Deal catchment on the pumping station capacity and the risk of discharges to the sea.

6.3 The Combined Sewerage system

What we know

We have a network model of the existing foul & combined sewer system of Deal, which we use to run different rainfall scenarios to understand the impacts on the system. As the catchment changes then this model must be updated, calibrated and verified. Figure 17 below shows the current extent of the model (red pipes need more investigation).

Figure 17 – Foul/combined sewer system in the Deal catchment (brown)

Historically there were a number of Storm overflows (see section 4) within the catchment that released pressure on the system during storms. These were closed off in 1993/1994 (tbc) to prevent diluted sewage discharging to the environment; and

were replaced with storage tanks in the catchment as part of the Dover District Council's Water Quality Scheme, Project SeaClean. These were also surveyed in 2015/2016 to confirm that they were fully concreted up.

Figure 18 – Storm storage tanks within the Deal catchment

Storage is now provided with the inclusion of oversized pipework (or online tank sewers) with storage being used by controlling the flow out of the tanks with a device called a HydroBrake. The largest storage facility (5000m3) is provided at North Road Tank Sewer, located between Albert Road and Golf Road Pumping Station. A further additional 4,000m3 of storage is distributed throughout the catchment, all of which are located upstream of Albert Road.

Additional online storage is also provided at points in the catchment where the sewer bifurcates (splits), and a second pipe runs in parallel to provide relief. A number of these storage tanks were inspected in 2016 either by sending sewer operatives down to visually inspect the manhole chambers and sewers, or by using remote Closed Circuit Television (CCTV) survey cameras.

Ref.	Name	Type	Volume (m^3)	Hydraulic Control
1	North Deal Bypass Sewer & (Golf Road) Tank	Online Tank Sewer	5000[11]	Downstream Network
2	Town Centre Relief Sewer (North)	Bifurcation[10]	300	Downstream Network
3	Middle Deal Road Relief Sewer	Bifurcation[10]	tbc	Downstream Network[10]
4	Albert Road Relief Sewer	Bifurcation[10]	tbc	Downstream Network[10]
5	Town Centre Relief Sewer (South)	Bifurcation[10]	120	Downstream Network
6	Orchard Avenue Tank	Online Tank Sewer	134	Downstream Network
7	Victoria Park Tank	Online Tank Sewer	1900	Hydrobrake
8	Hamilton Road Tank	Online Tank Sewer	995	Hydrobrake
9	Rectory Road Tank	Online Tank Sewer	284	HydroBrake
10	Walmer Paddock Tank (Warner pumping station/Walmer Castle Storage Tank)	Online Tank Sewer [12]	850	Downstream Network

Table 1 – Storm Storage Capacity in Deal catchment

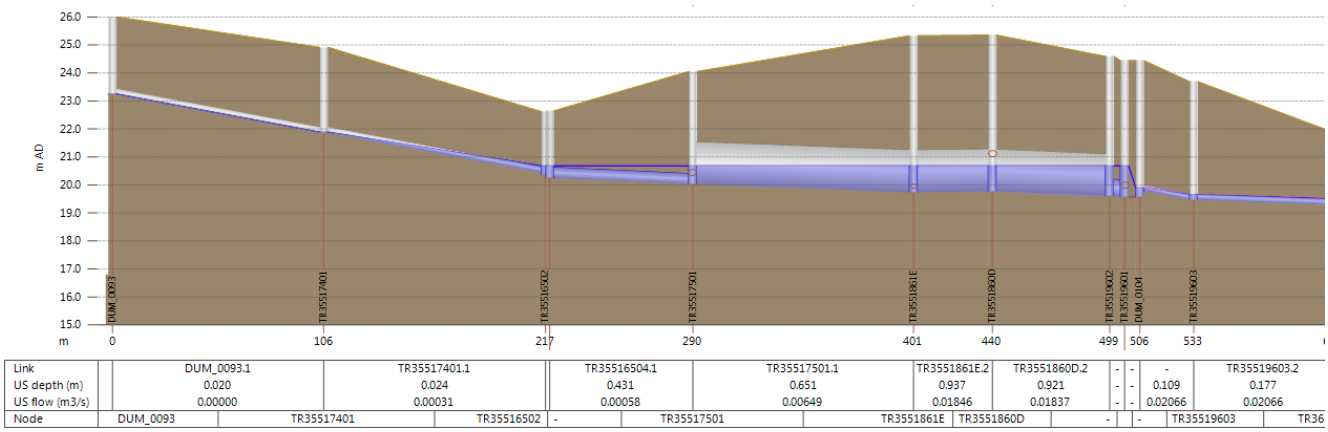


Figure 19 – Long Section of Rectory Road Storage tank

There are six sewer level monitors (SLMs) monitors in Deal, two located at the flooding location and four located within network storage tanks. The data is in the form of 15 minute level data with the level unit believed to be a percentage of the manhole depth.

[11] Storage volume as stated on Flood and Water Quality Drawing (Dover County Council).
[12] Storage volume, current control mechanism and further details to be confirmed.

Further investigations and surveys to be done

We have requested surveys to be done to assess the condition of the existing storage tanks and the method of outlet control. If required, then the storm tanks will be cleaned out to ensure full capacity is available in a storm.

There is a programme to install 350+ additional level monitors in the catchment which will begin in Deal soon. We are requesting that the existing SLMs are recalibrated as well.

A wider survey is being commissioned for the foul/combined system across Deal to enable the combined network model to be improved. This will support decision making around other potential large interventions, see section 7.

6.4 Surface Water system

What we know

Figure 20 below, shows the current surface water sewers in the Southern Water network model. These surface water sewers discharge to local ditches and to the sea in four locations. There are sea outfalls near Granville Road, Canada Road, and North Barrack Road.

Figure 20 – Current mapping of Surface water system in Deal

It is believed that during the Albert Road flooding event in 2016 one of these surface water outfalls (Canada Road) was blocked by shingle. Flow was observed backing up and flooding a road intersection where foul and surface water manhole covers are approximately 1m apart. If surface water could not escape from the system, then overland flow may have contributed to sewer flooding by entering the combined sewer nearby. Investigations at Golf Road pumping station showed that it observed much higher flow/level changes which could not be explained by the model until the additional Canada Road surface water was added. The outfall was extended to beyond the shingle line at Canada road to remove this risk going forwards.

Further investigations and surveys to be done

As you can see from Figure 20 only some sections of the surface water system are included in the current sewer model (light blue), the dark blue pipes need more investigation. We are commissioning a flow, connectivity and manhole survey that will enable the model to be expanded. The flow survey will be used to calibrate this model.

Building up a model of the surface water system will allow us to more clearly understand the interaction between the various sewers systems within the Deal catchment. A better understanding of the surface water system will help to highlight the opportunities to disconnect roads and roofs from the combined system, and therefore reduce the volume of water passing underneath Albert Road and reaching Golf Road Pumping Station.

6.5 Highway Drainage system

What we know

Kent County Council (KCC) Highways Department have provided us with mapping information for the road gullies across the Deal Catchment. They have also undertaken CCTV surveys of the highway drainage specifically around Albert Road and the neighbouring roads.

Further investigations and surveys to be done

We will be working with KCC to understand how the gullies connect to the combined and surface water sewers. How we use this information to identify future opportunities to disconnect highway drainage from the combined system, will be discussed and agreed as the project progresses through the stages. See section 7 for further details.

