

Kent County Council

Flood Risk to Communities Gravesham



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In partnership with:

Gravesham
Borough Council



 **Environment
Agency**

This document has been prepared by Kent County Council, with the assistance of:

- **The Environment Agency**
- **Gravesham Borough Council**
- **Southern Water**
- **North Kent Marshes Internal Drainage Board**

For further information or to provide comments, please contact us at flood@kent.gov.uk

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Introduction to Flood Risk to Communities

This document has been prepared for the residents and businesses of the Gravesham Borough Council area. It provides information on the nature and magnitude of the flood risk across the district, and outlines the existing and proposed approaches to manage the risk identified.

It has been developed with the help and support of the other Risk Management Authorities (RMAs) that operate in Gravesham. These include the Environment Agency, Kent County Council, Gravesham Borough Council, the North Kent Marshes Internal Drainage Board and Southern Water.

This document aims to provide a summary of:

- the main flood risks to the area,
- the key flood risk management assets/structures,
- any flood risk management plans or strategies that are in place and,
- where to find further information.

All links to plans, strategies and other pertinent information have been shortened to facilitate the use of non-electronic versions of this document.

This is a living document and will be periodically reviewed and revised as any relevant new information or plans become available.

Gravesham overview

The district of Gravesham sits on the north Kent coast. It covers an area of 99sq km and has a coastline of 12 km. Medway lies to the east, Dartford to the west, Sevenoaks to the south west and Tonbridge and Malling to the south east.

Of the district's 12 km of shoreline, 6 km is defended against flooding and coastal erosion by the Thames Tidal Wall, comprising raised reinforced concrete and sheet piled walls. The remaining frontage consists of marshy ground protected by an earth embankment. There are also a significant number of floodgates situated along the tidal defence line. These are mostly privately operated gates whose operation is overseen by Gravesham Borough Council. In combination, these defences offer a '1 in 1000 year' standard of protection from flooding from the tidal River Thames.

The only major historical flood event that is known to have affected this area occurred during the wider East Coast flooding of 1953. This was caused by the combination of a high spring tide with an area of deep low pressure that tracked down the North Sea; together these caused a damaging storm surge that affected much of the East Coast of England. As a result, the Thames Estuary tidal flood defences were improved throughout the 1970s and early 1980s. The nearby Dartford creek barrier and the Thames Barrier at Greenwich were included within these improvements.

The topography within Gravesham generally rises from the flat and low lying marshland in the north to the steeper and higher land to the south and east of Cobham where the North Downs begin to rise.

The chalky and freely draining nature of the most of the borough means there are few open watercourses on the surface. The most notable is the Ebbsfleet, a main river that forms the western boundary of the Borough with Dartford. The river emerges north of the A2 at the foot of the Ebbsfleet Valley and follows a course via the Swanscombe Peninsula towards its confluence with the River Thames at Robins Creek in Northfleet.

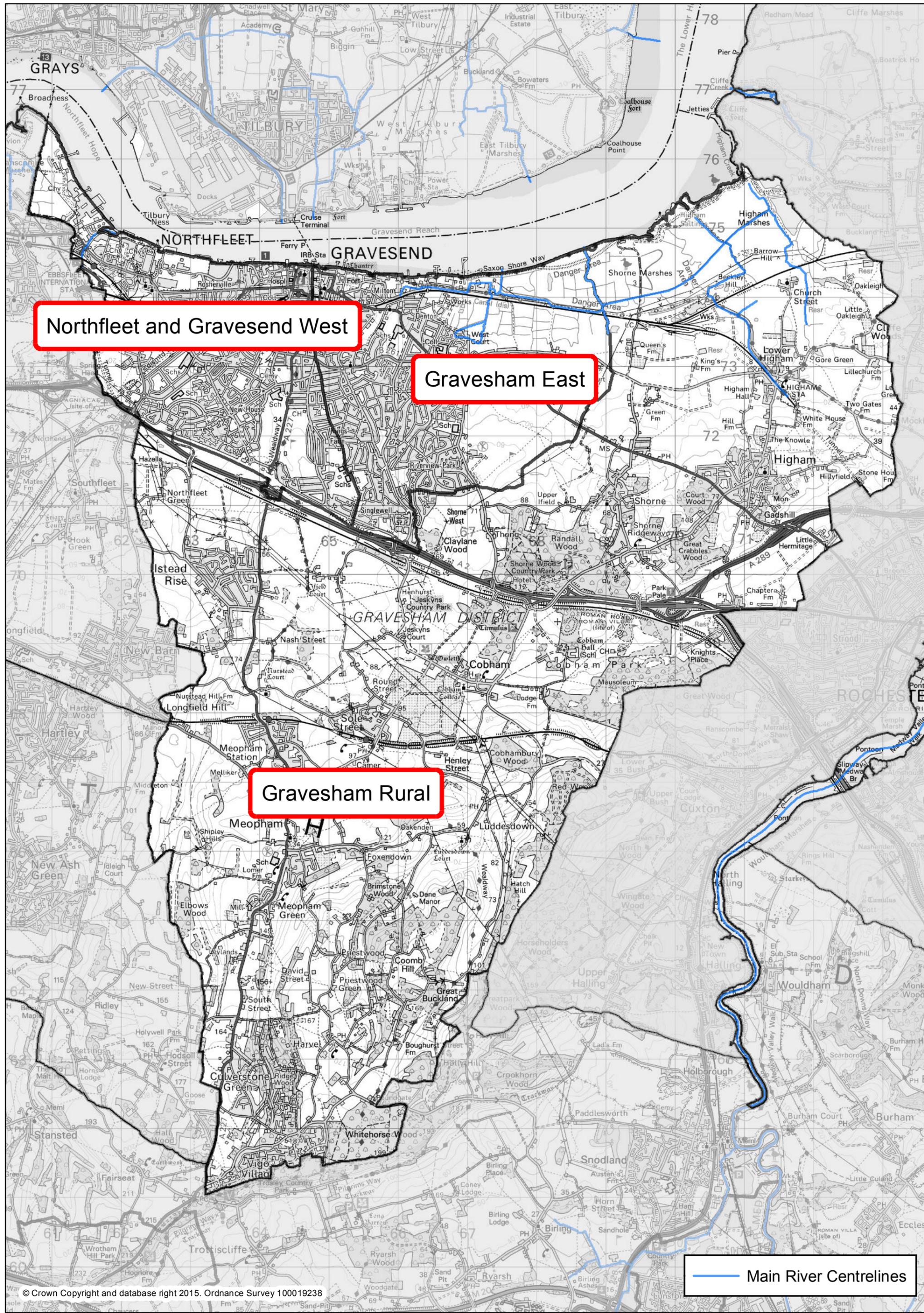
At present the Ebbsfleet holds little water, partly owing to dewatering to allow for extraction of chalk in Eastern Quarry to the west. In the near future, with the redevelopment of the quarry, this will no longer be necessary and the water levels in surrounding aquifers are likely to rise leading the Ebbsfleet flowing.

Streams emerge from the ground at the edge of the marshland around Lower Higham and Church Street. The marshes are then drained to the Thames through a network of man-made ditches, dating back to medieval times when the land was reclaimed for grazing. The man-made feature of the Thames & Medway Canal sits above the marshes, retaining water artificially.

Flooding from the district's main rivers is overseen and managed by the Environment Agency. The Environment Agency is also responsible for defining the extent of the flood zones, which are usually derived from detailed computer models.

Flooding from ordinary watercourses, surface water and groundwater across the borough is recorded and overseen by Kent County Council in their role as Lead Local Flood Authority.

The borough's administrative boundaries are shown in Figure 1 below.



Northfleet and Gravesend West

Gravesend East

Gravesend Rural

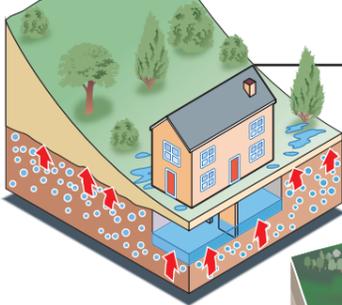
— Main River Centrelines

Sources of Flooding

Flooding sources

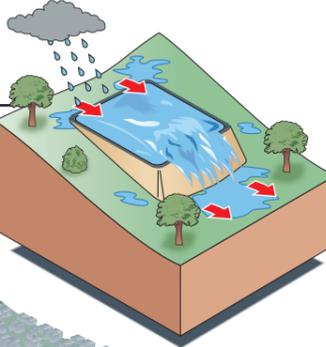
Groundwater
Occurs when water stored in the ground rises to the surface. This is most likely in areas with porous underlying rocks (like chalk).

