

Climate Change Risk and Impact Assessment for Kent and Medway

Part 2: Utilities Sector Summary

June 2020



U. Utilities

U.1 Key characteristics

Utilities providers for Kent and Medway currently employ 8,100 people directly and support many more jobs in the supply chain. Utilities provision in Kent and Medway is not straightforward – water and sewerage are provided by 5 different water companies, and the way electricity is generated is changing as large-scale power generation plants are decommissioned and renewable resources are increasingly utilised in meeting energy needs. Utility infrastructure in Kent and Medway can be vulnerable to extreme weather, impacting upon residents and the local economy.

U.1.1 Water and sewerage

Water usage per capita in the South East is the highest in the UK, at 152 litres per day in 2018. Kent's water comes from a variety of sources and management of these resources is split among companies across the county:

- South East Water provides water supply to most of Kent, including Ashford, Maidstone, Canterbury, Tunbridge Wells and Sevenoaks;
- Southern Water provides water supply to Thanet, the area around Deal and Sandwich, the Medway towns and the Isle of Sheppey;
- Affinity Water serves the area around Dover, Folkestone and Romney Marsh;
- Thames Water serves the area around Dartford;
- Sutton & East Surrey Water provides water supply to a small area of Sevenoaks;
- Southern Water manage wastewater services for most of the county, apart from areas of Sevenoaks and Dartford Districts where wastewater is managed by Thames Water.

Over 70% of water supply for Kent and Medway is derived from groundwater aquifers. 20% comes from rivers, and the remaining 10% from surface water reservoirs, such as Bewl Water. Southern Water manages this large reservoir which provides water to Tonbridge and Tunbridge Wells. It is the largest stretch of open water in the South East, with a capacity of 31,000 million litres¹, enough to supply 189,000 households for a year. It also acts as a country park and boating lake, attracting more than 150,000 visitors a year to the High Weald Area of Outstanding Natural Beauty (AONB)².

Kent and Medway are already areas of water stress, an issue that is likely to increase in the future as population increases and rainfall patterns change. Work is already underway to decrease water consumption, and average per capita consumption has fallen from around 160l/day in 2011 to around 154l/day in 2014³. However, there is still more to do to reduce water consumption – South East Water aim to save 151.6Ml/day by 2080 through engaging with customers on water saving

¹ Southern Water. Our reservoirs. <http://www.southernwater.co.uk/reservoir-levels>

² Bewl Water website. <https://www.bewlwater.co.uk/>

³ Kent County Council. Kent State of the Environment Report 2015: A review of current and potential indicators within the Kent Environment Strategy. https://www.kent.gov.uk/__data/assets/pdf_file/0020/63812/Kent-State-of-the-Environment-Report-Evidence-base-supporting-the-strategy.pdf

measures. This will lead to per capita demand decreasing from 150l/day in 2017-18 to 139l/day in 2025, 118l/day in 2045 and 90l/day by 2080⁴.

U.1.2 Electricity and gas

Per capita energy electricity and gas consumption figures for Kent and Medway show that domestic usage is decreasing roughly in line with national trends, although Kent and Medway use more electricity than the national average. In 2005, average electricity consumption in the county was 4,666 kWh. By 2017, this had decreased by 15.4% to 3,948 kWh⁵. Gas consumption in has also decreased over the same time period – from 18,418 kWh to 13,038 kWh⁶, a decrease of almost 30%.

The way electricity is generated across the UK is changing - two thirds of existing coal, gas and nuclear power stations are set to cease operations by 2030 and any future power stations will be largely decarbonised. At present, much of the energy for Kent and Medway is generated by Dungeness B Nuclear Power Station, which generates energy equivalent to the usage of 1.48 million homes annually. In 2009, the government ruled out Dungeness as a potential site for a new power station, and it is due to cease operations in 2028, with decommissioning from that date lasting up to 60 years. Dungeness B was originally due to be decommissioned in 2018 but will now remain until 2028 as a result of £150 million additional investment. The power station could also see its licence extended again with the possibility of it operating into the next decade. Dungeness B is an important local employer for Romney Marsh, and for Kent, employing over 750 people and contributing £58m to the local economy⁷, so its closure and decommissioning will have a significant impact on employment opportunities, specifically in Romney Marsh and East Kent.