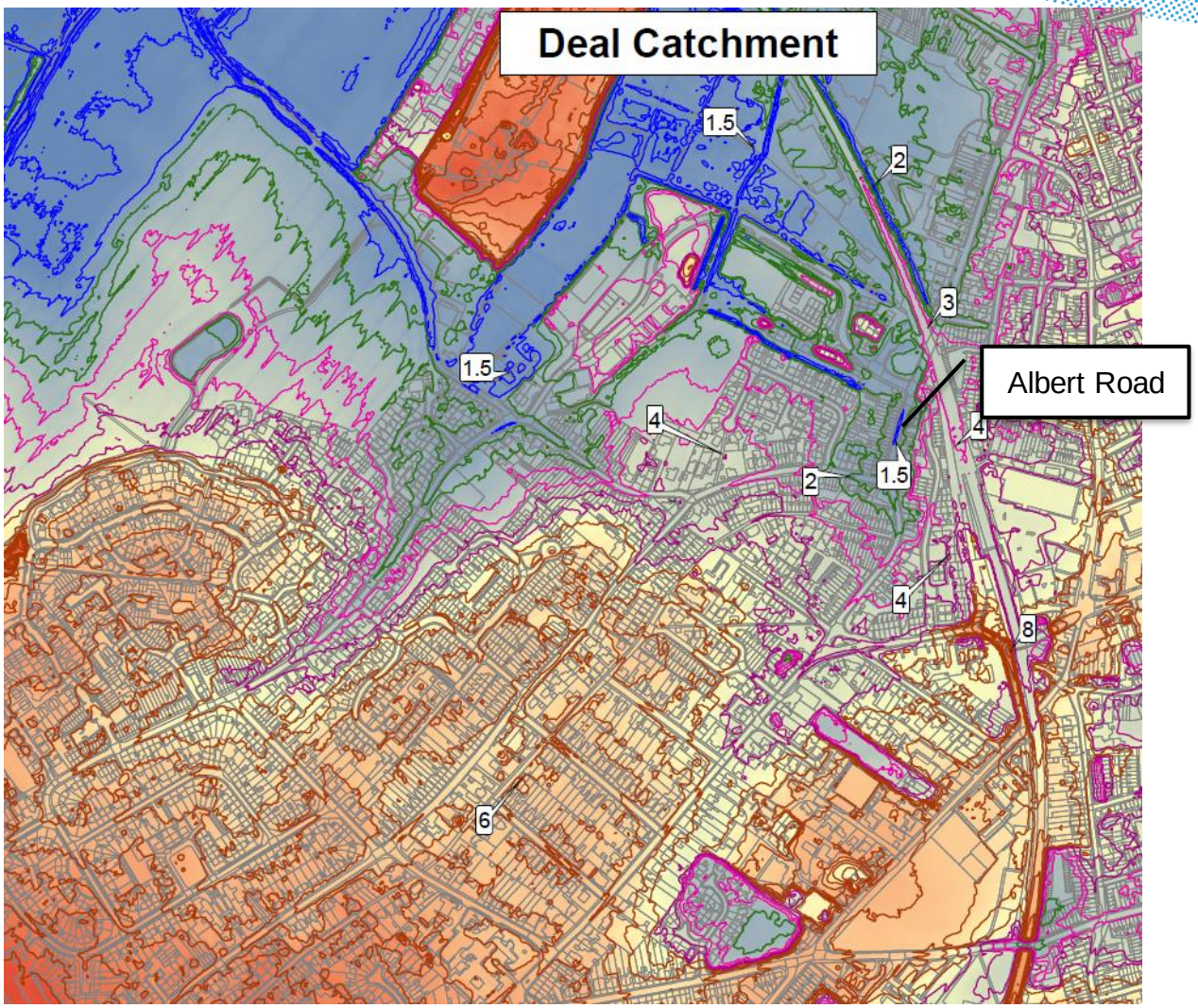


Figure 21 – Ground level Contours around Albert Road @1.5m[13]

The Deal catchment falls to the North East. We are using a 2D (2 dimensional) model to try to understand the direction of overland flows in this area. Early indications show that the neighbouring roads, in particular Middle Deal road and London road can channel overland flow towards Albert Road. For this early modelling we have assumed a scenario where the existing surface water drainage systems are either at capacity or unavailable due to blockage.

The impedance of the railway embankment also means that overland flow can collect at Albert Road as the lowest point, see Figure 21. During this process the overland flow can also enter the combined sewers via the manholes.

6.6 Land Drainage

What we know

Local surface water systems drain into the ditches leading away from Albert Road, including the Matthews Close development and the new development on Court Marsh Road. Management of these drainage ditches is an important part of the overall surface water drainage system. Clogged ditches or ditches of the wrong shape can mean that

[13] 2020 LIDAR Composite model, Environment Agency

the capacity of the ditch is restricted and/or rainwater (surface water) cannot drain away efficiently.

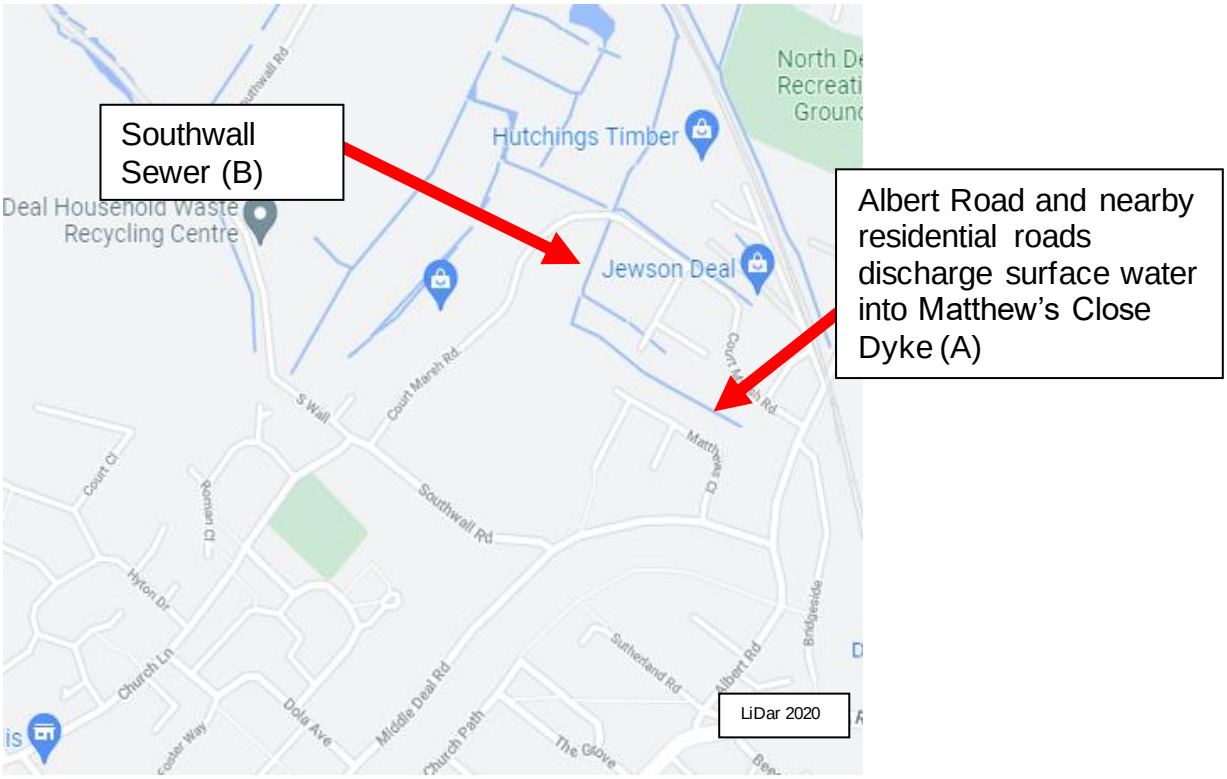


Figure 22 - Local drainage ditches

Evidence provided from the July 2021 flooding event shows that there was capacity within Ditch A. This ditch has also been recently cleared of overgrowth.

Figure 23 shows the Main River Southwall Sewer which is under EA control and maintained once a year (highlighted red), the IDB maintained watercourses (highlighted dark blue) and all other watercourses, riparian but also under IDB control (light blue). Matthew's Close Dyke (highlighted in green) is owned by DDC and maintained by the River Stour IDB on a twice yearly maintenance pattern.

Drainage from this area is relatively straightforward, in that the main route is Matthew's Close Dyke, into Southwall Sewer, into Upper and Lower Penfield Sewers, then pumped into the North Stream at Hacklinge Pumping Station. The whole of the Hacklinge Marsh is an important SSSI.