Risk Management Authority
• KCC As the Lead Local Flood Authority.



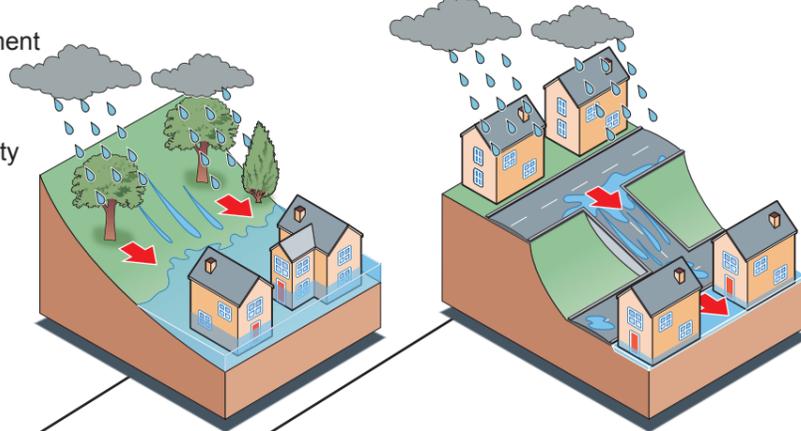
Reservoirs
Reservoir flooding is extremely unlikely to occur. When the amount of water entering the reservoir is greater than the amount the reservoir is designed to discharge, floodwaters may overtop the crest of the reservoir and flow downstream (some reservoirs are designed to manage excess flows in this way). Occasionally, where a reservoir has been poorly designed, the structure can fail, releasing water.

Risk Management Authority
• EA - regulator.
• Reservoir owner - managing on-site risks.
• KCC/KRT - off-site emergency plan.



Surface water
Occurs when the rate of rainfall is higher than the rate at which water can drain into the ground or enter a drainage system, creating runoff, running down hill and pooling in low points.

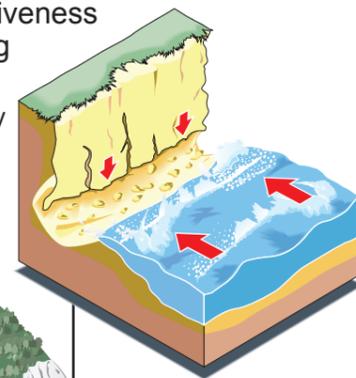
Risk Management Authority
• KCC as the Lead Local Flood Authority and Highway Authority.



- Authorities responsible
- KCC: Kent County Council
 - EA: Environment Agency
 - SW: Southern Water
 - TW: Thames Water
 - IDB: Internal Drainage Boards
 - o Lower Medway Internal Drainage Board
 - o Upper Medway Internal Drainage Board
 - o Romney Marshes Area Internal Drainage Board
 - o River Stour (Kent) Internal Drainage Board
 - o North Kent Marshes Internal Drainage Board
 - DB: District and Borough Councils
 - KRT: Kent Resilience Team
 - RO: Reservoir Operators

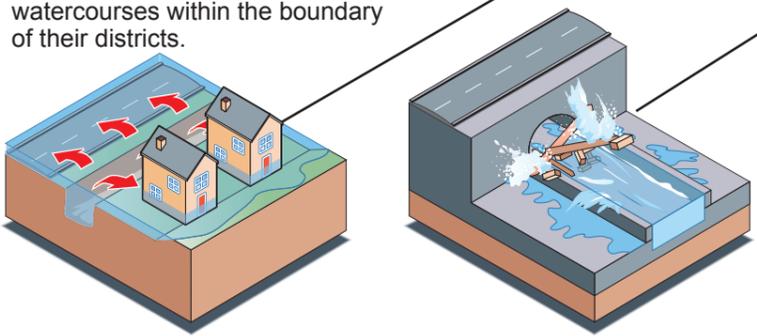
Coastal Erosion
Occurs when the coastline is eroded by the action of the sea, leading to loss of land. Whilst coast protection works are not the same as coastal flood defences, they can contribute to the effectiveness of flood defences along a shoreline.

Risk Management Authority
• DB



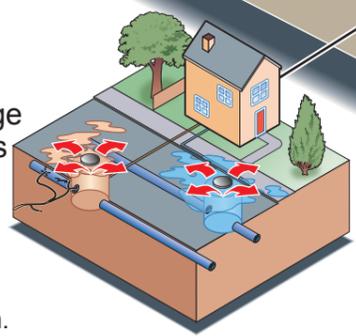
Main river and ordinary watercourses
Occurs when the water flowing in a watercourse (which may be in a culvert), exceeds the capacity of the channel and goes over its banks. The capacity of the watercourse maybe reduced by blockages and debris in the channel. There are two categories of watercourse: main rivers (those which present the greatest risk to life and property), and ordinary watercourses, which cover all other watercourses, including streams, drains and ditches.

Risk Management Authority
• EA - main rivers.
• KCC - ordinary watercourses, outside the boundaries of Internal Drainage Districts.
• Internal Drainage Boards – ordinary watercourses within the boundary of their districts.



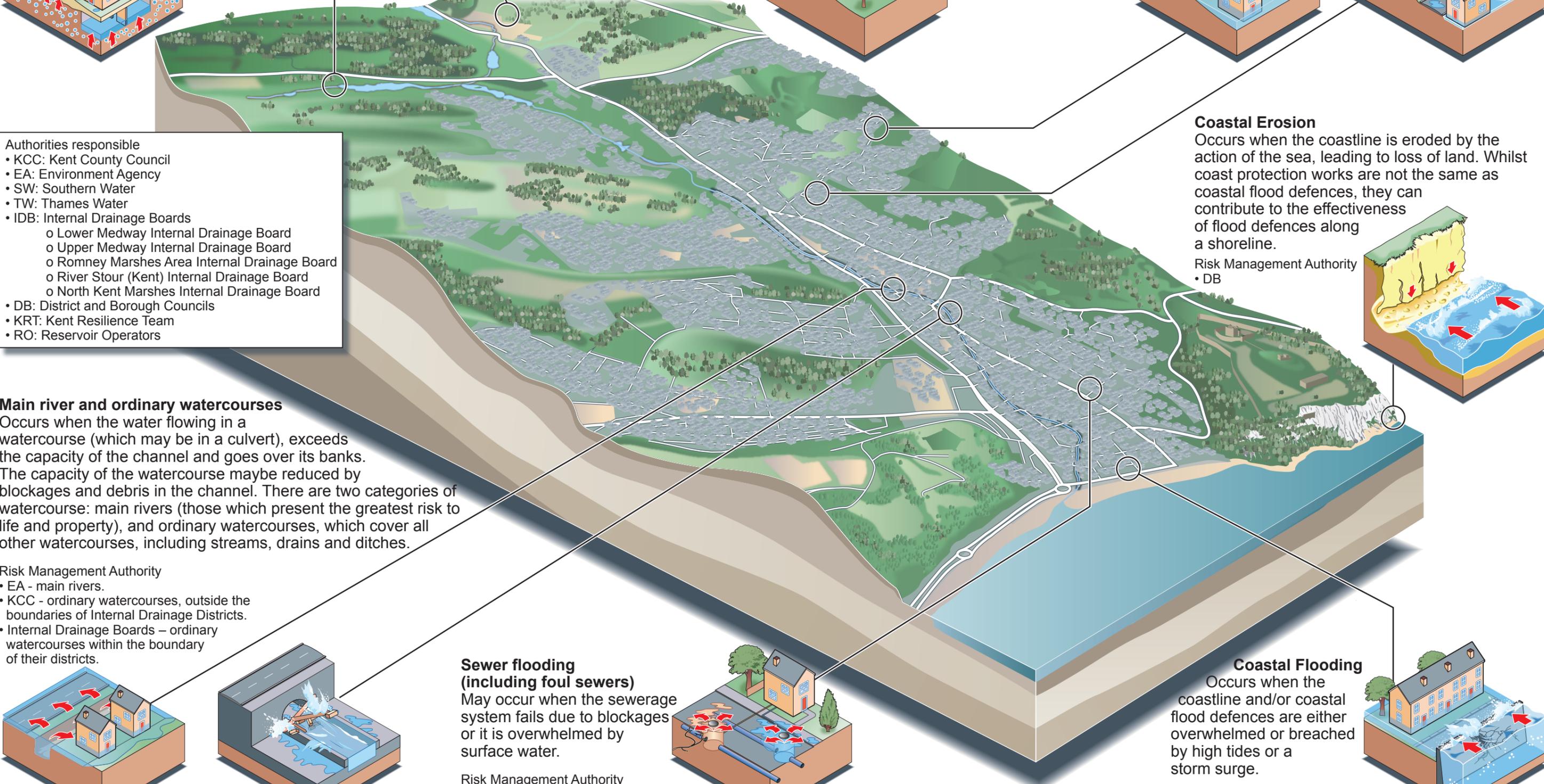
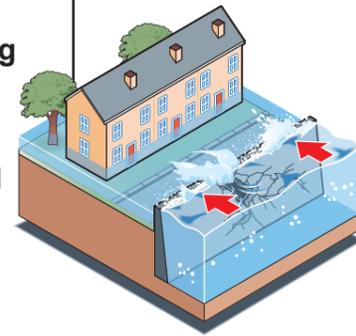
Sewer flooding (including foul sewers)
May occur when the sewerage system fails due to blockages or it is overwhelmed by surface water.