The Isle of Grain has one of the largest Liquid Natural Gas Terminals in the UK, with up to 20% of the UK gas supply entering the National Grid through this terminal⁸. Oil and gas currently supply approximately 54% of Kent and Medway's energy demands, but this is decreasing – gas consumption in Kent has fallen 10% since 2012⁹. It is expected that in the years to 2031, this trend will reverse, and overall gas demand in Kent and Medway will increase as population increases, despite average use per household decreasing.

U.2 Key projected changes to Kent's climate

The UK Climate Projections from the UKCP18 model identifies these potential changes for Kent:

- **Hotter summers** with an increase in average summer temperature of 2 – 3°C by 2040 and 5 – 6°C by 2080.

⁴ South East Water. 2019. Water Resources Management Plan 2020 to 2080. <https://corporate.southeastwater.co.uk/media/3465/sew-final-wrmp-2020-2080.pdf>

⁵ BEIS. 2019. Regional and local authority electricity consumption statistics. <https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics>

⁶ BEIS. 2018 Regional and local authority gas consumption statistics: 2005 to 2017.

<https://www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority>

⁷ EDF Energy. Dungeness B Power Station. <https://www.edfenergy.com/energy/power-stations/dungeness-b>

⁸ Grain LNG. 2019. Grain LNG in numbers. <http://grainlng.com/>

⁹ Kent County Council. 2018. Kent Growth and Infrastructure Framework (GIF). <https://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/growth-and-infrastructure-framework-gif>

- **Warmer winters** with an increase in average winter temperature of 1 – 2°C by 2040 and 3 – 4°C by 2080.
- **Drier summers** with a reduction in average precipitation of 20 – 30% by 2040 and 30 – 50% by 2080.
- **Wetter winters** with an increase in average precipitation of 10 – 20% by 2040 and 20 – 30% by 2080.
- **Increases in sea-level rise** by up to 0.3m by 2040 and 0.8m by 2080.

More details on the projected climate impacts for Kent can be found in Part 1 of the CCRIA.

U.3 Climate risks and impacts for Kent

The main relevant climate risks for utilities identified by the 2017 UK Climate Change Risk Assessment (CCRA) are:

- Flooding and coastal change to communities, businesses and infrastructure;
- Risks to health, wellbeing and productivity from high temperatures;
- Risk of shortages in the public water supply, and for agriculture, energy generation and industry.

Local stakeholders also identified the following risk to Kent and Medway, distinct from the risks identified in the UK CCRA due to its potential impact on the county:

- Risk of storm events impacting supply and infrastructure

U.3.1 Flooding and sea-level rise

In addition to being an area of water stress, Kent and Medway also have significant flood risk problems due to a long coastline and several major rivers. Previous development in low-lying areas has meant that some large utility infrastructure sites are susceptible to flooding. Flooding can impact utilities infrastructure and customers in the surrounding area, with the potential for long-term disruption, decrease in supply and high repair costs, depending on the type and severity of damage suffered. Water and sewerage infrastructure, including clean and wastewater treatment sites, powerplants and electricity substations may all be at risk as a result of flooding and sea-level rise.

Water and sewerage

Changes to rainfall patterns and more intense rainfall as a result of climate change will increase the risk of sewer flooding and the occurrence of overflow events from sewers designed to carry both rainwater and wastewater. This will impact on public health as foul water may mix with floodwaters, requiring additional treatment before being discharged, and leading to longer recovery times, particularly when grey water enters housing.

Wastewater treatment plants may become more susceptible to flooding and heavy rainfall. Intense rainfall and flooding can also affect substations and water treatment plants, and coastal erosion can affect utility assets.

During the storms of January and February 2014, the water table in some areas rose very rapidly, causing groundwater flooding as drainage networks struggled to cope with increased demand. In December 2016, the flooding of Southern Water's wastewater pumping station in Margate meant that Thanet District Council had to close some beaches for 9 days after they were contaminated with untreated sewage and the company was fined £2million¹⁰.

Pipe bursts can occur due to both very dry and very wet ground conditions as they result from a change in the volume of soil placing increased pressure on buried pipes. These events already cost £300 - 400 million to the UK economy annually, and incidents of pipe bursts may increase with climate change. In some areas of Kent pipe damage already occurs regularly – for example, places around Sittingbourne have experienced over 30 pipe bursts. Pipe leaks and bursts are anticipated to become more frequent and severe as increased occurrence of flooding is likely to cause longer periods where soils are waterlogged, particularly an issue in areas of clay soil.

