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# Ford Energy Recovery Facility and Waste Sorting and Transfer Facility

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Technical Appendix D3 – Climate Change Baseline

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# Document approval

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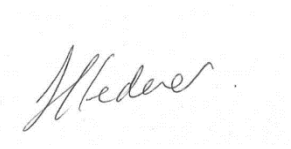
| Prepared by: | Hannah Lederer |  | Environmental Scientist | 29/03/2021 |
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# 1 Introduction

This appendix has been written is in support of Chapter 7 – Climate Change of the ES to support the planning application for an Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF) (the proposed development) to be located at the Ford Circular Technology Park.

This appendix provides detail of the current climate baseline in the vicinity of the proposed development, based on historical climate averages from Shoreham Airport Meteorological station and Met Office regional profile description for Southern England. This appendix also provides detail of the future climate baseline for the proposed development. This is calculated from the current baseline using the predicted changes in South East England as provided by The UK Climate Projections 2018 (UKCP18).

# 2 Baseline

The current climate baseline at the proposed development site is based on Met Office historical climate averages data from the period 1981-2010, from the closest meteorological station, Shoreham Airport (approximately 20 km to the east of the proposed development) and Met Office UK regional climates for Southern England.

Winter refers to the months of December, January and February, and summer refers to the months of June, July and August.

## 2.1 Temperature

Long term average mean temperatures in Southern England are warmer than the rest of the UK. July is the warmest month and February the coldest month. Extreme maximum temperatures can occur in July or August, and are usually associated with heat waves lasting several days. At approximately 3 km from the coast, during late spring through summer, the proposed development site may be subject to lower maximum temperatures due to sea breezes.

The mean winter temperatures recorded at Shoreham Airport are 5.1°C and mean summer temperatures are 16.1°C. The mean maximum temperature in winter is 8.0 °C and the mean maximum temperature in summer is 20°C. Note that these are means, and that there are individual days which will be greater than this each year.

## 2.2 Precipitation

Rainfall tends to be associated with Atlantic depressions or with convection. The Atlantic Lows are more vigorous in autumn and winter and bring most of the rain that falls in these seasons. In summer, convection caused by solar surface heating sometimes forms shower clouds and a large proportion of rain falls from showers and thunderstorms then. A further factor that greatly affects the rainfall distribution is altitude. Moist air that is forced to ascend hills may be cooled below the dew point to produce cloud and rain.

Periods of prolonged rainfall can lead to widespread flooding, especially in winter and early spring when soils are usually near saturation. Southern England is susceptible to summer thunderstorms, especially at inland locations. The associated high intensity rainfall can also result in flooding, but this is usually short-lived.

Conversely, the region can be subject to dry periods that place demands upon water supplies and require conservation measures such as summer hosepipe bans. If a period with below average rainfall includes winter months as well as the high-demand summer months, then conditions can become severe as the winter is the normal recharge time not only for reservoirs but the chalk aquifers upon which much of the region relies for water supplies.

In Southern England, rainfall is generally well-distributed throughout the year but with an autumn/early winter maximum that is more pronounced in counties bordering the English Channel.

Shoreham Airport data follows the patterns of Southern England. Mean winter rainfall is recorded to be 67.9 mm per month and mean summer rainfall is 47.5 mm per month.

The occurrence of snow is linked closely with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time, the temperature normally has to be lower than this. Over most of Southern England, snowfall is normally confined to the months from November to April and rarely sticks outside the period from December to March.

Snowfall is not included within the data from Shoreham Airport, but the regional profile for Southern England suggests that the area is one of the lesser snow prone places, with less than 10 days per year with snowfall.

## 2.3 Wind

Southern England is one of the more sheltered parts of the UK. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter half of the year, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are strongest.

The data for Shoreham Airport displays the monthly mean wind speeds at 10 m, which does not capture the days at which gale force winds (if wind reaches a mean speed of 34 knots or more over 10 consecutive minutes) are experienced. The region profile for Southern England suggests that most inland areas of the region the average is around 1-2 days per year and exposed places along the South Coast experience about 10 gales in an average year.

Wind direction tends to blow from the south or south-west, as Atlantic depressions pass the UK, and later comes from the west or north-west as the depression moves away. The range of directions between south and north-west accounts for the majority of occasions and the strongest winds nearly always blow from this range of directions. Springtime tends to have a maximum frequency of winds from the north-east.

## 2.4 Sea level

Sea level change is controlled by two main factors: eustatic (changes related to the expansion and contraction of sea water plus changes in the volume of water stored on land as ice sheets/glaciers) and isostatic (changes related to movement of the land in responses to the effect of glaciers on the Earth's crust).

## 2.5 Summary

A summary of the baseline is included in Table 1.

*Table 1: Existing baseline climate conditions*

| Item | Units | Baseline (Shoreham 1981-2010) |
|---|---|---|
| Mean annual temperatures | °C | 10.5 |
| Mean winter temperatures | °C | 5.1 |
| Mean summer temperatures | °C | 16.1 |
| Mean in winter precipitation | mm | 67.9 |
| Mean summer precipitation | mm | 47.5 |

# 3 Future Baseline

The future climate baseline at the proposed development site has been defined using UKCP18 projections.