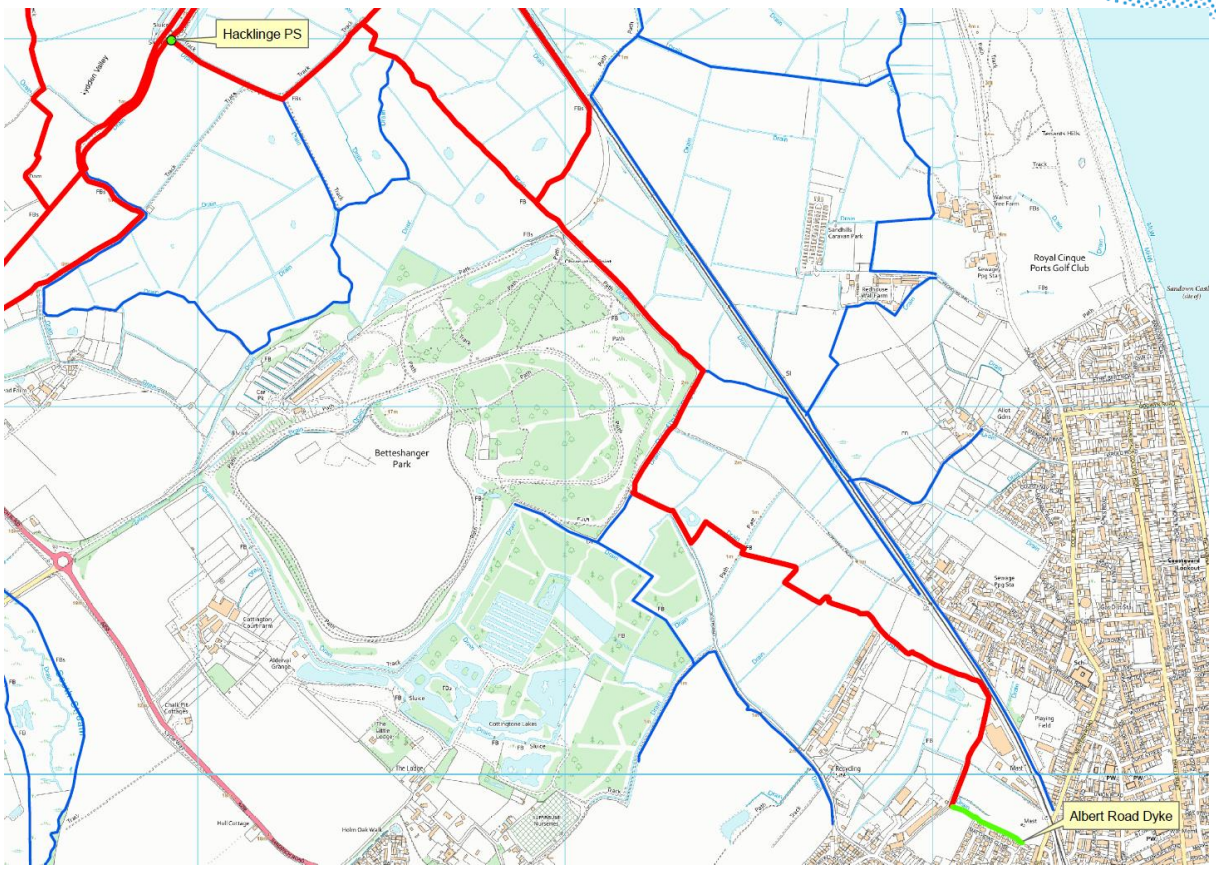


Figure 23 - Local drainage ditches

Further investigations and surveys to be done

We are working with Dover District Council (DDC) and other partners to ensure that the water level in the ditch doesn't prevent the current surface water systems from discharging efficiently. This includes ensuring continued maintenance of both the nearby ditches (Figure 22, A & B) as well as understanding the impact of any additional surface water discharges from further phases of the Court Marsh Road housing development.

6.7 Surface Water and Coastal Flooding

What we know

The Section 19 report from KCC into the 2020 flooding states the following:

"Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events. The Environment Agency's map indicates that the areas at a high risk of flooding from surface water sources include areas that experienced flooding during the August flood event."[14]

[14] KCC Section 19 investigation Deal report v4.0 August 2020

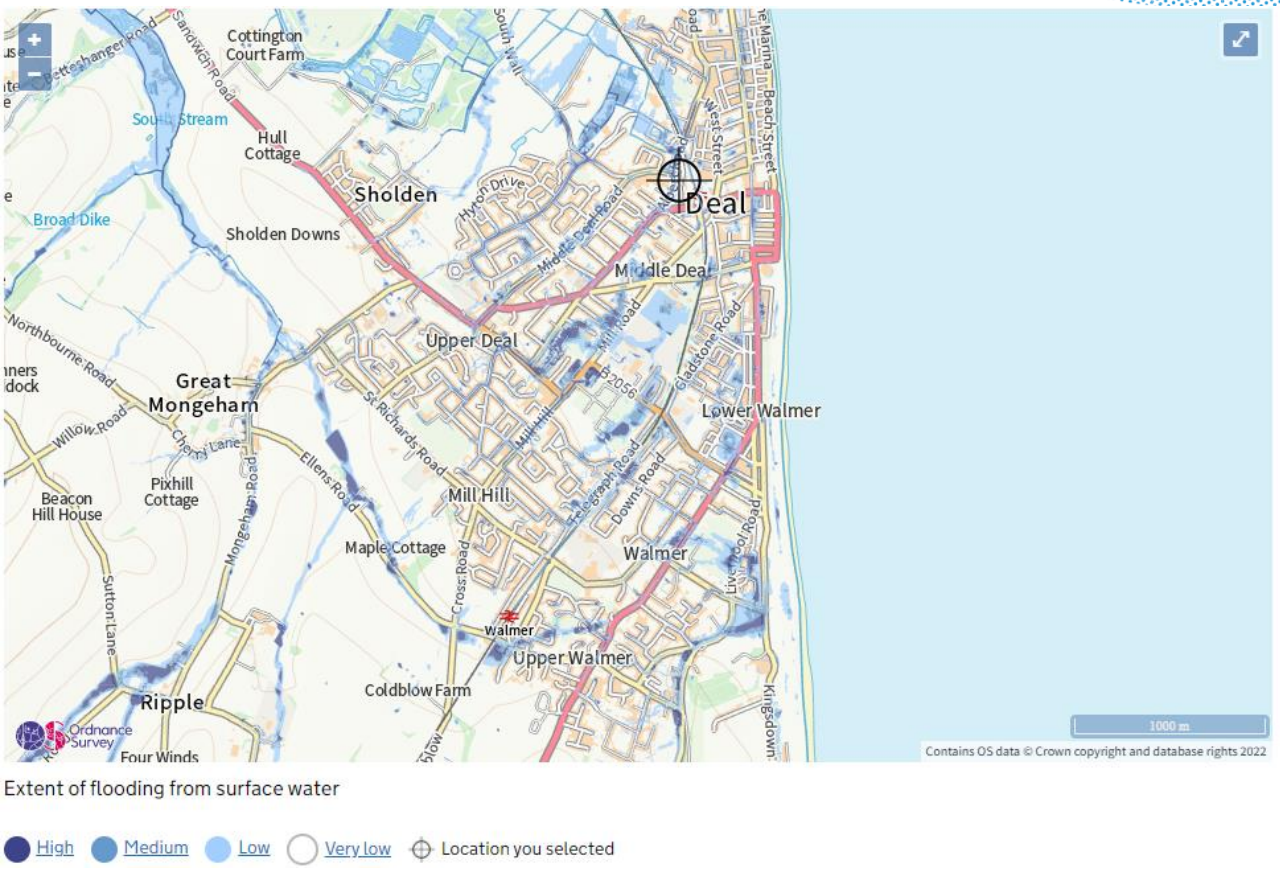


Figure 24 – Extract from the Environment Agency's Flood Risk from Surface Water map[15]

Further investigations and surveys to be done

We are looking to work with the Environment agency, the IDB, DDC and KCC to understand if there is any contribution to the flooding of Albert Road or impacts on the combined sewer system from other flooding sources.

6.8 The Deal system and impacts on Albert Road

As you can see from the above, there are many aspects to the surface water and drainage system within the Deal catchment that can interact and interfere with each other. Appendix C shows how the additional data that we want to capture around the catchment will be combined to provide a holistic view for rainwater management. This is an ongoing process. Early small interventions with low risk of unintended consequences can be enacted quickly. As we gain a more detailed understanding of the catchment then our understanding of the risks associated with a larger scale more complex intervention improves, which provides confidence in its delivery.

Also due to the topography and the legacy layout of these systems, Albert Road is the location where these issues first show themselves. Section 5.0 discussed some potential types of interventions that could be used within the catchment to reduce the impact of these systems on Albert Road. Section 7 looks at some specific interventions for Deal that could be utilised.

[15] Your long term flood risk assessment - GOV.UK (check-long-term-flood-risk.service.gov.uk)

7. What are the next steps for Albert Road & the wider Deal catchment?

There are many interventions that could be considered for Albert Road and the Deal catchment. Section 6 sets out the additional investigations that we intend to undertake with our partners in the Deal catchment. These investigations will further influence our understanding of the issues, risks, impacts and benefits of various interventions.

Some actions can be implemented immediately, some will require design and procurement time, and others will need to be trialed and/or modelled to ensure that the potential impacts are well understood. Southern Water along, with its partners, will log and monitor these interventions, applying them as per the staged approach described in Section 4.2.

The sections below list some of the interventions that have been completed, are in progress or will be considered and modelled to assess their impact. This list is not exhaustive, and we intend to continuously review it as the pathfinder project progresses.

7.1 Albert Road

Southern Water and Kent County Council will undertake remedial work identified by the latest CCTV surveys in December 2021/January 2022. In addition to this we are working with KCC on ways that this drainage could be improved.