Dams and reservoirs are also at risk from increases in flood and extreme rainfall events – reservoirs may be overtopped and will be more susceptible to erosion and seepage. Due to its surrounding geology of sand and siltstone, the impacts of increased or extreme rainfall on reservoirs will be most visible at Bewl Water - the risk of erosion may increase following heavy rainfall as sediment is washed into the reservoir.

Electricity and gas

Flooding and sea-level rise will increase the risk to both electricity generation and substations; and to gas provision and supply, particularly in coastal areas and flood plains.

Key areas where previous flood events have affected energy substations include Paddock Wood and Maidstone. Impacts have been felt by residents, industry and the wider Kent and Medway economy. As with water pipes, significant and repeated expansion and contraction of soils from heavy rainfall can result in additional stress being placed on buried gas pipes, causing them to crack and leak, impacting gas supply and contaminating the surrounding soil.

Sea-level rise will have the greatest impact on Dungeness B Power Station. The site is less than 70m from the current mean high-water mark and is well defended, meaning a tidal flood event is unlikely to impact the site under current conditions. However, with projected changes in sea-level, there is the potential that an extreme coastal flood event may cause Dungeness to temporarily cease operation. As well as impacting energy supply, this could result in up to 750 staff being placed on temporary leave. Dungeness' emergency plan cites flooding and potential failures in shoreline management as possible causes of a radiation event. In an extreme instance of coastal flooding with specific wind conditions, there is the potential for a release of nuclear radiation with significant impacts on the population of the South East, as well as much further afield. Kent County Council Emergency Planners and

¹⁰ House of Commons Briefing Paper CBP7839. 2016. Sewer Flooding:
<http://researchbriefings.files.parliament.uk/documents/CBP-7839/CBP-7839.pdf>

partners have produced an emergency plan that details the responses to be taken in the event of a radiation incident at Dungeness¹¹.

U.3.2 Increasing temperatures

The South East is one of the warmest parts of the UK. With the potential increase in summer and winter temperatures, there will be increased demand on, and for, electricity and gas provision and infrastructure.

Water and sewerage

Subsidence is likely to become more common due to shrink-swell processes driven by cycles of drought, high temperatures and heavy rain. This can damage buried infrastructure, including wastewater and water supply pipes. Risks of ground subsidence are most significant in areas where clay soils dominate, such as the North Downs, around Ashford, Canterbury, Medway and Swale.

Wastewater collection will be affected by warm, dry weather. One potential benefit of increases in temperatures may be that sewage treatment processes are improved. Prolonged low flows will enable longer retention time of sewerage in settling tanks, reducing suspended solids. This reduces the load, and biological oxygen demand, during secondary treatment steps. Increased treatment efficiency will help to offset the contribution of effluent to summer river flows, which can be significant. However, increased temperature and reduced river flows in summer months may mean that surface water will require additional treatment to meet and retain runoff consents.

Electricity and gas

Climate change is likely to cause changes in energy use patterns as people increasingly look to cool business and residential buildings in the summer. Increased summer energy cost may be balanced by savings from needing to heat homes and buildings less in winter, however these changes may require a restructure of power generation across the UK as traditional patterns of energy use change. The National Grid anticipates that electricity used to cool buildings in the UK will constitute 2.5% of all energy use by 2050, up from 0.02% today¹². At the height of summer, energy demand for cooling will likely be significantly higher than this.

Increased temperatures could also impact upon efficiency of electricity transfer. Electricity transmission lines begin to sag when temperatures reach 50°C. This increases the resistance of the lines, meaning transmission of energy is less efficient, potentially increasing the cost of electricity generation. Power lines have some capacity to sag incorporated into their design and as a result are not usually damaged by current high temperatures. However, this can create additional safety concerns for individuals working at height in their proximity.

Energy supply to Kent and Medway could be affected as summer temperatures increase and heatwaves become more frequent. Dungeness B Power Station is

¹¹ Kent County Council. 2018. Dungeness B Nuclear Power Station Off-Site Emergency Plan, Issue 2.4. https://www.kent.gov.uk/__data/assets/pdf_file/0017/11339/Dungeness-off-site-emergency-plan.pdf

¹² National Grid. Our Energy Insights: Residential air-conditioners; giving them the third degree. <http://fes.nationalgrid.com/media/1290/ac-2050-v212.pdf>

cooled by carbon dioxide, and as summer temperatures increase, cooling the reactor cores will become more expensive. Increases in demand for cooling will impact maintenance costs and may increase prices for supply and end consumers. In extreme heatwave situations like those experienced in summer 2018, the power station may have to operate at reduced capacity or temporarily cease operations, which could create energy shortages.