Risk Management Authority
• SW and TW for public sewers
• Sewer owner for a private system.



Coastal Flooding
Occurs when the coastline and/or coastal flood defences are either overwhelmed or breached by high tides or a storm surge.

Risk Management Authority
• EA



Roles and functions in the management of flood risk

This section sets out the roles, responsibilities and functions of the main bodies that have a part to play in managing flood risk. Further information on the nature of these Risk Management Authorities is set out in Section 3.1 and Annex A of Kent County Council's Local Flood Risk Management Strategy.

Kent's Local Flood Risk Management Strategy can be found at <http://goo.gl/hpw021>

The Environment Agency

The Environment Agency (<https://goo.gl/ohv7Jv>) is a non-departmental public body, responsible to the Secretary of State for Environment, Food and Rural Affairs.

They are responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion. This role includes:

- setting the direction for managing the risks through strategic plans,
- providing evidence and advice to inform Government policy and to support other RMAs,
- working collaboratively to support the development of risk management skills,
- providing a framework and capacity to support local delivery.

The Environment Agency also have operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea (as well as being a coastal erosion risk management authority).

As part of its strategic overview role, the Environment Agency is producing Flood Risk Management Plans with partner Risk Management Authorities (RMAs). Flood Risk Management Plans will highlight the hazards and risks associated with flooding from rivers, the sea, surface water, groundwater and reservoirs; they will set out how RMAs work together with communities to manage flood risk.

The Environment Agency have also prepared the National Strategy for Flood and Coastal Erosion Risk Management to clarify their role and to outline the principles that guide flood risk management in the UK (please see the following [Plans and Strategies](#) section for further information).

Their legal powers relating to FCRM are *permissive* and are largely set out in the Water Resources Act 1991 and the Flood and Water Management Act 2010. The term *permissive* means that they have the power to undertake flood and coastal risk management works but are not legally obliged to undertake such activity. The maintenance of a main river channel and its banks is ultimately the responsibility of the riparian landowner. The Environment Agency has powers of enforcement to ensure that riparian landowners keep any main rivers flowing through their land clear of obstruction.

As with any Risk Management Authority, when they use their permissive powers they must comply with European legislation (particularly the Habitats and Birds Directives, the Floods Directive and the Water Framework Directive) and any other legal requirements.

They prioritise their investment in flood and coastal risk management works according to Government policy (and in line with Treasury guidance on economic appraisal). They implement Government policy such that public money is:

- spent on the works that provide the greatest benefits to society,
- is spent efficiently and effectively, and
- reflects a partnership approach.

They assess the costs, economic benefits, environmental impact and flood risk to set their spending priorities.

The Environment Agency also have a regulatory role to consent works carried out by others in, under, over or within eight metres of a main river or any associated flood defence (unless a watercourse is tidally influenced, in which case their permission must be sought for all works within 15 metres). The Environment Agency has statutory byelaws specifying the range of operations that are either precluded from occurring, or that require the Environment Agency's formal consent, within this area.

Their formal permission is required to ensure that those works do not adversely affect the operation of the drainage system or cause unnecessary environmental damage.

The local Environment Agency office should be contacted in advance of any planned works taking place. For further information on any of the above, please contact KSLE@environment-agency.gov.uk

Maintenance Protocol (2013)

Maintaining some assets that have been maintained in the past may no longer be economically justifiable or the work may not have a high enough priority for central government FCRM funding over the longer term. In these circumstances, they might decide not to maintain them in the future.

The River Medway and its tributaries are split by communities according to the risk of flooding and its economic impact, these are known as asset systems. Each system has a System Asset Management Plan (SAMP); this is a long-term plan covering a collection of assets. The SAMP includes information on the costs for maintaining and replacing assets over their life as well as details of the economic benefits within the system. The available maintenance budget is then directed to areas with the greatest need.

Kent County Council

Kent County Council has two main functions that affect flood risk management. They are both the **Lead Local Flood Authority** and the County's **Highway Authority**.

Additionally, and as with any riparian land owner, they are responsible for any land they own, and should maintain all ordinary watercourses and assets in their ownership.

The functions and associated responsibilities of the Lead Local Flood Authority and the Highway Authority are explained below:

Lead Local Flood Authority

Kent County Council (KCC) was made the Lead Local Flood Authority for Kent by the Flood & Water Management Act 2010; this means Kent County Council has a strategic overview role for **local** flooding (which is defined as flooding from surface water, groundwater and ordinary watercourses). As part of their role as Lead Local

Flood Authority, KCC has produced a Local Flood Risk Management Strategy (please see the following [Plans and strategies](#) Section).

Kent County Council also has a duty to:

- Maintain a register and record of structures and features,
- Undertake flood investigations,
- Regulate proposals which affect ordinary watercourses,
- Provide advice and guidance on the provision of Sustainable Drainage within new development as a statutory consultee within the planning process.

As Lead Local Flood Authority, Kent County Council are required to oversee the management of local flood risk; this includes the management of risk of flooding from ordinary watercourses. As such, Kent County Council's formal written Consent is required prior to undertaking any works which may obstruct the passage of water within an ordinary watercourse. Such works can include culverting, diversion and the construction of new dams/weirs, etc. They have powers of enforcement over any works which have been undertaken without consent and should be contacted in advance of the commencement of any proposed works. They can be contacted at flood@kent.gov.uk.

Highways Authority

Under the Highways Act 1980, Kent County Council has a duty to maintain the highways in Kent (apart from those managed by Highways England). One of their responsibilities is to ensure that the highways are appropriately drained.

The Kent County Council Highways and Transportation department maintains the roadside surface water drains (also known as gullies) which allow rain water to run away freely from roads, pavements and cycleways. Table 1 shows the frequency of gully cleansing, according to the type of road.

Table 1. Highways drainage maintenance schedule.

Type of road	Description	Frequency
Flood routes	Roads known to flood frequently	Every 6 months
High speed roads	Roads with a speed limit of 70mph	Every 12 months
Strategic routes	Roads that are the main connection between towns and villages	Every 12 months
Urban and rural routes	All other roads	Targeted maintenance

The map in [Appendix 1](#) shows the major and strategic routes across the Gravesham Borough Council area, along with the highways which receive more frequent maintenance owing to known drainage problems. Any road not depicted in red or green should be assumed to be a normal road that receives targeted maintenance, as required (as outlined in Table 1).

Other forms of drainage (catchpits, soakaways, pipes, highway ditches etc.) are checked and cleaned or repaired when required, or when a problems are reported to us.

Highways drainage problems should be reported at <http://goo.gl/9qgjEe> or by phone on **03000 41 81 81**.

Gravesham Borough Council

The Environment Agency are normally responsible for managing the other sea defences (although there are some privately owned frontages). For the management of erosion of the land above sea level within the district, the responsibility will normally lie with Dartford Borough Council as Coast Protection Authority under the Coast Protection Act 1949.