Figure 25 – Existing manhole connection for the Albert Road surface water sewer

KCC are looking at replacing the existing gullies with new ones with a larger outlet diameter for connection to the existing sewer as well as installing additional gullies and rebuilding an existing gully chamber.

We are also looking at increasing the size of the surface water sewer where it turns 90 degrees to connect into the ditch, including ensuring the full outlet diameter is available at the outfall. However, the route of this sewer is in a constricted area and is likely to contain many services, therefore some investigation into the most appropriate solution is required.

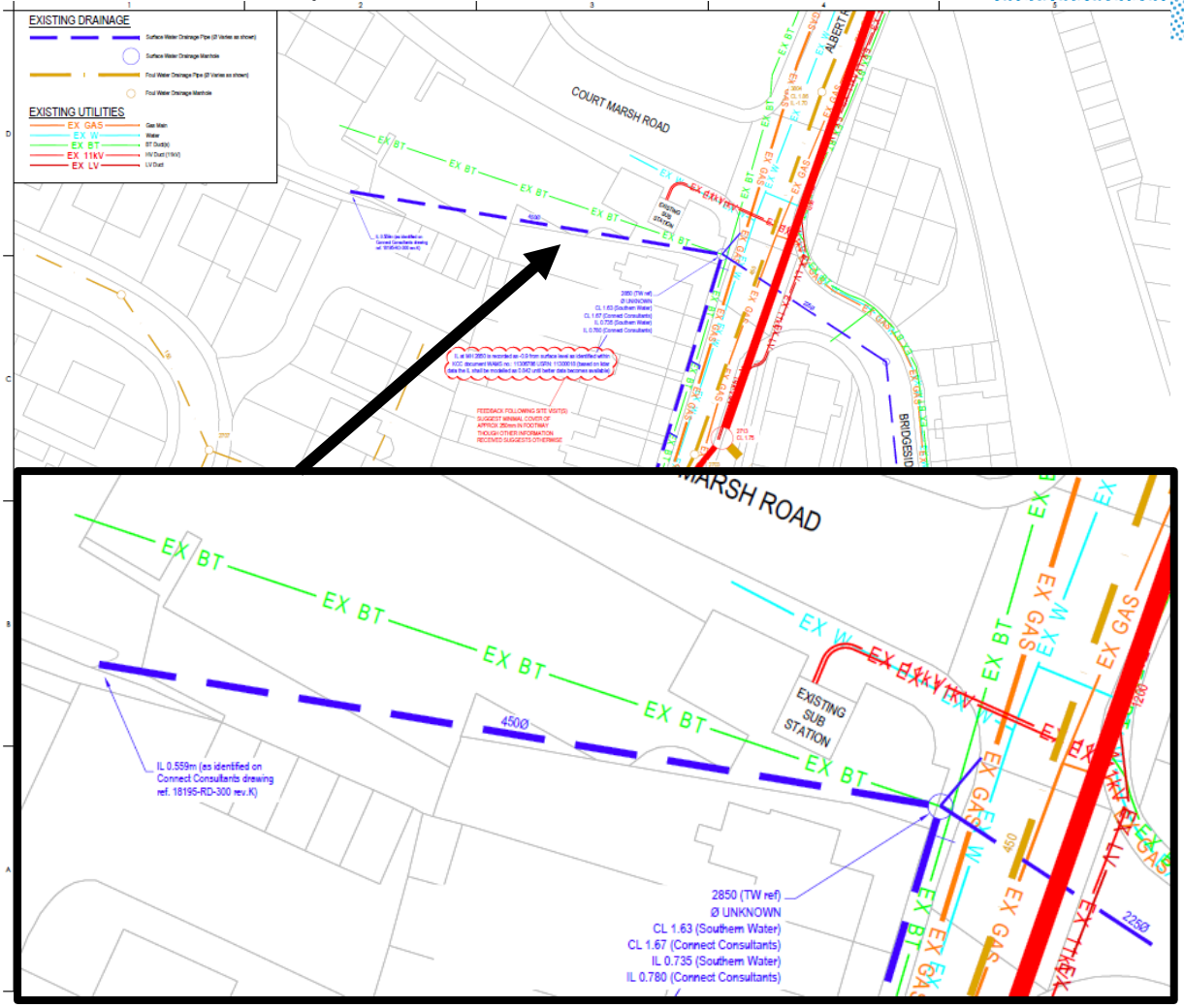


Figure 26 – Indicative route of new larger surface water sewer

These works are to enable water to leave Albert Road as quickly as possible if standing water starts to collect on the road, however as Figure 10 shows this is only one element of the system that can influence flooding at Albert Road.

7.2 Deal Catchment

	• We will review the sensors in the sewers at Albert Road that provide warnings of sewer surcharges and investigate whether they are operating correctly and that the triggers are appropriate. • Where we believe overland flow is a contributor to Albert Road then we will look to work with KCC to either remove the cause e.g., blocked gullies or pipes or increase the gully capacity & pipe capacity or diverting overland flow to other locations..
	*Golf Road Pumping Station Pumping Station:* The following interventions are being considered: • Additional level monitoring on the pumping station wet wells to identify issues, such as blockages early (see section 8), and inform the operations staff for action. • Additional pressure monitoring on the rising main to Weatherlees Wastewater Treatment Works to identify bursts as soon as possible. • Control system improvements to improve the resilience of the site. • Automation of the storm pump testing to reduce the manual requirement and ensure it can be efficiently and frequently tested. • Improve the representation of Golf Road Pumping Station within the catchment model to allow more accurate modelling to inform decisions about sustainable growth and new developments
	*Storage Tanks:* • Confirm that all the catchment storage tanks on the Deal sewer network are free of siltation and operating properly. • Model alternative methods of control of the outlet of the storage tanks to understand the benefits during different intensities of storm. *Additional catchment data:* • The Deal Catchment is complex but passive. We are looking to put additional sewer level monitoring devices within the catchment to provide real time data on the sewers to provide Operators with invaluable live insight into the whole system and to provide more data to improve our modelling and system optimisation. • The GIS data and network model have historically been updated separately. New surveys ensure that both records are updated together however this has not been undertaken historically. An exercise to identify where data is missing and prioritise collection (depending on flooding/Storm Overflow discharge benefit) will be undertaken.

	*Impermeable area management* • Domestic 'slow the flow' solutions' – initially a pilot programme of smart water butts within the catchment to assess the benefit, adoption and maintenance requirements. • Large scale roof drainage removal – work with partners to identify large areas of roof that may be connected to the combined sewer system, and they could be diverted to infiltration solutions (sustainable urban drainage type) or the surface water system. • Highway drainage disconnection – work with KCC to identify areas of highway drainage that could be disconnected from the combined sewer and connected to the surface water system or an infiltration solution (sustainable urban drainage type).
	*Local drainage:* We are looking to work with Dover District Council (DDC) and other partners to ensure that the water level in the ditch doesn't prevent the current surface water systems from discharging efficiently. This includes ensuring continued maintenance of both the nearby ditches (Figure 22, A & B) as well as understanding the impact of any additional surface water discharges from further phases of the Court Marsh Road housing development.
	*Grey solutions:* There is currently no indication that additional storage or upsizing of combined or foul sewer pipes is required. However, as the survey data is incorporated and the network model rerun these will continue to be a potential option.

The above interventions are indicative at this stage and would need further investigation of their benefit and design and then agreement with the community and delivery partners. In particular for any solutions below ground, they would need:

- Confirmation of appropriate ground conditions to slow and/or infiltrate the flow. Including a specific ground investigation, and this should include borehole permeability tests, or better, soakaway tests carried out in inspection pits dug to the depth of the proposed soakaway.
- Sufficient space without significant utilities infrastructure (electrical cables, gas pipes, fibre cables).

Stage	Description	Types of intervention	Timescales
Stage 0	Initial surveys and study with identification of early low risk interventions and any additional surveys and modelling requirements	• Replacement of flap valve • New DWF pumps in Golf Road Pumping Station • Non-return valve replacement • Washwater resilience	• Complete • Complete • In progress • In progress
Stage 1	Immediate low risk interventions and small trials (SWS and partner organisations)	• Replace the Albert Road gullies. • Enlarge the surface water outfall pipe • Smart Water butt trial • Golf road control and resilience works.	• Summer 2022 • Spring/Summer 2022
Stage 2	More complex interventions and scaled pilots (SWS and partner organisations)	• SuDs for Schools engagement • KCC highways disconnection	• Autumn 2022 • Autumn 2022 (depending on engineering requirements)
Stage 3	Larger scale investments to achieve pathfinder outcomes (SWS and partner organisations) - Model updates - Large Scale interventions	• Remove large roof areas from the combined system and connect to the surface water or SuDs solutions. • Smart control of the catchment storage tanks	• Autumn 2022 onwards depending on partnership and community engagement. • 2023+ depending on modelling and EA agreement

Table 2 - Planned interventions for the Deal Catchment

8. Partnership and Community working – what can you do to help?

As shown in section 3.0 of this report "water companies are not solely responsible for rainwater (surface water) management; they are one of many organisations involved in ensuring communities are protected. The change in the weather is testing all sectors of UK society, and we are all moving towards changes in population and in weather conditions that we have never before had to plan for"[16].