These impacts are already being seen elsewhere – in Norway, nuclear plants had to run at a reduced capacity or shut down in summer 2018 as ambient air temperature was 6 – 10°C above average. This caused record high electricity prices in Norway¹³. Instances like this are yet to happen in the UK, but the likelihood of one occurring will increase as average summer temperatures rise, and extreme weather events such as heatwaves become more common.

U.3.3 Drought

There are many water supply challenges facing the South East, including climate change and population growth, that are likely to increase water demand in Kent and Medway. Significant investment will be needed to balance future supply and demand across the county.

In 2007, most of the South East was designated as an area of serious water stress by the Environment Agency. This means that current and future expected demand for water makes up a high proportion of expected rainfall. Balancing the water needs of residents, industry, agriculture and the natural environment while not overusing resources is a constant challenge facing water companies in Kent and Medway.

Droughts can have a range of effects on water supply and sewerage, and as Kent and Medway have multiple water resource zones with different characteristics, managed by different water companies, each water zone will have different risks, impacts, and responses to increasing temperatures and droughts. During periods of drought, water infrastructure can be damaged, and suppliers may have to make difficult decisions to protect their assets. Increasing pressure on the system from high demand, coupled with dry weather, can result in pipe leaks and bursts (as can very wet weather).

In addition to the impacts of droughts on water supply infrastructure, droughts may also have a negative impact on water quality and on the ability of water companies to abstract water from surface water sources. Low, slow or no-flows in water bodies will impact dilution of pollutants and may trigger toxic algal blooms, which will negatively impact the ability to abstract water from rivers and reservoirs. These impacts may be worsened if a period of drought was followed by an extreme rainfall event – dry ground is less able to take up water, increasing direct runoff into watercourses.

Depending on climate change, population growth and the level of mitigation action taken, projections suggest an additional 910 million – 2.6 billion litres/day by 2080 in the South East will be needed¹⁴. Kent and Medway's use of groundwater sources

¹³ Reuters. 2018. In Hot Water: How Summer Heat Has Hit Nordic Nuclear Plant. <https://www.reuters.com/article/us-nordics-nuclearpower-explainer/in-hot-water-how-summer-heat-has-hit-nordic-nuclear-plants-idUSKBN1KM4ZR>

¹⁴ Water Resources in the South East. 2018. From Source to Tap: the south east strategy for water. http://www.wrse.org.uk/wp-content/uploads/2018/04/WRSE_File_726_From_Source_To_Tap.pdf

may also increase in the future, as groundwater aquifer levels are less susceptible to daily fluctuations in weather than surface water reserves. However, there is an increased risk to replenishment of groundwater supply during extended periods of low rainfall. Risks from drought are compounded by the fact that the South East obtains 70% of its water supply from groundwater aquifers (more than any other region of the UK)¹⁵, drying soils further.

Availability and quality of groundwater supplies are likely to be an issue in areas such as Romney Marsh due to the large number of rural properties in those areas that are not on mains drainage and rely on local sewage storage and disposal. With increasing droughts and changing precipitation patterns leading to potential changes in groundwater levels, groundwater quality in these areas will need careful monitoring to ensure quality.

Water companies are ultimately responsible for ensuring proper management of water supplies to meet the needs of customers and minimise environmental impact. Increasing reliance on one source of water could make meeting both responsibilities increasingly difficult. To protect and ensure long-term supply of water in prolonged drought conditions, water companies may have to implement drought plans more frequently. These plans, and the measures companies take, can negatively impact residents and the economy and are often unpopular.

In 2012, many water companies implemented temporary usage bans on water in order to preserve supply during a particularly long drought. This significantly impacted business profits in the second quarter of 2012, where it is estimated that £96 million in revenue was lost as a result of drought management measures. To combat exceptionally low rainfall in 2016-17, Southern Water was granted a Drought Permit enabling it to extract increased volumes of water from the Rivers Teise and Medway¹⁶ in order to refill Bewl Water reservoir and protect public supply of water.

U.3.4 Increased storminess

Storm damage from high winds or heavy snow can have a significant impact on utilities infrastructure for Kent and Medway, and increased storminess has the potential for long-term disruption and high costs of repair. Electricity and gas networks and infrastructure, particularly overhead cables, are vulnerable to tree and debris-related damages. The UK CCRA 2017 identified that the impact of lightning strikes on the energy network may increase by up to 36% by the 2080s, with a similar increase in the incidence of damage to mobile base stations.