Due to the enormous expense such works incur, they are normally only undertaken where it can be demonstrated that the benefits outweigh the costs. It is likely therefore that any further works apart from routine maintenance will be of a limited nature.

Gravesham Borough Council also has powers under the Land Drainage Act 1991 to carry out flood risk management work on ordinary watercourses. They also have the responsibilities of a riparian owner for any land they own and should maintain all ordinary watercourses and assets in their ownership.

They are a key partner in planning local flood risk management works, and are able to carry out flood risk management works on minor watercourses within their district.

They also work with Kent County Council and the other Risk management Authorities to ensure that the risks to/from any new development are effectively managed through making decisions on planning applications. They are ultimately responsible for ensuring that any new development does not exacerbate the flood risk to the area in which it is proposed.

North Kent Marshes Internal Drainage Board

The North Kent Marshes Internal Drainage Board was formed in 2016 and is administered by Medway Council. It covers areas in and around Gravesend including Shorne Marshes, Filborough Marshes and Westcourt Marshes and continues to the east to the Hoo Peninsula. The area and watercourses included in the Internal Drainage Board are shown in Appendix 2.

Internal Drainage Boards use their powers to maintain watercourses within their district for land drainage, flood risk management, environmental protection/enhancement and water level management purposes.

Whilst they undertake routine maintenance of adopted ordinary watercourses, pumping stations, and other critical water control infrastructure under permissive powers, the overall responsibility for maintenance still lies with the riparian owner.

They also have a general supervisory duty over all drainage matters within their districts and have consenting and enforcement powers for works carried out by others in or adjacent to ordinary watercourses within their operational district.

This is done by reasonable application of the board's byelaws and the Land Drainage Act 1991, to ensure that any development has regard to secure the

efficient working of the drainage system (now and in the future) and does not cause unnecessary adverse environmental impact as a consequence, including increased risk of flooding.

Southern Water

Southern Water is responsible for the maintenance of foul and surface water public sewers. These are usually in roads or public open spaces, but may run through private gardens. They have a right of access to these sewers for maintenance. If they wish to carry out work on sewers on your land they must follow a code of practice; this is available from them upon request.

To report a problem or for general enquiries, please contact Southern Water here: <http://goo.gl/FrP68N>

Southern Water is a risk management authority and has the following flood risk management functions:

- To respond to flooding incidents involving their assets;
- To maintain a register of properties at risk of flooding due to a hydraulic overload in the sewerage network;
- To undertake capacity improvements to alleviate prioritised sewer flooding problems;
- To provide, maintain and operate systems of public sewers and works for the purpose of effectually draining their operative area;
- To co-operate with other relevant authorities in the exercise of their flood and coastal erosion risk management functions;
- To have a regard to national and local flood and coastal erosion risk management strategies.

Parish councils

Parish councils are involved in managing local issues, and the management of local flooding may be one of the problems they help coordinate. They can also be a source of local information about flood risk and are likely to know which areas are prone to flooding (particularly from local flooding incidents). They may have records of flooding, which may not be recorded by other authorities.

Parish Councils are involved in responding to emergencies and have a consultation role in local planning applications, and can influence how local developments are delivered.

They have also been working with the Risk Management Authorities to prepare Parish Emergency Plans and train Community Flood Wardens. These wardens will act as a link between the Environment Agency and the communities at risk; they will disseminate information to local residents, and will assist with the preparation for flooding and management of incidents when they occur.

Land owners

If you own land or property that is crossed by (or next to) a river, stream or ditch, you are a riparian owner. Under common law, riparian owners possess rights and responsibilities pertaining to any stretch of watercourse which falls within or follows the boundaries of their property. It is normally presumed that a riparian owner owns

land up to the centre line of a non-tidal watercourse where the watercourse itself forms a boundary, even if this is not denoted on the Land Registry plan for the property.

Riparian owners have a duty of care towards their neighbours upstream and downstream. This means they must avoid any action likely to cause flooding of their neighbour's land or property; they are therefore responsible for accepting water from the section of watercourse owned by their upstream neighbour and then transferring this, together with drainage from their own property, to their neighbour immediately downstream.

The ultimate responsibility for the maintenance of a watercourse and its banks always lies with the riparian owner, regardless of whether such works have been carried out by any other Authority at its own expense in the past. Such maintenance works can include clearing obstructions, repairing the banks, and the management of vegetation or trees.

It is important that riparian owners preserve access to the banks of rivers and streams for maintenance and safety purposes. Access to the watercourse should therefore be considered when erecting any fencing, and undergrowth and vegetation on and around the banks should be appropriately controlled.

Further information on riparian rights and responsibilities can be found in the Environment Agency's document 'Living on the Edge'.

If you are a riparian owner and planning works on a watercourse (or in the vicinity of flood defences) you must contact the relevant authority to discuss whether you need formal consent for your works. This is to ensure that you do not increase flood risk or damage watercourses and flood defences. The relevant consenting authority has powers to remove works that are not consented.

If you are not sure whose consent you may require, please contact the Kent County Council Flood Risk team at flood@kent.gov.uk, or phone 03000 414141.

It should be noted that the abstraction of water from (and the discharge of water to) any watercourse is also regulated by the Environment Agency. They should be contacted prior to the commencement of any such activity.

Flood and Coastal Risk Management Investment

The government provides an annual grant to invest in flood defence works; this is known as Flood Defence Grant in Aid. The government offers funding to projects based on the outcomes they will deliver. Whilst the number of homes protected from flooding is the primary consideration, the amount of habitat created and other economic benefits are also taken into account. Any risk management authority can apply for funds from this source.

Flood defence schemes which provide a significant reduction in risk to a large number of properties may occasionally be funded in their entirety by FDGIA; however, smaller schemes which provide a smaller benefit will usually require additional contributions from elsewhere to proceed.

Any other body, organisation or person may make a contribution to meet the shortfall. This process has been established by the government to encourage the communities that benefit from these schemes to invest directly in them. This is known as partnership funding.

Each year risk management authorities from each region are invited to submit details of any proposed flood or coastal erosion management works which will require funding over the next five years. The proposals are captured in a report known as the Medium Term Plan (MTP) by the Environment Agency. Each regional MTP is combined into one national plan to give an indication of investment needs across the entire country.

Projects on the MTP are ranked according to the benefits provided divided by the remaining cost (once partnership funding contribution have been taken into account). The highest ranked schemes receive the greatest proportion of government allocation. The lower ranked schemes typically require a greater contribution from other concerned parties.

Figure 2. shows how this mechanism of flood defence funding differs from how flood defence investment was allocated in the past.

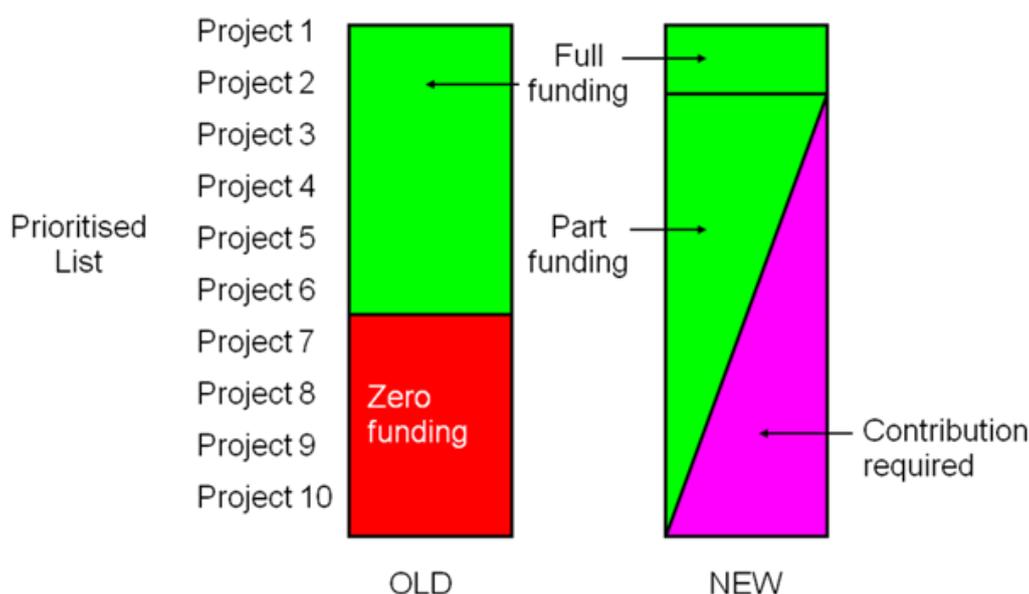


Figure 2. Flood defence investment.

