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Lostock Sustainable Energy Plant

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EIA Report for Proposed Increase to Waste Tonnage Throughput of the Lostock Sustainable Energy Plant

Appendix 9.3 – Climate Change Resilience Assessment – Detailed Results

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Document approval

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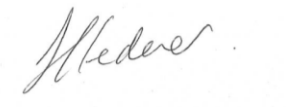
Prepared by:	Hannah Lederer		Environmental Scientist	05/07/2021
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Contents

1 Introduction

This appendix has been written in support of Chapter 10 – Climate Change of the Environmental Impact Assessment (EIA) Report to support the section 36 (s.36) variation application the Lostock Sustainable Energy Plant (LSEP) at Lostock Works, Northwich.

This appendix provides the detailed results of the climate change resilience assessment.

The climate change resilience has been assessed for the following vulnerable receptors:

- plant buildings and operational equipment;
- vehicular access to site (for workers and waste);
- grid connection and local users; and
- on-site workers.

For each receptor, the impact of each predicted climatic effect has been assessed. This has incorporated the design mitigation associated with each receptor, which is listed for each receptor and impact. The susceptibility and vulnerability to climate change have then been considered to determine the resulting sensitivity to the impacts of climate change. Magnitude and overall significance to effects have then been determined. This uses the methodology set out in Chapter 10 – Climate Change of the EIA Report.

The following climatic impacts were scoped out as part of the scoping exercise for the application, as follows.

1. Sea level rise, storm surge and storm tide - there are no anticipated impacts as the site is not in a coastal region.
2. Decreased summer precipitation - – a decrease in precipitation will have no anticipated impacts on the LSEP.
3. Snow and ice - the latest UK Climate Predictions (UKCP) (UKCP18) predictions anticipate less snow and ice than the current baseline and as such the risk from snow and ice is not anticipated to increase due to climate change.
4. Increased winter temperatures - increases in winter temperatures do not exceed the current baseline for other times of the year and so the proposals would not be vulnerable to this effect.
5. Increase in summer temperatures - increases in temperatures could affect electrical infrastructure and conditions within working areas. However, cooling systems will be included in the design to allow for a range of ambient temperatures which will include for any projected increases due to climate change.
6. Relative humidity – changes in humidity are not included in the UKCP18 predictions and it is not likely to have a significant effect on the proposals as the LSEP is designed to allow for a range of ambient conditions.
7. Water quality and soils - water availability has the potential to cause changes to the mobilisation of pollutants. More acidic soils and/or water can increase the deterioration of building materials. Soil stability may be altered by a change in water availability. However, the design has accounted for a range of conditions.

2 Plant buildings and operational equipment

2.1 Climatic effect – increase in precipitation

Anticipated potential impacts to the plant buildings from an increase in winter precipitation of 7% as a central estimate are:

- increased surface run off and associated surface water flooding of the Site;
- fluvial flooding; and
- groundwater flooding.

2.1.1 Surface water flooding

As set out in the Flood Risk Assessment (FRA) contained in the original Environmental Statement (ES) submitted in 2011 for the original LSEP application (the May 2011 ES) as technical appendix 10.1 the Environment Agency's (EA's) surface water flood mapping indicates that the LSEP is within Flood Zone 1. This is the lowest risk zone and is described as "land having a less than 1 in 1,000 annual probability of river or sea flooding'. However, the closest Flood Zone 2 or 3 area is along the section of Wade Brook to the north west of the Site, which is adjacent to the LSEP site boundary.

The FRA includes assessment of surface water drainage. It states that due to the current hardstanding and built structure at the site, LSEP will result in minimal alteration of the areas current response to rain events and surface water runoff rates and conveyance will not be altered. The surface water drainage system will include a storage pond and subsurface storage (Stormcell) which will have capacity to retain excess water in the event of up to a 1 in 100 year flood event, with a 20% allowance for climate change. The FRA also includes climate change allowance based of 50 years which equates to the FRA incorporating a 20% increase in peak rainfall intensity and a 20% increase in peak river flow into its assessment.

If flooding of the Site were to be severe, there would be a risk of flood damage to buildings, resulting in maintenance and possible generation disruption. Whilst climate change is likely to result in increased potential for surface water flooding, the surface water drainage scheme has been designed to account for climate change impacts.

As set out in the FRA, the surface water drainage strategy incorporates a 20% allowance for climate change and sufficient subsurface storage or pond storage that will store surface water prior to discharging it at the allowed rates to Wade Brook. These measures will ensure that LSEP will not be at increased risk of surface water flooding as a result of climate change.

Taking into account this imbedded mitigation:

- The susceptibility of the plant building and operations to surface water flooding is deemed to be low as the receptor has the ability to withstand the projected increased potential for surface water flooding.
- The vulnerability of the plant to surface water flooding is considered to be moderate as although the increased potential for surface water flooding could impact upon the buildings and operations, the proposed mitigation measures ensures that they can tolerate the projected increases in surface water flooding events.