Utility infrastructure and supply has been significantly impacted by storm events in the past, most recently in 2016 when Storm Katie (March 2016) and Storm Angus (November 2016) caused widespread power outages across Kent and Medway – Storm Katie caused loss of power to 2,200 residents during the Easter Bank Holiday. During the snow event in March 2019, some villages in Medway were left without water for 24 hours after a series of pipe bursts around St Mary Hoo.

¹⁵ Environment Agency. No date. Underground, under threat – the state of groundwater in England and Wales - <https://webarchive.nationalarchives.gov.uk/20140329205941/http://cdn.environment-agency.gov.uk/geho0906bldb-e-e.pdf>

¹⁶ Southern Water. 2018. Statutory Notice for Drought Permit Application. <https://www.southernwater.co.uk/media/default/PDFs/DroughtPermitNotice-2018.pdf>

Gas supply in Kent could become less reliable with an increase in storminess for several reasons: 44% of the gas used in the UK (approximately 33 billion m³) is sourced from rigs in the North Sea¹⁷. An increase in storminess could result in these rigs becoming less hospitable places to work, slowing the production of gas and making supply less reliable, which could in turn, increase the cost. Impacts of storms are already being felt on rigs in the North Sea – they have had to be evacuated several times in the last few years due to severe storm conditions^{18,19}. 9% of the gas used in the UK is imported by ship²⁰, predominantly docking on the Isle of Grain, and increased storminess could result in this supply becoming less reliable.

U.4 Management of climate risks and impacts

A range of measures are already being adopted by utility companies in Kent and Medway to manage current and future climate risks and impacts.

Water companies in Kent and Medway have been adopting measures, through their Resource Management Plans, to reduce per capita water consumption. Southern Water has offered water efficiency support to 120 small businesses, 156 schools and 12,000 homes in its catchment which has saved 11.3 million litres of water. South East Water has reduced household demand in its catchments by 24 million litres of water a day, despite 47,000 new homes being built. Affinity Water has plans to install 525,000 water meters by 2025 as part of their water saving programme. Metered homes have been shown to use 25% less water than unmetered homes.

Under the Drought Plan Regulations 2005²¹, all water companies operating in England and Wales are obligated to have drought plans that detail what measures they would take in drought events of varying severity. Measures in these plans include re-education of customers and requests for self-imposed restraint in the case of minor droughts. These plans do not rule out restrictions or bans on water usage during severe droughts – measures that could impact upon the health and wellbeing of Kent and Medway residents and businesses. In the event of a drought, water companies' initial response is to call for voluntary restraint and increase operational works in order to reduce water demand. If drought severity increases, companies can introduce temporary restrictions on water use through Drought Orders.

An alliance of six water companies, Water Resources for the South East (WRSE), was formed in the 1990s. Operating in the South East, along with the EA, Ofwat, the Consumer Council for Water, Natural England and Defra it aims to develop long-term regional scale plans to secure water supply across the South East. WRSE sets high-level aims and objectives for all regional water companies to follow, ensuring consistency in water resources management across the area. Through WRSE, water companies recognise that while water supply issues are regional, their solutions may be a combination of smaller scale measures and tend to focus on catchment

¹⁷ British Gas. 2017. Where does UK gas come from? - <https://www.britishgas.co.uk/the-source/our-world-of-energy/energys-grand-journey/where-does-uk-gas-come-from>

¹⁸ Offshore Energy Today. 2017. Workers evacuated from North Sea Platform ahead of storm - <https://www.offshoreenergytoday.com/report-workers-evacuated-from-north-sea-platform-ahead-of-storm/>

¹⁹ Reuters. 2015. North Sea storm forces oil platform evacuations, output shutdown - <https://www.reuters.com/article/us-weather-northsea-idUSKBN0UEOOR20151231>

²⁰ British Gas. 2017. Where does the UK's gas come from? <https://www.britishgas.co.uk/the-source/our-world-of-energy/energys-grand-journey/where-does-uk-gas-come-from>

²¹ HM Government. The Drought Plan Regulations 2005. <http://www.legislation.gov.uk/uksi/2005/1905/regulation/4/made>

management options. The alliance has developed a South East Water Strategy: From Source to Tap²² that sets out a range of climate futures that all assume reduced per capita consumption of water. WRSE will be producing a regional plan in 2022.