Flood risk management plans and strategies

There are a number of flood risk management plans and strategies that affect how flood risk in Gravesham is managed. More detailed information about flood risk management in Gravesham can be found in these documents.

This section aims to give you an overview of the most important of these documents and lets you know where to find them.

National Flood and Coastal Erosion Risk Management Strategy

The National Flood and Coastal Erosion Risk Management Strategy (the National Strategy) provides a national framework for managing the risk of flooding and coastal erosion in England.

It has been prepared by the Environment Agency with input from Defra, and sets out the objectives and six guiding principles on how flood risk management should be delivered by all risk management authorities in England

The National Strategy can be found here: <http://goo.gl/27nZp0>

Flood Risk Management Plans

By law, the Environment Agency and Natural Resources Wales must produce flood risk management plans (FRMPs) for each River Basin District. These FRMPs must cover flooding from main rivers, the sea and reservoirs.

Lead Local Flood Authorities must also produce FRMPs for all Flood Risk Areas covering flooding from local sources (surface water, ordinary watercourses and groundwater). LLFAs may either prepare a separate FRMP or contribute to a joint partnership FRMP for the River Basin District.

Kent County Council do not have any designated Flood Risk Areas under their jurisdiction, but they may contribute to a joint partnership FRMP. Other RMAs can also contribute to developing the joint partnership FRMP for the River Basin District. Such contributions are carried out on a voluntary basis and will result in better co-ordinated flood management.

The preferred approach to completing a FRMP

The preferred approach to FRMPs is for Environment Agency and Natural Resources Wales to prepare joint FRMPs in partnership with others, in particular LLFAs and other RMAs. Information about all sources of flood risk is combined to form a single FRMP. This approach co-ordinates flood risk management planning with river basin management planning under the Water Framework Directive, in particular the statutory consultation on proposed updates of River Basin Management Plans (RBMPs) and draft FRMPs.

LLFAs preparing separate FRMPs must co-ordinate the activities of interested parties with those developing RBMPs in England and Wales.

What FRMPs contain

Flood Risk Management Plans must include:

- a map showing the boundaries of the Flood Risk Area
- the conclusions drawn from the flood hazard and risk maps
- objectives for the purpose of managing the flood risk
- proposed measures for achieving those objectives
- a description of the proposed timing and manner of implementing the measures including details of who is responsible for implementation
- a description of the way implementation of the measures will be monitored
- a report of the consultation
- where appropriate, information about how the implementation of measures under the FRMP and RBMP area will be co-ordinated

'Flood Risk Management Plans (FRMPs): how to prepare them' provides more guidance for Risk Management Authorities.

<https://goo.gl/LzkfUM>

Local Flood Risk Management Strategy

Kent County Council's Local Flood Risk Management Strategy (the Local Strategy) sets out a countywide strategy for managing the risks of local flooding; this is defined as flooding from:

- surface water
- groundwater and
- ordinary watercourses.

The Local Strategy is prepared by Kent County Council as part of its role as Lead Local Flood Authority. The aims of the local strategy are:

- To support and improve the safety and wellbeing of Kent's residents and the economy of Kent through appropriate flood risk management;
- To ensure that we all work together effectively to understand and deliver appropriate flood risk management in Kent
- To contribute to sustainable development, regeneration and land management in Kent through the promotion of sustainable flood risk management practices that utilise natural processes where appropriate.

Part of the Local Strategy sets out how KCC prioritises the management of local flooding in the county. The county is divided into areas with similar local flooding issues. These areas are given a policy for the management of this risk according to its complexity.

The Local Strategy can be found here:

<http://goo.gl/hpw021>

Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are produced by the Environment Agency; they set policies for how inland flood risk should be managed within the catchment (coastal flooding is considered in Shoreline Management Plans, see

below). Catchment Flood Management Plans pre-date the Flood and Water Management Act and were not prepared with the input of the Lead Local Flood Authorities (or with the additional data that is now available about local flooding).

Catchment Flood Management Plans consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding. Shoreline management plans consider flooding from the sea.

CFMPs also include:

- the likely impacts of climate change
- the effects of how we use and manage the land
- how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs

CFMPs help the Environment Agency and their partners to plan and agree the most effective way to manage flood risk in the future.

Gravesham is in the North Kent Rivers Catchment Flood Management Plan. The policies, along with an explanation of what each of the 6 policies mean, are shown on the map in [Appendix 4](#). The North Kent Rivers Catchment Flood Management Plan can be found here: <https://goo.gl/Za60b7>

Thames Estuary 2100 (TE2100)

The Environment Agency developed the Thames Estuary 2100 Plan (TE2100) to recommend how to manage tidal flood risk to the end of the century and beyond. The plan sets out how 1.3 million people and £275 billion worth of property will continue to be protected from tidal flood risk.

TE2100 recommends the actions the Environment Agency and others will need to take in the short, medium and long term. The plan is based on contemporary understanding of predicted climate change, but is designed to be adaptable to changes in predictions (including for sea level rise) throughout the century.

Further information on the TE2100 project can be found here:

<https://goo.gl/ny4YtF>

The area covered by this project can be seen on the map in [Appendix 4](#).

Surface Water Management Plans

Surface Water Management Plans (SWMPs) are prepared by Kent County Council in partnership with the other Risk Management Authorities. They provide an overview of local flood risk for the study area (despite their name) and may cover the risks from other sources of flooding, including where there are combined risks of flooding.

Surface water management plans can vary in scope and detail. Some provide an overview of historic flooding and a general review of existing information. Other surface water management plans use complex rainfall modelling to determine the flood risk from a range of storm durations and intensities to quantify the risks (usually in high risk areas). These plans identify the areas of significant local flood risk and seek to identify options to address the identified risks.

The Thameside Surface Water Management Plan can be found at:

[Thameside surface water management plan](#)

Strategic Flood Risk Assessment (SFRA)

Strategic Flood Risk Assessments (SFRAs) are prepared by Local Authorities and are primarily used to influence local planning policy decisions to ensure future development in the borough are appropriately located and sustainably constructed. They provide a general assessment of the flood risk from all sources across a borough (tidal, fluvial, surface water, groundwater, impounded water bodies and sewers) and should take full account of the likely impact of predicted climate change.

The original Strategic Flood Risk Assessment (SFRA) of Kent Thameside can be read here:

<https://goo.gl/TqgGG5>

River Basin Management Plan

River Basin Management Plans are a requirement of the Water Framework Directive; they provide an overview of how water framework directive objectives (achieving the protection, improvement and sustainable use of the water environment) will be met for the water bodies in the river basin that the plan covers. They are not flood risk management documents, but they can influence how rivers and other water bodies are managed.

Gravesham falls within the area covered by the Thames River Basin Management Plan; this can be found here: <http://goo.gl/6aUiTb>

Understanding flood risk

There are a number of maps available that show the risk of flooding to areas from various sources. This section explains what the easily available maps are and what form of flooding they show.

Flood risk mapping

Not all flood risk is nationally modelled and mapped. For instance, the flood risk arising from ordinary watercourses has not been specifically investigated and depicted on a national scale. It is also important to note that many types of flood map only include one type of flood risk. For example, a flood map of Gravesend would not include the potential for any groundwater or surface water flooding that might occur at the same time as tidal flooding.

Combining the different types of flooding into one model (and one map) is very difficult. The mechanisms involved in combining the different types of flooding are extremely complex and the scales are different, consequently it is not easily computable in one model. However, in some areas where a significant risk from combined sources of flooding has been identified, KCC has investigated flooding collectively and produced mapping to depict this within their Surface Water Management Plans. Unfortunately it is not yet possible to produce a map to show this risk for the whole county.

How flood risk is expressed

The terms Annual Exceedance Probability (AEP) and Return Period are common ways to describe the likelihood of a flood of a certain magnitude happening in any given year.