The buildings are high value receptors. The sensitivity of the plant buildings to surface water flooding is deemed to be low as although the receptor is of high value and climatic factors can affect it, the receptor has the ability to withstand the projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). Although the probability of increased surface water flooding is high, the mitigation measures embedded in the design of LSEP are such that the consequence is low, and the overall magnitude is small. As a result, it is considered that the predicted increase in winter rainfall leading to the increased potential for surface water flooding would be of negligible significance to the plant buildings and operation.

2.1.2 Fluvial flooding

The predicted 7% increase in winter precipitation increases the potential risk of fluvial flooding. If flooding of the site were to be severe, there would be a risk of flood damage to buildings, resulting in maintenance and possible generation disruption.

The Wade Brook is the main watercourse in the surrounding area, located within 100 m of the Site. The Trent and Mersey Canal is also situated adjacent to the LSEP site and there are agricultural drainage ditches in the surrounding fields. As set out in the FRA the Site is within Flood Zone 1, which is the lowest risk zone and is described as low probability of fluvial flooding. However, the closest Flood Zone 2 or 3 area is along the section of Wade Brook to the north west of the Site, which is adjacent to the site boundary. Taking this into account:

- The susceptibility of the plant buildings and operations to fluvial flooding is deemed to be moderate, as LSEP would be negatively impacted should fluvial flooding occur but has limited ability to withstand some increase in levels.
- The vulnerability of the plant buildings to fluvial flooding is considered to be moderate, as the receptor is dependent upon climatic factors but can tolerate a range in conditions (being in a Flood Zone 1).

The buildings are high value receptors. The sensitivity of the plant buildings and operations to fluvial flooding is deemed to be medium as the receptor is of high value and climatic factors can affect it. However, the receptor has some ability to withstand the projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). The site is located within Flood Zone 1 and therefore there is a low risk probability of a flood event occurring. Although this does not take climate change into account and so may not be as applicable to the future baseline, the change would have to be considerable for the flood zone to change enough that the site would not be within Flood Zone 1. Although flooding would result in a high consequence, due to a low probability, the overall magnitude is deemed to be small. As a result, it is considered that the predicted increase in winter rainfall leading to the increased potential for fluvial flooding on site would have an effect of slight significance on the plant buildings and would not be considered significant.

2.1.3 Groundwater flooding

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods may emerge from either point of diffuse locations. They tend to be long in duration developing over weeks or months and prevailing for days or weeks.

The predicted 7% increase in precipitation increases the potential risk of groundwater flooding. If flooding of the site were to be severe, there would be a risk of flood damage to buildings, resulting in maintenance and possible generation disruption.

As set out in the FRA, there is no history of groundwater flooding in the area and the risk of groundwater flooding has been conserved to be negligible. However, it is not clear whether this has taken into account the potential impacts of climate change.

Taking this into account:

- The susceptibility of the plant buildings and operations to groundwater flooding is deemed to be 'moderate', as LSEP would be negatively impacted should groundwater flooding occur but has limited ability to withstand some increase in levels.
- The vulnerability of the plant to groundwater flooding is considered to be 'low' as the risk of groundwater flooding in the area has been assessed to be negligible but may have not incorporated in climate change.

The buildings are high value receptors. The sensitivity of the plant buildings and operations to groundwater flooding is deemed to be 'medium' as the receptor is of high value and climatic factors can affect it. However, the receptor has some ability to withstand the projected changes to climate.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). Despite a potential consequence, due to the low probability of occurrence, the overall magnitude is deemed to be 'negligible'. As a result, it is considered that the predicted increase in winter rainfall leading to the increased potential for fluvial flooding on site would have an effect of slight significance on the plant buildings and would not be considered significant.

2.2 Climatic effect – extreme events

The predicted increase in rain caused by storms and extreme events is covered in the flooding sections. Surges in wind may have an impact on the wind loading of buildings, the potential impact being structural damage to the buildings, for example wind gusts could cause damage or shifting to cladding or bolts causing a risk of cladding or external parts of the building coming loose.

However, as part of the structural design for the building wind loading studies will be carried out which include a safety factor. This safety factor is sufficient to allow for these strong winds and associated wind loading. In addition, preventative measures such as preventative maintenance and regular inspections of the cladding and building materials will also be carried out.

Taking into account this imbedded mitigation:

- The susceptibility of the plant building and operations is deemed to be 'low' as the receptor has the ability to withstand any the projected increase in wind speeds due to incorporated design.
- The vulnerability of the plant is considered to be 'moderate' as the receptor is dependent upon climatic factors but can tolerate a range in conditions.