UK Power Networks, the network operator for electricity distribution in Kent and Medway, has planned to spend £154,630,000 on reinforcing and replacing assets in Kent and Medway by 2023 to ensure they are more resilient to climate change. Dungeness B Power Station is undertaking improvements to its coastal flood defences – EDF have spent £5 million since 2013 upgrading defences, and the site can now withstand a 0.001% AEP flood event. Work to further improve defences is ongoing at Dungeness, and a 1.5m high, 1.3km long, concrete flood wall is still to be constructed, which will cost a further £2.3 million.

U.5 Urgency scoring and recommendations

Using available evidence, urgency scoring was undertaken based on risk magnitude, interdependencies, and adaptation shortfall. This urgency scoring can be used to help prioritise and manage the climate risks and opportunities to Kent and Medway. Further information on the methodology can be found in the CCRIA Part 1.

²² Water Resources South East. 2018. From Source to Tap – The South East Strategy for Water. http://www.wrse.org.uk/wp-content/uploads/2019/01/From_Source_To_Tap.pdf

Table U-1: Urgency Scoring for Utilities Sector

Risk	Magnitude	Explanation	Adaptation Shortfall	Explanation	Inter-dependencies	Explanation	Urgency score	Recommendation
Drought in already water-stressed areas	High	<p>Increasing drought events will result in reductions in water availability for supply.</p> <p>Restrictions on water use may have to be actioned more frequently as summers become drier.</p>	Medium	<p>Water companies have drought plans in place; however, they do not prevent restrictions, and each company having different plans could lead to inconsistency in future strategies.</p>	High	<p>Increased costs for water companies could be passed onto consumers.</p> <p>Serious water restrictions could impact population health (especially the very young, old, and Blue Badge holders) and the local economy, especially agriculture, which often requires large volumes of water.</p> <p>More frequent drought events could make it more difficult for water companies to maintain supply whilst minimising impacts on the natural environment, as greater levels of abstraction could result in reduced water quality.</p>	High	<p>More action is to monitor utility assets for pipe leaks or damage to minimise wastage.</p> <p>More research on innovative water saving techniques.</p>

Risk	Magnitude	Explanation	Adaptation Shortfall	Explanation	Inter-dependencies	Explanation	Urgency score	Recommendation
Flooding and heatwaves making energy generation and transfer more difficult	High	As temperatures increase, the cost of cooling Dungeness B will increase, and in extreme heatwaves, the station may have to operate at reduced capacity, diminishing supply. Power lines sag in higher temperatures, increasing resistance and making energy transfer less efficient.	Medium	Demand for gas and electricity are expected to rise by 19% and 23% respectively and new sources of both need to be developed to meet this demand.	Medium	Disruption to services could impact business. An increase in the cost of energy and decrease in the reliability of supply could impact upon the health of residents.	Medium	More action is needed to diversify the sources of electricity to the National Grid and more uptake of renewables. Infrastructure may have to adapt to warmer climate by following measures currently utilised by warmer countries.
Soil destabilisation and landslips from over-abstraction of water and increased rates of subsidence	Medium	Subsidence has previously resulted in damage to water and sewerage pipes. Over-abstraction and lack of replenishment would reduce opportunities for groundwater recharge, result in landslips and cracks in pipes.	Low	Drought management plans and water resources management plans consider the impacts over abstraction on soils.	High	Landslips will impact the natural environment. Disruption to supply could have adverse effects on population health and local businesses.	Medium	More research is needed to understand how soil dryness can cause soil destabilisation or subsidence. Maintenance of infrastructure may have to become more proactive in order to prevent pipe bursts.
Increased rainfall and flooding of landfill sites, electricity substations and other infrastructure	Medium	There are currently 400 landfill sites in Kent in areas at risk of flooding. Increased costs to utility companies for repairs or protection measures,	Medium	Many landfill sites have business continuity plans and there are high standards in place for	High	Any hazardous waste impacted by flooding could affect groundwater or water supplies, impacting both utilities and the	Medium	More action is to build the resilience of infrastructure. Historic landfill may need to be either remediated or

Risk	Magnitude	Explanation	Adaptation Shortfall	Explanation	Inter-dependencies	Explanation	Urgency score	Recommendation
		some of which could be passed to consumers.		substations.		natural environment. If substations are flooded and this disrupts electricity supply, this could impact homes and businesses.		defended in future to prevent leaking of hazardous substances into watercourse e.g. there are historic landfill sites at risk of flooding close to the River Medway.