An AEP is the *probability* of a certain size of flood occurring in any one year. A 1% AEP flood event has a 1% (or 1 in 100) chance of occurring in any one year.

A Return Period is a way of expressing how often a flood of a given magnitude might reoccur over a long period of time. For example, a flood described as having a 1 in 100 year return period is likely to occur, on average, ten times every 1000 years (or once every 100 years).

A 1 in 100 year Return Period flood and 1% AEP flood event are different terms to describe the same event.

It is important to note that while a 1% AEP flood may occur once every 100 years on average, the probability of a flood of that size occurring in any particular year does not change. If a 1% AEP flood was recorded this year, the probability of another flood of that magnitude being recorded in the following year (or any other subsequent year) would still be 1%. Accordingly, it is statistically possible to have several 1% AEP floods over a period of 100 years. Similarly, it is equally statistically possible have a period of 100 years without a single 1% AEP flood being recorded.

Table 2. Annual Exceedance Probabilities and their equivalent Return Periods.

AEP (%)	Equivalent return period (yrs)	Magnitude	
0.1	1000	Less frequent/more extreme events.	
1	100		
1.33	75		
2	50		
3.33	30		
5	20		
10	10		
20	5		
50	2		
100	1		More frequent/less extreme events.

Flood Map for Planning

The Flood Map for Planning is the Environment Agency’s original format for flood mapping and depicts the three flood zones used to define areas of risk of flooding from rivers and the sea. It is important to note that these maps show the predicted extent of flooding **if there were no defences or buildings present** to affect the flow of water into and through the natural floodplain.

The three flood zones are:

Flood Zone 3

Flood Zone 3 is the area deemed to be at the highest risk from flooding; it is subdivided into two categories:

Flood Zone 3a - In the absence of defences, this is an area that would be considered to be at risk from:

- the sea during a flood event that has an AEP of 0.5% (i.e. a Return Period of 200 years)
- a river during a flood event that has an AEP of 1% (i.e. a Return Period of 100 years)

Flood Zone 3b – This zone is also known as the functional floodplain. The functional floodplain is defined as the area that would be susceptible to flooding from rivers or the sea during any event up to and including the 5% AEP event (i.e. the 1 in 20 yr event, or more frequently). Unlike the other Flood Zones, Zone 3b takes full account of any defences which may offer protection to the area. **The functional floodplain is the area that would flood despite the presence of defences.**

Flood Zone 2 - This shows the additional extent of an extreme flood from rivers or the sea. In the absence of defences, these outlying areas would be affected by a major flood, with an AEP of up to 0.1% (i.e. an area at risk from flooding from an event with a 1000 year Return Period). This is also known as the Extreme Flood Outline.

Flood Zone 1 – This shows all areas not covered by the other two flood zones, it is an area considered to be a negligible risk of flooding from rivers or the sea. However, areas in this flood zone may still be at risk from other forms of flooding.

The primary use of this map is for planning purposes to ensure that new developments can take account of the risk of flooding as they are being planned. It is important to understand that there remains a flood risk, even if there are defences that protect the area from flooding. Flood defences can only reduce the risk from flooding. No matter how well constructed a flood defence may be, there will always be a risk of its overtopping or failure. This residual risk must be taken into account when considering new development to ensure it is appropriately constructed, and to ensure the users, inhabitants or emergency services are not placed in unnecessary danger in the unlikely event of flooding.

The Flood Map for Planning is available on the Environment Agency's website:

[Flood map for planning](#)

The Environment Agency are statutory consultees for all development at risk of flooding from rivers and the sea, defined as Flood Zones 2 and 3. They should be consulted as early in the development planning process as possible.

National Flood Risk Assessment

The Environment Agency's National Flood Risk Assessment (NaFRA) mapping provides an assessment of the likelihood of flooding from rivers and the sea during an extreme 0.1% AEP event. Unlike the Flood Map for Planning (as described above), the NaFRA mapping **takes full account of the flood defences protecting an area**. It considers the likelihood of the defences being breached or overtopped during a flood event. This likelihood depends on the type of defence, its location, its condition and the designed standard of protection.

The mapped flood risk is presented as a grid of 50m² squares. The likelihood of flooding is determined for each 50m² within the entire area of the Extreme Flood Outline (i.e. Flood Zone 2).

Each 50m² area within the Extreme Flood Outline is then assigned one of four categories:

- High – At risk from an event with an AEP of 3.3% or greater (i.e. at risk from floods with a Return Period of 30 years, or more frequently)
- Medium – At risk from an event with an AEP of less than 3.33% AEP but greater than or equal to 1% (i.e. at risk from flooding events with a Return Period of between 30 years and 100 years)
- Low - At risk from an event with an AEP of less than 1% AEP but greater than or equal to 0.1% (i.e. at risk from flooding events with a Return Period of between 100 years and 1000 years)
- Very Low – At risk from events with an AEP of less than 0.1% (i.e. at risk from floods with a Return Period of 1000 years or greater).

The NaFRA mapping is generally considered to present a more accurate representation of the flood risk to an area than the Flood Map for Planning provides owing to its incorporation of existing flood defences.

Properties at risk

In the Gravesham district, there are a total of 2274 dwellings in areas considered to be at risk from tidal or fluvial flooding (this figure is taken from the Environment Agency’s NaFRA mapping, which takes the presence of flood defences into account); 307 of these are at a medium-high risk of flooding.

Table 3 (below) outlines the level of this risk within each parish.

Table 3. Dwellings at tidal/fluvial flood risk in Gravesham.

Parish	Number of dwellings at medium-high risk (up to 1% AEP)	Number of dwellings at overall risk (up to 0.1% AEP)
Cobham	0	0
Gravesend Town	1130	2338
Higham	0	30
Luddesdown	5	5
Meopham	2	2
Shorne	0	0
Vigo	0	0

Surface Water Mapping

The Environment Agency’s surface water flood mapping gives a broad indication of the areas likely to be at risk from surface water flooding. These are areas where surface water would be expected to flow or pond if the capacity of the drainage networks and ground were exceeded.

The Flood and Water Management Act 2010 defines surface runoff, and the type of flooding shown by the updated Flood Map for Surface Water fits with the definition given within the Act. It shows the extent of flooding that could occur from any form of precipitation (including melted snow), which:

- is on the surface of the ground (whether or not it is moving), and
- has not yet entered a watercourse, drainage system or public sewer.

In 2013, the Environment Agency produced the updated Flood Map for Surface Water (uFMfSW). The aim of the uFMfSW is to provide the best single source of information on surface water flooding for England and Wales which includes local information and knowledge. It is a separate, single, mapping product that draws together:

- The Environment Agency’s national scale surface water flood mapping, and
- appropriate locally produced mapping from LLFAs.

The uFMfSW should not be used to identify the flood risk to individual properties, and should only serve to give a more general indication of an area’s susceptibility to surface water flooding.

Planning and Flood Risk

Flood risk is a material consideration in planning. The National Planning Policy Framework sets strict guidelines on flood risk management in the planning process to protect people and property from flooding.

Assessing Flood Risk

Local planning authorities should undertake a Strategic Flood Risk Assessment to fully understand the flood risk in the area to inform Local Plan preparation and the flood risk to specific sites.

In areas at risk of flooding, Flood Zone 2 or 3 or for sites of 1 hectare or more, developers should undertake a site-specific flood risk assessment to accompany applications for planning permission or prior approval for certain types of permitted development.

Avoid flood risk

In plan-making, local planning authorities apply a sequential approach to site selection so that development is, as far as reasonably possible, located where the risk of flooding, from all sources, is lowest, taking account of climate change and the vulnerability of future uses to flood risk. In plan-making if a site is at risk of flooding the 'Sequential Test' must be applied, if this isn't passed the 'Exception Test' must then be applied. If these aren't passed the development cannot be included in the Local Plan. These assessments take account of the proposed uses of the site, as some uses are less vulnerable to flooding.

In decision-taking, local planning authorities also apply a sequential approach. In decision-taking this involves applying the Sequential Test for specific development proposals and, if needed, the Exception Test, to steer development to areas with the lowest probability of flooding.