The buildings are high value receptors. The sensitivity of the plant building and operation to extreme events is deemed to be medium because the receptor is of high value and climatic factors can affect it, although there is some ability to withstand the projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). The probability of increased winds speeds is medium (UKCP18 projections do not quantify but predict they will increase), the mitigation measures imbedded in the design of LSEP are such that the likelihood of adverse impacts is low and the overall magnitude is considered to be 'small'. As a result, it is considered that the predicted increase in wind speeds during extreme events leading to increased potential for structural damage to buildings would be of have an effect of slight significance on the plant buildings and operation and would not be considered significant.

2.3 Summary

The assessment of climate change impacts on plant buildings and operation is summarised in Table 1.

Table 1: Summary of assessment for plant buildings and operation

Predicted change in climate	Impact	Susceptibility	Vulnerability	Resulting sensitivity	Magnitude of effect considering mitigation	Overall significance
Increase in temperatures	Over -heating	Low	Moderate	Low	Small	Negligible
Increase in precipitation	Surface water flooding	Low	Moderate	Low	Small	Negligible
	Fluvial flooding	Moderate	Moderate	Medium	Small	Slight
	Groundwater flooding	Moderate	Low	Medium	Negligible	Slight
Extreme events	Building damage from high winds	Low	Moderate	Medium	Small	Slight

In summary, the overall significance of effects of climate change on the buildings and operation is assessed to be negligible to slight. This is not a significant effect.

3 Vehicular access to site (for workers and waste)

3.1 Climatic effect – increased winter precipitation

Anticipated potential impacts to vehicular access to site from a 7% increase in winter precipitation are:

- Increased surface run off and associated surface water flooding of access routes;
- Fluvial flooding of access routes; and
- Groundwater flooding of access routes.

If waste feedstock cannot access LSEP, there is a risk of supply disruption and potential shut down. If staff cannot access the Site, there may be an impact to shift patterns and the potential for partial or complete shut down if there are not enough staff to maintain safe plant operation.

The highways network is designed for resilience to extreme events and it is the local council (CWACC)'s and highways authority's responsibility to maintain the roads.

In the case that vehicles are restricted from accessing the Site, the design of the LSEP includes contingency planning for three days: the waste bunker has the capacity for four days' worth of waste storage; there are five days of APCr residues maintained on site; and there is sufficient storage capacity for three days of IBA storage. Therefore, the LSEP be able to continue normal operations for five days, by which time it is expected that any road restrictions would have been removed or alternative routes created. In addition, the operating procedures would include monitoring of weather conditions and should weather conditions occur that could result in localised flooding of roads then measures would be put in place to ensure the facility could continue to operate.

Taking into account this imbedded mitigation:

- The susceptibility of the vehicular access to site to flooding is deemed to be 'moderate' because the receptor would be temporarily impacted by flooding.
- The vulnerability of the vehicular access to site to flooding is considered to be 'low' as the receptor is dependent upon some climatic factors, but these have been accounted for by the LSEP's contingency plan.

The value of vehicular access to site is medium. The sensitivity of vehicular access to site to flooding is deemed to be low because the receptor has the ability to withstand projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). Although the probability of increased flooding is high, the mitigation measures imbedded in the design of the proposals are such that the consequence is low and the overall magnitude is small. As a result, it is considered that that the predicted increase in winter rainfall leading to the increased potential for surface water and fluvial flooding would be of negligible significance to the vehicular access to site.

3.2 Climatic effect – extreme events

The predicted increase in rain caused by storms and extreme events is covered in the flooding sections. Surges in wind may have an impact on the vehicular access to site where they cause branches to be blown off or trees to be blown over, resulting in a road blockage.

If waste feedstock cannot access the LSEP, there is a risk of supply disruption and potential shut down. If staff cannot access the Site, there may be an impact to shift patterns and the potential for partial or complete shut down if there are not enough staff to maintain safe plant operation.

The highways network is designed for resilience to extreme events and it is the local council's (CWACC) and highway authorities responsibility to maintain the roads.

In the case that vehicles are restricted from accessing the Site, the design of the LSEP includes contingency planning for three days: the waste bunker has the capacity for four days' worth of waste storage; there are five days of APCr residues maintained on site; and there is sufficient storage capacity for three days of IBA storage. Therefore, the proposals would be able to continue normal operations for five days, by which time it is expected that any road restrictions would have been removed or alternative routes created.

Taking into account this imbedded mitigation:

- The susceptibility of vehicular access to site to tree fall as a result of extreme winds is deemed to be 'low' as the receptor has the ability to withstand a blockage to the site.
- The vulnerability of vehicular access to site to tree fall as a result of extreme winds is considered to be 'moderate' as it is expected that CWACC would remove any blockages promptly, but if not any impact from said blockages have been accounted for by the LSEP's contingency plan.