To achieve what is needed utilities, councils and communities need to work together to achieve mutual benefits. Southern Water and its partner organisations KCC, DDC, the IDB and EA have committed to doing this by engaging with each other and the community to solve the problems.

So how can the community help? We would be grateful for support from the community in the following ways.

Support further investigations for Albert Road:

We are interested in time and date stamped photos and videos to help us understand the Albert Road flooding. With time and date stamped evidence, and a clear location, we can match this information with other information to better understand how the whole system interacts. This includes:

- Photos and videos of overland flow.
- Photos and videos of flooded areas.
- Photos and videos of the level of the surface water ditches.
- Ensuring that reports of blocked highway gullies are made to KCC.

Protect Golf Road and other Pumping Station, Foul and combined sewers

Fat, oil and grease[17]

Fat, oil and grease (FOG) often ends up being washed down the kitchen sink. Over time, FOG hardens to a concrete-like material and restricts the flow of wastewater in the pipes or even block them. These blockages can cause wastewater to back-up through toilets and sinks into homes and businesses, or escape through manholes into streets and rivers

Unflushables[18]

Items such as wipes, nappies and cotton buds are the scourge of our sewers - they create blockages, cause flooding in homes and damage the environment. Every year in England and Wales water companies deal with over 300,000 blockages – thousands of which see people's homes and belongings ruined by sewer flooding. Wastewater companies are still spending around £90 million each year clearing blockages nationwide, while damage to the environment by the plastics used in unflushable items has become a real focus.

Our sewers are only designed to take away the three Ps – pee, poo and paper.

[16] 21st Century Drainage Programme – the context, Water UK
[17] Fat, oil and grease (southernwater.co.uk)
[18] The Unflushables (southernwater.co.uk)

In the kitchen, follow the below top tips to avoid fat, oil and grease building up in the sewer.

- Use containers – butter tubs, yoghurt pots or jam jars can all be used to collect cooled fat and oil – then just put them in the bin
- Clear plates – scrape any leftover food or grease and fat residue from plates, pans or cooking utensils into the bin before washing up
- Bag it and bin it – put a bin in the bathroom for anything that isn't pee, poo or paper. Perhaps use scented nappy sacks or dog poo bags (degradable if possible) to throw away any nappies, sanitary items or condoms.
- Compost food waste – collect uncooked fruit and vegetable peelings for use as compost in the garden.
- Strain the pain – a simple sink or drain strainer can stop food and hair getting down the pipes.

Protect surface water and combined sewer capacity – existing developments

Capacity in the existing sewer systems can be released by using less water, removing surface water connections and slowing the flow

Households:

- Install water butts and planters on properties that take the rainwater from roofs and either slow its connection to the sewers or ideally divert to a soakaway.
- Consider converting paved, impermeable driveways into permeable surfaces?
- Try to ensure that existing impermeable surfaces drain to a permeable surface rather than the road or the sewers.
- If possible, ensure existing drainage is disconnected from the combined and surface water sewerage systems
- Report blocked highway gullies and drains asap to KCC
- Report blocked sewers to Southern Water.

Target 100[19]

Population growth, climate change, increased urbanisation and environmental protection mean we all need to change how we use and value water. Target 100 is a commitment by Southern Water to its customers to support them to reduce personal consumption to an average of 100 litres each per day by 2040; while we reduce leakage by 15% by 2025 and 40% by 2040. As well as making sure there is enough water to go round, households could cut their bills and less water used mean less water going into the foul and combined sewers creating more capacity.

Community, Businesses, Developers & Partnerships:

Engage with SWS, KCC, DDC and other partners to identify areas for rainwater (surface water) removal, ownership and maintenance. As described in Section 5 there are multiple benefits that can be achieved for the whole community.

Protect surface water and combined sewer capacity – future developments

Households:

- If a house is extended and creates additional roof areas (urban creep) if possible, make sure these drain to a soakaway or surface water system or consider green roofs.

[19] Target 100, together let's hit target 100. (southernwater.co.uk)

- If developing a drive or garden, install permeable paving rather than connect to the surface water system or drain to the highway system.
- Avoid misconnections - misconnections can happen during work to extend or improve a house, when a new house is built or simply when a new appliance is plumbed in. If any plumbing drains to a surface water sewer, the wastewater will pollute local watercourses. Similarly if clean water drains are misconnected, they can overload the foul sewer and lead to flooding. It's the homeowner's responsibility to ensure there are no misconnections at their property. For clarify of action to take go to ConnectRight or contact Southern Water directly. Alternatively, visit the WaterSafe website.[20] for a list of plumbers in your area.

Community, Businesses, Developers & Partnerships:

- Ensure new developments are sustainable i.e. they are not connected to the combined sewer and where possible also avoid connection to the surface water system to allow rainwater to infiltrate to the water table. Thus increasing the water availability for rivers and streams for biodiversity and for extraction for drinking water.

[20] Bad plumbing and pollution (southernwater.co.uk)

9. Future sustainable Growth

Figure 27 –Dover District Council Local Plan – Proposed Draft Local Plan Housing Allocations[21]

Southern Water is looking with our partners, DDC and KCC at how rainwater (surface water) management can be better considered and incorporated into the sustainable growth plans for Deal. These conversations could include areas such as:

- More detailed consultation on specific proposals, including small scale developments
- Support to encourage more use of sustainable urban drainage schemes and nature based solutions, including upstream 'slowing the flow' type measures.
- Ensuring that post construction, the installations comply with the requirements
- Collaboration to make policies more aligned with sustainable drainage and climate change requirements.

[21] Deal (arcgis.com)

10. Conclusions

A large number of historical investigations have been undertaken into the Albert Road flooding issues, this pathfinder project is looking to bring the data and learning from those historical investigations plus additional surveys, new techniques and a collective understanding, to produce a holistic view of how the combined and surface water systems can be made more resilient.

This report summaries the investigations completed and potential interventions. As the pathfinder project progresses through stage 1,2 & 3 further investigations will be completed and the model updated. Where interventions can be identified and delivered quickly, we are working to do so, to provide immediate benefit and to allow us to monitor the extent of the benefit.

This work must be done as a partnership due to the complexity of the various systems. Albert Road is a vulnerable location and therefore we must all work together to build that resilience, particularly as extreme rainfall events are now likely to happen more frequently.

Appendix A1 – Deal Action Taskforce Attendees

- Natalie Elphicke MP (Co-Chair)
- Ian McAulay, Southern Water (Co-Chair)
- Cllr Trevor Bond, DDC, KCC
- Roger Walton, DDC
- Max Tant, KCC
- Earl Bourner, KCC
- Simon Parker, Southern Water
- Andy Adams, Southern Water
- Nick Mills, Southern Water
- Rob McTaggart, (Stantec) Southern Water
- Nicole McNab, Southern Water
- Penny Green, (Stantec) Southern Water

Appendix A2 – Deal Technical Working Group

- Max Tant, KCC
- Neil Clarke, KCC
- Alex Bruninger, KCC
- Earl Bourner, KCC
- Nick Mills, Southern Water
- Rob McTaggart, (Stantec) Southern Water
- Penny Green, (Stantec) Southern Water
- Roger Walton, DDC
- Keith Watson, DDC
- Pete Dowling, IDB Stour (as required)
- Ed Quantrill, Environment Agency (as required)
- Kate Harris, (Stantec) Southern Water (as required)
- Dan Collier, (Stantec) Southern Water (as required)

Appendix B – How does Urban drainage work?

B.1 The development of the urban drainage system

Victorian drainage – single pipe solution

The modern built sewerage network began to appear in the mid-19th century. Overcrowded cities had no means to control the disposal of wastewater. Rivers were overloaded and public health was under threat. Over the next 70 – 100 years thousands of kilometres of sewers were laid. These combined sewers, as we know them today not only took wastewater from homes but also rainfall runoff from paved and roofed area. Roofs and Paved areas (Urbanisation) and the provision of artificial drainage, or sewer systems, has a twofold effect on the natural drainage process. Firstly, it reduces infiltration thereby increasing the volume of run-off. Secondly, artificial surfaces, pipes and channels convey run-off more rapidly, making drainage areas more responsive to short duration/high intensity storms. This two-fold effect significantly changes the rates of run-off, by a factor of 10 or more when compared to a natural drainage system.
In addition to the intensification of peak flow, the single pipe system mixes untreated wastewater and rainwater (surface water) runoff. Conveyance capacity and disposal capacity at wastewater pumping stations and treatment works has traditionally been limited such that during heavy rainfall (to protect life and property) Storm Overflows operate to discharge a mixture of 'clean' surface runoff and screened untreated or partly treated wastewater, see Figure 28.