UKCP18 has predictions based on different emissions scenarios. These are determined by the Representative Concentration Pathways (RCPs), which specify concentrations of greenhouse gases that will result in total radiative forcing (the difference between the incoming and outgoing radiation at the top of the atmosphere). Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre to span a wide range of plausible future emissions scenarios. Each scenario includes many assumptions regarding population growth, economic development, technological innovation and attitudes to social and environmental sustainability. This assessment has used the data produced by using the high emissions scenario (RCP8.5). This is the worst-case scenario but is plausible and realistic should the societal behaviour reflect the assumptions up to 2100 as set out in RCP8.5. In UKCP18, the probabilistic projections provide local low, central, and high changes across the UK, corresponding to 10%, 50% and 90% probability levels. This assessment has used the central estimate, which is considered to be the level at which as much evidence points to a lower outcome as a higher one. The 10$^{th}$ and 90$^{th}$ percentiles reflect the lowest and highest 10% of the model runs – the value at which 10% of the model runs fall at or below (10$^{th}$ percentile) or at and above (90$^{th}$ percentile) fall at or above. These have been considered where the direction of change is predicted to vary at each level. The predictions also cover a range of spatial resolutions. The data scenario from which the future baseline is calculated in summarised in Table 2.

*Table 2: Future climate change data scenario summary*

| Projection | Emissions scenario | Percentile | Area | Baseline time period | Time horizon |
|---|---|---|---|---|---|
| UKCP18 | RCP8.5 | 50%, 10% and 90% (where appropriate) | South East England | 1981-2000 | 2040-2059 |

The identified changes have then been incorporated to the current baseline from Shoreham Airport to give a local prediction of future climatic conditions.

It is noted that the baseline from which the predicted changes are based is not the same as the baseline climate data from Shoreham. Therefore, some of the results may be slight over or under estimations. Nevertheless, they offer an estimate sufficient for this assessment in order to determine likely significant effects.

It should be noted that predictions are a general trend. Due to natural variations there will still be cold winters, dry winters, cooler summers and wetter summers.

## 3.1 Temperature

Climate change is projected to lead to hotter summers and warmer winters. Probabilistic projections show that there is more warming in summer than winter, and a more pronounced north-south contrast in summer. This trend is projected in the low, central and high estimates. The projected changes in mean temperature as a central estimate are an overall annual increase of 1.9 °C, an increase of 1.7 °C in winter and an increase of 2.5 °C in summer.

## 3.2 Precipitation

Over land, projections show a move towards wetter winters and drier summers as a central estimate. However, there is some variation in the projections. The change in winter precipitation for the low estimate is projected to decrease, but, for the central and high estimate this is projected to increase. The change in summer precipitation for the low and central estimate is projected to decrease, but for the high estimate this is projected to increase.

Projections generally show a pattern of larger increases in winter precipitation over southern and central England and some coastal regions. Summer rainfall reductions tend to be largest in southern England.

The projected change in mean winter precipitation is an increase of 13% as a central estimate. Projected change in mean summer precipitation is a decrease of 22% as a central estimate, and an increase of 5% as high estimate.

Projections show that more rain will fall during intense or extreme events. Projections indicate an increase in precipitation intensity on wet days in winter and decreases in precipitation intensity on summer wet days, across southern England.

## 3.3 Wind

There is large uncertainty in projected changes in wind and air circulation across the UK and it is difficult to represent regional extreme winds for the future. However, projections indicate there will be an increase in near surface wind speeds over the UK and more significant impacts of wind will be experienced in the winter months, including an increase in frequency of winter storms. However, projections have not been quantified and so shall be assessed qualitatively within ES Chapter 7.

## 3.4 Sea level

Projections indicate that sea levels for the UK coastline will continue to rise; London projections for RCP8.5 (which is the closest city to the proposed development contained within RCP18) predict an increase of between 0.21 and 0.4 m (5th and 95th percentiles) by 2050. Projections predict that the rise in sea level may affect tidal characteristics, but atmospheric contribution to storm surges is unlikely to change. Although the proposed development is only 3 km from the nearest coastline and is at an elevation of around 10 m above sea level, rising sea levels are not predicted to impact the proposed development site.

## 3.5 Summary

### 3.5.1 Projections

Table 3 shows the variations in projections at the low, medium and high estimates. Those which are a projected increase have been highlighted in bold.

*Table 3: Future baseline climate conditions variables*

| Item | Units | Low estimate - 10%ile | Central estimate - 50%ile | High estimate - 90%ile |
|---|---|---|---|---|
| Mean annual temperatures | °C | **+0.9** | **+1.9** | **+2.9** |

| Item | Units | Low estimate - 10%ile | Central estimate - 50%ile | High estimate - 90%ile |
|---|---|---|---|---|
| Mean winter temperatures | °C | **+0.5** | **+1.7** | **+2.9** |
| Mean summer temperatures | °C | **+1.1** | **+2.5** | **+4.0** |
| Mean in winter precipitation | mm | -5% | **+13%** | **+34%** |
| Mean summer precipitation | mm | -48% | -22% | **+5%** |

It should be noted that predictions are a general trend. Due to natural variations there will still be cold winters, dry winters, cooler summers and wetter summers.

### 3.5.2 Summary

*Table 4: Future baseline climate conditions*

| Item | Units | Baseline (Shoreham 1981-2010) | Predicted change (UKCP18) | Future baseline (At Shoreham 2050) |
|---|---|---|---|---|
| **Central (50thpercentile) estimate** | | | | |
| Mean annual temperatures | °C | 10.5 | **+1.9** | 12.4 |
| Mean winter temperatures | °C | 5.1 | **+1.7** | 6.8 |
| Mean summer temperatures | °C | 16.1 | **+2.5** | 18.6 |
| Mean in winter precipitation | mm | 67.9 | **+13.0%** | 76.8 |
| Mean summer precipitation | mm | 47.5 | -22.0% | 37.0 |
| **High (90th percentile) estimate** | | | | |
| Mean summer precipitation | mm | 47.5 | **+5.0%** | 49.9 |

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