Further information on the Sequential Test is available here:

<http://goo.gl/KMj5lo>

Further information on the Exception Test is available here:

<http://goo.gl/HEcd9F>

Manage and Mitigate flood risk

Where alternative sites are not available and development needs to be in locations where there is a risk of flooding, local planning authorities and developers should ensure development is appropriately flood resilient and resistant, safe for its users for the development's lifetime, and will not increase flood risk overall.

Local planning authorities and developers should seek flood risk management opportunities (e.g. safeguarding land), and reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems in developments).

The requirements to consult the Environment Agency on applications where there is a risk of flooding are available here:

<http://goo.gl/YNGxPs>

Drainage

The impact of increased surface water discharges from new developments must be considered at the planning application stage. Developers are required to provide details of the drainage of new sites at the application stage.

This is assessed by the Lead Local Flood Authority, Kent County Council for any new **major development** (which includes proposals for ten homes or more, floor space of 1,000 sq m or more, a site of one hectare or more), who provide their comments to the planning authority. Existing planning policies, National Planning Practice Guidance, and the recently published national '*non-statutory technical standards for the design, maintenance, and operation of SuDS*' provide the guidance upon which their consultation responses will be based.

As statutory consultees, KCC will be seeking to assist the delivery of requirements of the Government's National Planning Policy Framework (NPPF). This framework promotes sustainable development and makes specific recommendations for the incorporation of SuDS into new development.

Sustainable Drainage

Kent County Council encourages the use of Sustainable Drainage Systems (SuDS) to manage surface water in a sustainable way in all development. For all new major development it should be demonstrated that:

- an appropriate SuDS system will be incorporated (unless it is clearly demonstrated and agreed that they would be inappropriate),
- the minimum standards of operation proposed by the applicant are appropriate,
- that there are clear arrangements in place for the ongoing maintenance of any SuDS scheme over the lifetime of the associated development (through the use of planning conditions or planning obligations, where appropriate).

Further information:

The National Planning Policy Framework can be found at:

<http://goo.gl/KIbX9p>

The Government's Planning Practice Guidance can be found at:

<http://goo.gl/K5i5gz>

The associated NPPF guidance related to surface water management can be found at:

<http://goo.gl/W4ePfy>

The non-statutory technical standards for the design, maintenance, and operation of SuDS can be found at:

<http://goo.gl/5pcA7f>

Emergency Planning

Planning for and managing flooding emergencies

Severe weather and any associated flooding can lead to an emergency being declared. It is important that plans are maintained to outline the actions that should be taken to both reduce the likelihood of an emergency occurring, and to reduce its impact far as possible if an emergency does occur. Regular training and exercising supports this planning. The Civil Contingencies Act 2004 designates response agencies as either Category 1 or 2 responders, and sets out their roles and responsibilities.

Category 1 responders are known as 'core responders', and they include the emergency services and local authorities. Category 2 responders are 'key co-operating responders' acting in support of Category 1 responders; they include utility companies and transport organisations.

There are a number of bodies responsible for planning for and responding to a flood emergency, their roles and responsibilities are summarised below:

Category 1 Responders

Kent County Council

- Coordinate emergency support within their own functions.
- Establish multi-agency command and control systems (County Emergency Centre).
- Coordinate emergency support from the voluntary sector.
- Mobilise and chair Severe Weather Advisory Group.
- Mobilise military aid to the civil community.
- Liaise with central and regional government departments.
- Liaise with essential service providers.
- Open and support survivor reception and rest centres.
- Manage the local transport and traffic networks.
- Mobilise social care interventions.
- Provide emergency assistance.
- Coordinate the recovery process.
- Provide advice and management of public health.
- Assist with business continuity.

Gravesham Borough Council

- Deal with emergencies on 'non main rivers'.
- Establish multi-agency command and control systems (District Emergency Centre).
- Liaise with central and regional government departments.
- Co-ordinate the response to any homelessness issues which may arise.
- Deal with environmental health issues, such as contamination and pollution.
- Coordinate emergency support within their own functions.

Kent Police

- Save life.

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- Establish multi-agency command and control systems.
- Coordination and communication between emergency services and organisations providing support.
- Coordinate the preparation and dissemination of public warning and informing.
- Establish and maintain a Casualty Bureau.

Kent Fire and Rescue Service

- Save life, rescuing people and animals.
- Carry out other specialist work, including flood rescue services.
- Where appropriate, assist people where the use of fire service personnel and equipment is relevant.

South East Coast Ambulance Service

- Save life.
- Provide treatment, stabilisation and care at the scene.

Environment Agency

- Issue Flood Alerts and Warnings and ensure systems display current flooding information.
- Provide information to the public on what they can do before, during and after a flood event.
- Work with professional partners and stakeholders and respond to requests for flooding information and updates.
- Mobilise and chair Severe Weather Advisory Group.
- Receive and record details of flooding and related information.
- Operate water level control structures within its jurisdiction and in line with permissive powers.
- Flood event data collection.
- Arrange and take part in flood event exercises.
- Respond to pollution incidents and advise on disposal.
- Assist with the recovery process, for example, by advising on the disposal of silt, attending flood surgeries.

Category 2 Responders

Utility providers

- Attend emergencies relating to their services putting life at risk.
- Assess and manage risk of service failure.
- Assist with the recovery process, including the management of public health considerations.

Kent Resilience Forum

The Kent Resilience Forum (KRF) is one of a number of Local Resilience Forums (LRFs) that have been set up across England. The overall aim of a LRF is to ensure that the various agencies and organisations plan and subsequently work together to

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ensure a co-ordinated response to any emergency that could have a significant impact on any community.

LRFs are partnerships made up of a number of different organisations and agencies (although they are not legal organisations in themselves). The areas covered by a LRF align with the local police area boundaries.

The various agencies that form the KRF work together in a range of areas including:

- Assessing risks across the county and developing the Kent Community Risk Register
- Planning for emergencies
- Planning for Business Continuity Management
- Producing multi-agency plans
- Carrying out training and exercising
- Warning and informing the public - before, during and after emergencies.

Member organisations of the LRFs are the Category 1 and 2 responders (as outlined [above](#)). The KRF is required to meet at least every six months.

Further information:

The National Flood Emergency Framework for England can be found at:

<http://goo.gl/vkeV3O>

Kent County Council's Flood Response Plan can be found at:

[KCC flood response plan](#)

Sandbags

Gravesham Borough Council do not hold a stock of sandbags to distribute to residents.

Concerned residents are urged to be proactive in sourcing sandbags from local suppliers and to take necessary precautions to protect their property from flooding or weather damage.

For further information visit Gravesham Borough Council website:

[Emergencies - Flooding](#)

Personal flood planning and assistance

The Government has produced a guide on what to do before, during and after a flood. It features advice such as how to check whether you are at risk of flooding, checklists to help you prepare and practical advice should flooding occur.

According to this advice, you should initially:

- Find out if you're at risk,
- Make a Flood Plan,
- Improve your property's protection,
- Get insurance,
- Get help during a flood,
- Get help after a flood.

Further guidance on each of these steps is available at:

<http://goo.gl/qPRnP1>

Flood advice for businesses

The Government has also produced advice and guidance specifically aimed at businesses at risk from flooding. This guidance can be found at:

<http://goo.gl/oyrbfA>

Flood Warnings

The Environment Agency provides a free Flood Alert and Warning service in many areas at risk of flooding from rivers or the sea.

Flood warnings give advanced notice of potential flooding by phone, text, email, pager or fax.

To find out if you live within a Flood Warning area and to sign up, please visit [Flood warnings](#) or call **0345 988 1188**.

The Environment Agency's live Flood Warning map identifies areas where Flood Alerts, Flood Warnings or Severe Flood Warnings are in force. The map is updated with information from the Flood Warning service every 15 minutes; it can be found here: [Live flood map](#)

It should be noted that the Environment Agency's Floodline Warnings Direct service only pertains to flooding from rivers and the sea.

Table 4. Flood Alert and Warnings

Symbol	Status	Action
	A Flood Alert means that flooding is possible and that you need to be prepared	Residents should make some low impact preparations (e.g. move small / valuable items upstairs) check travel plans and remain vigilant.
	A Flood Warning means that flooding is expected. You should take immediate action and not wait for a severe flood warning.	Put in place home flood defences. Move valuables and people upstairs. Turn off utilities.
	A Severe Weather Warning means that there is severe flooding and danger to life.	These are issued when flooding is posing significant risk to life or disruption to communities.
There is no symbol for this stage.	Warnings no longer in force	This message will be issued when no further flooding is currently expected in your area.