Early 20th Century drainage - Two pipe solution

With the advent of modern sewers and cleaner streets it became feasible to separately drain the two flows, wastewater and rainwater (surface water). Between the first and second World Wars the building of new combined systems declined in favour of the new separate systems. The roofs and paved area were drained by a surface water system and the wastewater was drained by a foul water system. These foul water systems, from new developments would typically connect to their older combined systems for conveyance and disposal at wastewater treatment works. Surface water systems would discharge direct to receiving waters (water courses, estuaries and coastal waters). Although separate systems removed the need to install new overflows, the rapid collection and conveyance of rainwater away from where it fell, continues to cause problems particularly in intense storms.

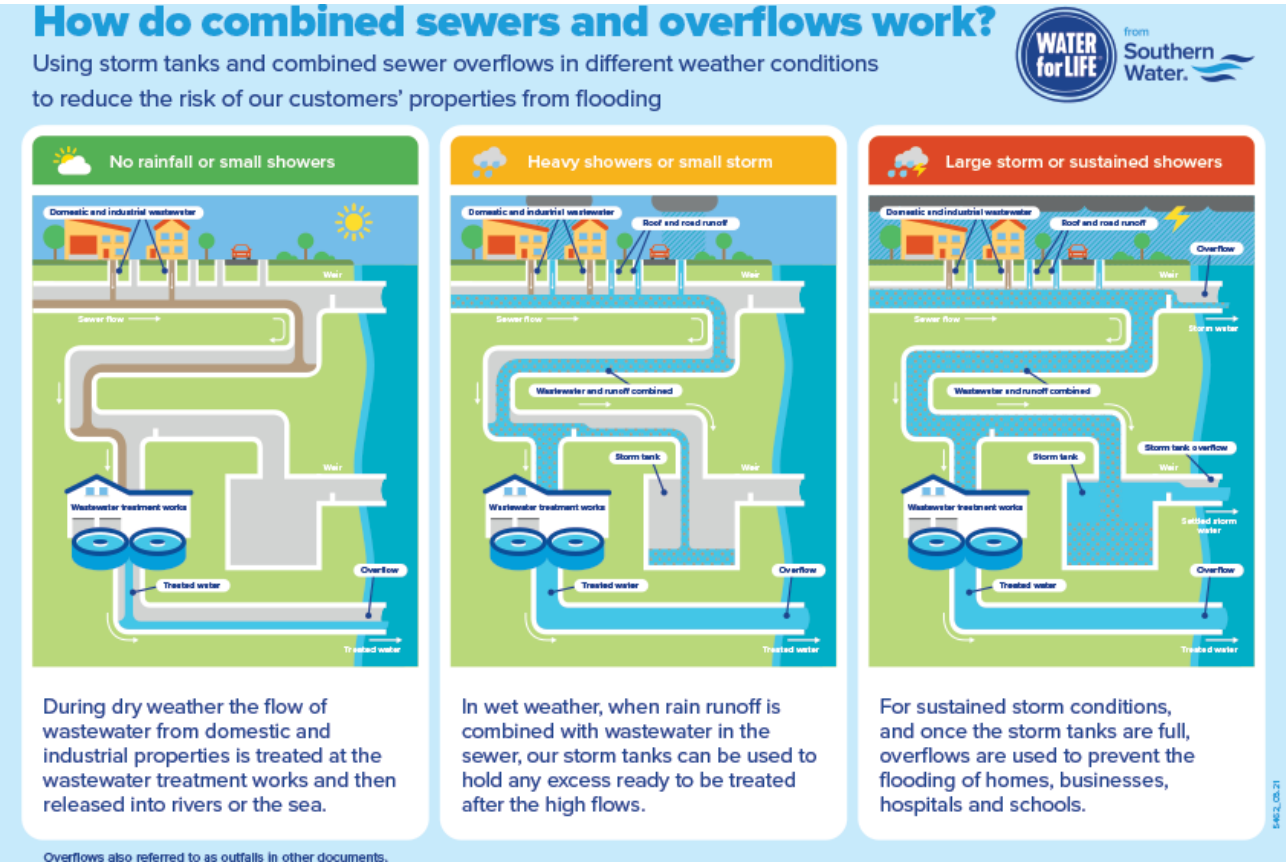


Figure 28 – How do combined sewers and overflows work

Late 20th Century drainage – Sustainable drainage

In the last 30 years planning regulation has changed and there is now a requirement to reduce peak runoff rate from urbanized areas. Flows from new developments are restricted to 'greenfield' runoff i.e. a rate equivalent to that of a green field and are typically built with a Sustainable Urban Drainage System (SuDs). These systems closely mimic a natural drainage system.

Retrofitting Sustainable drainage

Homes and paved areas drained by combined sewers can be retrofitted with a range of Sustainable Urban Drainage systems (SuDS) features which either 'slow the flow' or fully disconnect the surface water flow from the combined sewer system. Both methods reduce the intensity of the peak flows to a more consistent level and mimic natural drainage systems.

By using sustainable drainage systems they can also reduce flooding in the catchment, increase infiltration to replenish ground water systems and restore capacity in the network. They also reduce pressure and therefore increase the asset life of existing infrastructure. This also results in Storm Overflows operating less often with more flow being treated at wastewater treatment works before discharge to the environment.

B.2 The contribution of Legacy Housing

Legacy houses are houses that are connected to the combined system. As you can see from Figure 29 only 13% of the water that falls on a home with sustainable drainage will drain to the sewer therefore significantly reducing the contribution to, pressure on and risk to the downstream assets.

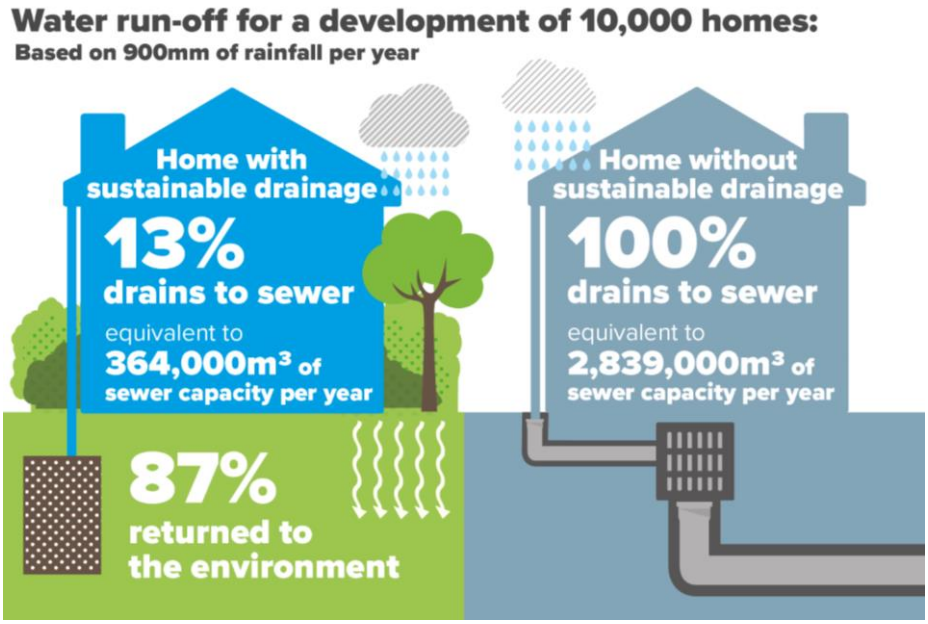


Figure 29 – The impact of legacy drainage systems

B.3 Highway Drainage system

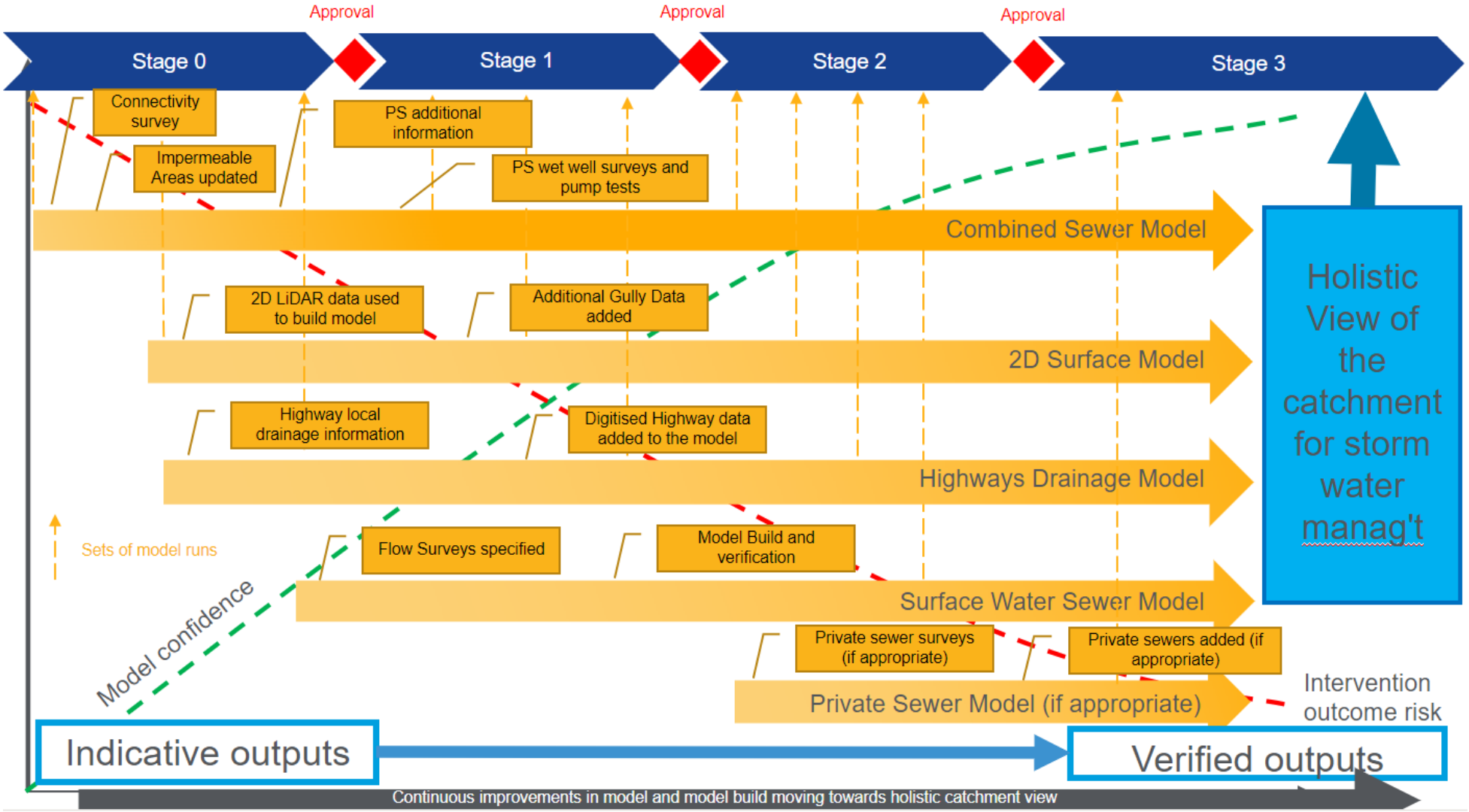
Road or Highway drainage i.e. road gullies, also connect to surface water systems. Often this is the same surface water system that takes roof drainage into the single pipe/combined system described in Appendix B.

When rain falls on the impermeable highway areas this can contribute to rapid increases in flow to the drainage system an overwhelm it. In particularly intense storms and/or if gullies are blocked then overland flow can occur. This overland flow can cause flooding or allow rainwater to enter combined sewers which are not always designed for these extreme flows.