Key contacts

Main sewers (foul and surface water)

Southern Water:

0330 303 0368, customerservices@southernwater.co.uk

Private connections to the main sewer

Householders responsibility.

Domestic drainage in social housing properties

Gravesham Borough Council Housing Services

[Website](#)

Main rivers

Environment Agency

0345 988 1188 (Floodline 24-hour service),
0800 80 70 60 (24-hour emergency hotline),

[Website](#),

E-mail: enquiries@environment-agency.gov.uk

Ditches, watercourses and land drainage

Kent County Council

03000 41 81 81 (9am - 5pm),
03000 41 91 91 (out of office hours),

[Website](#),

E-mail: flood@kent.gov.uk

Highway flooding, including blocked gullies (kerbside gratings)

Kent County Council Highways

03000 41 81 81,

[Website](#)

Environmental Services

Gravesham Borough Council

[Website](#)

Environment Agency

0800 80 70 60 (24-hour emergency hotline)

Gravesham East

In the Gravesham East area there are a total of 1549 properties at risk from rivers or the sea (taking the existing defences into account); 410 of these are at medium to high risk.

Table 3. Number of dwellings at risk from fluvial/tidal flooding in Gravesham East

Ward	Number of dwellings at medium-high risk (up to 1% AEP)	Number of dwellings at overall risk (up to 0.1% AEP)
Central	0	0
Chalk	7	90
Riverside	146	1173
Riverview	0	0
Singlewell	92	94
Westcourt	108	121
Whitehill	64	71

There are a significant number of properties within the Riverside Ward which are at a low risk from tidal flooding owing to their relatively low-lying position behind the Thames tidal defences. Although the standard of protection offered by these well-maintained defences is good, there remains a residual risk that these structures may be breached or overtopped by extreme tidal conditions. This residual risk of tidal flooding also represents the greatest threat to the predominantly low-lying and marshy Chalk Ward.

Further south and away from the tidal defences and low-lying land at residual risk from tidal flooding, the area is bisected by a 'dry valley'.

A dry valley may develop on many kinds of permeable rock, such as limestone and chalk, or sandy terrains that do not regularly sustain surface water flow. Such valleys do not hold surface water because it usually sinks into the permeable bedrock beneath.

There is a risk of flooding in some of these dry valleys when the rate of rainfall exceeds the rate of infiltration into the ground, resulting in surface water flow in excess of the capacity of the surface drainage infrastructure. This is particular concern in large dry valleys with significant areas of hardstanding. During extreme rainfall events (or when the catchment is frozen) ordinarily absent watercourses in dry valleys could become active, thereby causing flash flooding.

This flash-flooding represents the greatest risk to the Singlewell, Westcourt and Whitehill wards. Although much of this risk is theoretical, there have been recorded instances of highway flooding and overwhelmed sewers throughout the area.

The NaFRA mapping for Gravesham East (which shows the areas at risk from flooding with the defences in place) is shown in Appendix 4.

Further information:

- The Thameside Surface Water Management Plan can be found at: [Thameside surface water management plan](#)

Flood Risk to Communities – Gravesham

- The Thameside Water Cycle Study Phase 1 and SFRA Update can be read here: <https://goo.gl/433AN9>
- The original Strategic Flood Risk Assessment (SFRA) of Kent Thameside can be read here: <https://goo.gl/TqgGG5>

Planned flood defence works in the Gravesham East area

Gravesham Rural

In the Gravesham Rural area there are a total of 198 properties at risk from rivers or the sea (taking the existing defences into account), 166 of which are at a medium to high risk.

Table 4. Number of dwellings at risk from fluvial/tidal flooding in Gravesham Rural

Ward	Number of dwellings at medium-high risk (up to 1% AEP)	Number of dwellings at overall risk (up to 0.1% AEP)
Higham	0	30
Istead Rise	159	161
Meopham North	1	1
Meopham South and Vigo	1	1
Shorne, Cobham and Luddesdown	5	5

There are a number of properties within the Church Street area of the Higham Ward which are at a low risk from tidal flooding owing to their relatively low-lying position behind the Thames tidal defences. Although the standard of protection offered by these well-maintained defences is good, there remains a residual risk that these structures may be breached or overtopped by extreme tidal conditions.

Further south and away from the tidal defences and low-lying land at residual risk from tidal flooding, the area interspersed with 'dry valley' features.

A dry valley may develop on many kinds of permeable rock, such as limestone and chalk, or sandy terrains that do not regularly sustain surface water flow. Such valleys do not hold surface water because it usually sinks into the permeable bedrock beneath.

There is a risk of flooding in some of these dry valleys when the rate of rainfall exceeds the rate of infiltration into the ground, resulting in surface water flow in excess of the capacity of the surface drainage infrastructure. This is particular concern in large dry valleys with significant areas of hardstanding. During extreme rainfall events (or when the catchment is frozen) ordinarily absent watercourses in dry valleys could become active, thereby causing flash flooding.

This flash-flooding represents the greatest risk to the Istead Rise ward, although the other wards are at a low risk. Although much of this risk is theoretical, there have been recorded instances of highway flooding and overwhelmed sewers throughout the area.

The NaFRA mapping for Gravesham Rural (which shows the areas at risk from flooding with the defences in place) is shown in Appendix 5.

Further information:

- The Thameside Surface Water Management Plan can be found at: [Thameside surface water management plan](#)
- The Thameside Water Cycle Study Phase 1 and SFRA Update can be read here: <https://goo.gl/433AN9>

Flood Risk to Communities – Gravesham

- The original Strategic Flood Risk Assessment (SFRA) of Kent Thameside can be read here: <https://goo.gl/TqgGG5>

Planned flood defence works in the Gravesham Rural area

Northfleet and Gravesend West

In the Northfleet and Gravesend area there are 277 properties at risk from rivers or the sea (taking the existing defences into account); 15 of these are at medium to high risk.

Table 5. Number of dwellings at risk from fluvial/tidal flooding in Northfleet and Gravesend West

Ward	Number of dwellings at medium-high risk (up to 1% AEP)	Number of dwellings at overall risk (up to 0.1% AEP)
Coldharbour	0	0
Northfleet North	0	43
Northfleet South	443	452
Painters Ash	0	0
Pelham	0	14
Woodlands	118	119

There are a number of properties around the Tower Wharf area of the Northfleet North which are at a low risk from tidal flooding owing to their relatively low-lying position behind the Thames tidal defences and their proximity to the tidal portion of the River Ebbsfleet. Although the standard of protection offered by these well-maintained defences is good, there remains a residual risk that these structures may be breached or overtopped by extreme tidal conditions.

Further south and away from the tidal defences and low-lying land at residual risk from tidal flooding, the area interspersed with 'dry valley' features.

A dry valley may develop on many kinds of permeable rock, such as limestone and chalk, or sandy terrains that do not regularly sustain surface water flow. Such valleys do not hold surface water because it usually sinks into the permeable bedrock beneath.

There is a risk of flooding in some of these dry valleys when the rate of rainfall exceeds the rate of infiltration into the ground, resulting in surface water flow in excess of the capacity of the surface drainage infrastructure. This is particular concern in large dry valleys with significant areas of hardstanding. During extreme rainfall events (or when the catchment is frozen) ordinarily absent watercourses in dry valleys could become active, thereby causing flash flooding.

This flash-flooding represents the greatest risk to the Northfleet South ward, although the Pelham and Woodlands wards are also partially at risk. Although much of this risk is theoretical, there have been recorded instances of highway flooding and overwhelmed sewers throughout the area.

The NaFRA mapping for Northfleet and Gravesend (which shows the areas at risk from flooding with the defences in place) is shown in Appendix 6.

Further information:

- The Thameside Surface Water Management Plan can be found at: [Thameside surface water management plan](#)

Flood Risk to Communities – Gravesham

- The Thameside Water Cycle Study Phase 1 and SFRA Update can be read here: <https://goo.gl/433AN9>
- The original Strategic Flood Risk Assessment (SFRA) of Kent Thameside can be read here: <https://goo.gl/TqgGG5>

Planned flood defence works in the Northfleet and Gravesend area