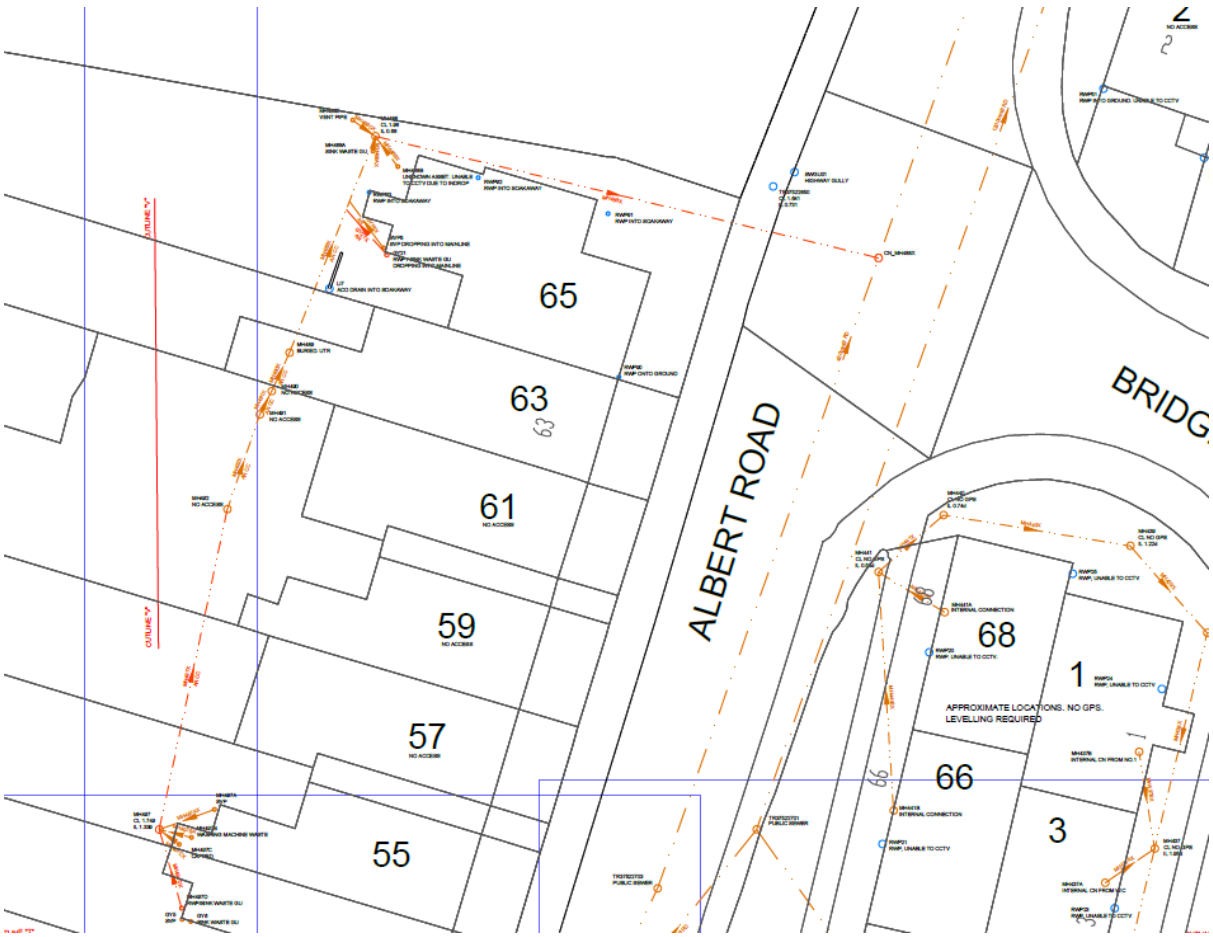
B.4 Internal Drainage Board

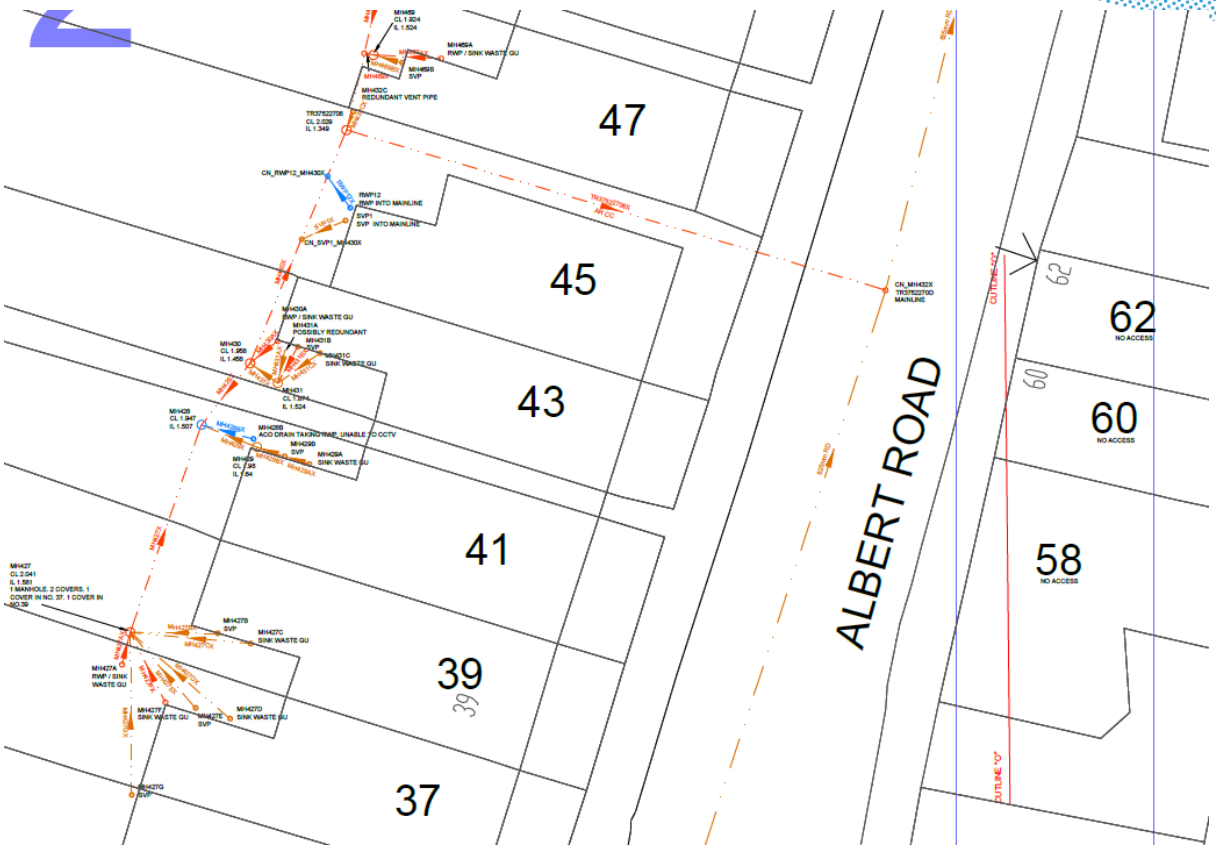
Across England there are a number of Internal Drainage Boards who work in partnership with local councils, the Environment Agency and other local partners to reduce the risk of flooding to agricultural, residential and industrial land, and are overseen by the Department for the Environment, Food and Rural (DEFRA). They carry out an annual programme of maintenance works to ensure water levels are kept at an appropriate and safe level.

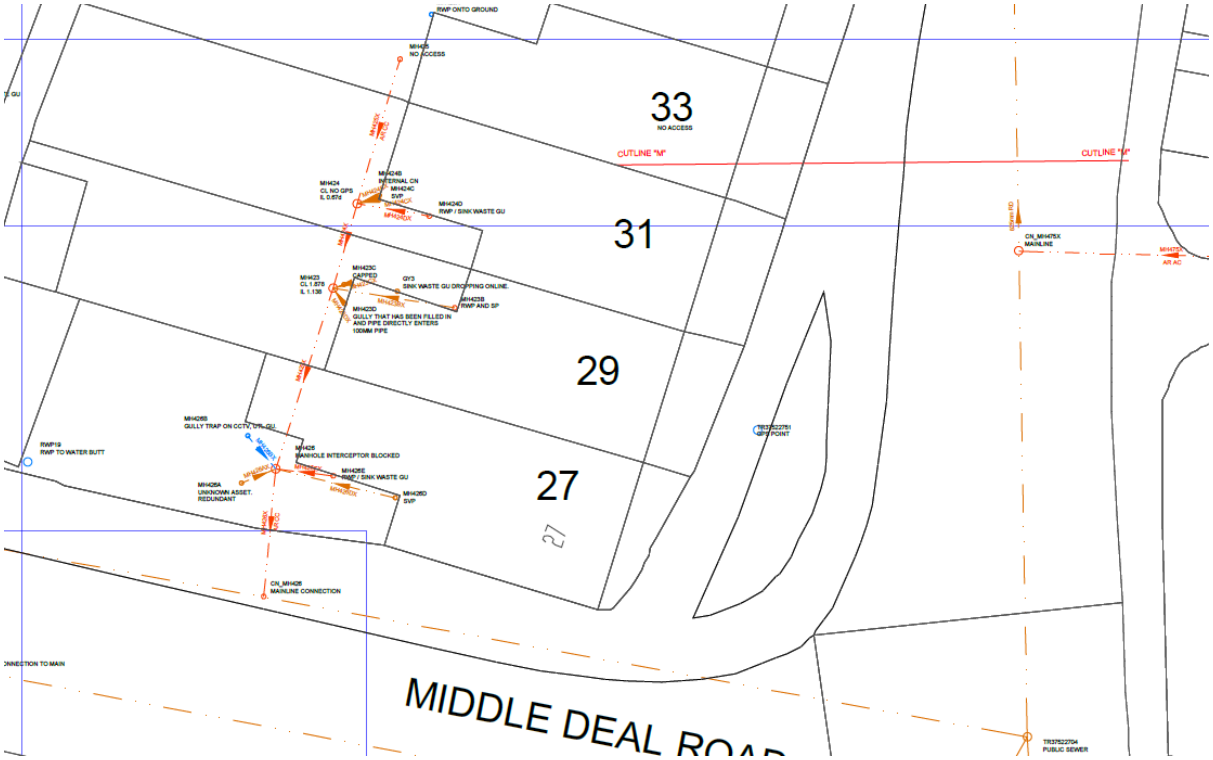
Appendix C – Building a holistic view of a drainage catchment for storm water management



Appendix D – Connectivity survey excerpts







Glossary

Catchment	An area that is drained by a complex sewerage system comprising a network of pipes, wastewater pumping stations, and wastewater treatment works (WwTW).
CCTV	Closed Circuit Television Video sewer inspection refers to the process of using a camera to see inside of pipelines, sewer lines, or drains.
Combined Sewers	The same pipe that serves the purposes of both above.
Storm Overflow	A traditional storm overflow which will have a condition for pass forward flow, an Event Duration Monitor (EDM) a screen and possibly storage volume.
DEFRA	Department for the Environment, Food and Rural
Dry weather flow (DWF)	Dry weather flow is the flow of wastewater in a sewer system during dry weather that presents with minimal infiltration.
Dry weather flow pumps	These are pumps whose size is calculated to pump an agreed volume of flow forward to the WwTW. This flow rate is agreed with the EA.
Emergency Overflow (EO)	Typically, on a pumping station or WwTW only used the site has suffered a power or mechanical failure. For example, Margate Emergency Overflow (EMO) goes straight on to the beach so when the station failed it the last route used.
EDM	Event Duration Monitor
FFT	Flow to Full Treatment
FOG	Fat, oil and grease
Foul Sewer	A Sewer that that is expected to carry predominately foul sewage from toilets, sinks, baths and appliances from a domestic property. The foul sewer also carries wastewater industrial and commercial properties.
GIS	Geographic Information Systems (GIS) are most often associated with mapping and provides geographic information through maps or databases. GIS combines hardware, software and data to provide visual geographic information. Also known in Southern Water as the sewer record.
Hydro-Brake®	This is a device that controls the flow coming out of a tank. Under regular conditions, water passes through the Hydro-Brake® unrestricted and continues downstream at normal levels. At times of high flow e.g. during a rainstorm, the structure's internal geometry harnesses the natural energy of the flow. This holds back the water, releasing it at a controlled rate.
IDB	Internal Drainage Board
Intervention	An action or project being undertaken in order to provide a solution/benefit for the catchment issue. E.g. flooding risk or number of storm overflow discharges.

KCC	Kent County Council
LSO	Long Sea Outfall
Main River	Main rivers are usually larger rivers and streams. The Environment Agency designates these and carries out maintenance, improvement or construction work on main rivers to manage flood risk.
Natural capital	Southern Water defines natural capital as the element of nature that provides value to society.
Network model	A software model representing the piped drainage system through which different rainfall scenarios can be run. To understand the impact on storage capacity, water levels & pumping stations capacity.
No regret intervention	Where it has been agreed through Governance that intervention will provide a benefit with negligible risk of a negative outcome.
Ofwat	The Water Services Regulation Authority
Rainfall scenario	Different types of storms that can be used in a network model. These storms may vary in length or intensity.
Social capital	Social capital is defined as Southern Water's relationships and others' trust in the business.
SWS	Southern Water Services
SSO	Short Sea Outfall
Storm Overflow	Where a combined sewer discharges a dilute but untreated mix of wastewater and rainwater into a water body during rainfall. The term is synonymous, for the purposes of this document, with the terms, combined sewer overflow, intermittent discharge and storm tank overflow.
SuDs	Sustainable Urban Drainage systems
Unflushables	Items which should be disposed of in the bin, not the toilet.
WwTW	Wastewater treatment works