The value of vehicular access to site is medium. The sensitivity of vehicular access to site to tree fall as a result of extreme winds is deemed to be low because the receptor has the ability to withstand projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). Although the probability of increased tree fall is high, the mitigation measures imbedded in the design of the LSEP and actions of the highways authority and CWACC are such that the consequence is low and the overall magnitude is small. As a result, it is considered that the predicted increase in wind speeds leading to the increased potential for tree fall causing access road blockages would be of negligible significance to the vehicular access to Site.

3.3 Summary

The assessment of climate change impacts on vehicular access to the site is summarised in Table 2.

Table 2: Summary of assessment for vehicular access to site

Predicted change in climate	Impact	Susceptibility	Vulnerability	Resulting sensitivity	Magnitude of effect considering mitigation	Overall significance
Increase in winter precipitation	Flooding of access roads	Moderate	Low	Low	Small	Negligible
Extreme events	Trees and branches blocking access roads	Low	Moderate	Low	Small	Negligible

In summary, the overall significance of effects of climate change on vehicular access to site is assessed to be negligible.

4 Grid connection and local users

4.1 Climatic effect - Increased winter precipitation

Anticipated potential impacts to grid connection and local electricity users from a 15% increase in winter precipitation are flooding events from surface water flooding, groundwater flooding, or fluvial flooding which could cause water damage to the grid connection and electricity supply. This would result in no output of power from the LSEP to the local electricity distribution network.

However, the LSEP has been designed so that the grid connection and associated cables are underground. This protects them from any above ground damage from storm or wind events and the cables are designed to be resilient to water and so would not be impacted by any flooding events.

Taking into account this imbedded mitigation:

- The susceptibility of grid connection and local users is deemed to be 'moderate' as the receptor would be impacted should flooding damage to cables occur but has some ability to withstand flooding.
- The vulnerability of grid connection is considered to be 'low' as mitigation measures (such as the use of underground caballing) have been included to ensure that climatic factors have little influence on the receptor.

The value of gird connection and local users is high. The sensitivity of grid connection and local users to increased winter precipitation is deemed to be low as the receptor has the ability to withstand projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). Although the probability of increased winter precipitation is high, the mitigation measures imbedded in the design of the proposals are such that the consequence is low and the overall magnitude is small. As a result, it is considered that the predicted increase in rainfall leading to the increased potential for flooding would be of negligible significance to the grid connection and local users.

4.2 Climatic effect - extreme events

The predicted increase in rain caused by storms and extreme events is covered in the flooding sections. Surges in wind are not expected to impact the grid connection or local users, given that the connection is via an underground cable.

4.3 Summary

The assessment of climate change impacts on grid connection and local users is summarised in Table 3.

Table 3: Summary of assessment for grid connection and local users

Predicted change in climate	Impact	Susceptibility	Vulnerability	Resulting sensitivity	Magnitude of effect considering mitigation	Overall significance
Increase in winter precipitation	Infrastructure damage due to flooding	Moderate	Low	Low	Small	Negligible

In addition, unlike conventional power stations such as gas fired power stations, LSEP has the ability to re-start itself in the event of a shut down, without reliance on supply of electricity from the grid. This is referred to as the facility having 'black start' capability. This enables the facility to generate and supply electricity into the local grid, even in the event of a major grid failure. Such facilities are important for the resilience of the local and national grid.

In summary, the overall significance of effects climate change on the grid connection and local users is assessed to be negligible.

5 On-site workers

5.1 Climatic effect - Increased winter precipitation

Increase in summer rainfall gives the possibility of flooding on-site (either fluvial, groundwater or surface water). This could result in dangerous working conditions or closure of the site. However, as set out previously there are mitigation measures built into the design including Risk Assessment Method Statements (RAMS) to account for these events should they occur.

Taking this into account:

- The susceptibility of the on-site workers to flooding is deemed to be 'moderate', as the workers would be negatively impacted should flooding occur but they have the ability to withstand some increase in levels.
- The vulnerability of the on-site workers flooding is considered to be 'low' as although the increased potential for groundwater flooding could impact upon the buildings and operations, the proposed mitigation measures ensures that they can tolerate the projected increases in flooding events.

The on-site workers are high value receptors. The sensitivity of the on-site workers to flooding is deemed to be 'low' as the receptor is of high value and climatic factors can affect it. However, the receptor has some ability to withstand the projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). The embedded mitigation measures are such that the consequence of a flooding event on on-site workers would be low, although the probability is medium. Therefore, the overall magnitude is deemed to be 'small'. As a result, it is considered that the predicted increase in winter rainfall leading to the increased potential for flooding and the effects on on-site works would be of negligible significance.

5.2 Climatic effect - extreme events

The predicted increase in rain caused by storms and extreme events is covered in the flooding sections. Gusts of wind may have an impact on the safety of on-site workers around the buildings. For example, if wind gusts were to cause damage or shifting to cladding or bolts there is risk of cladding or external parts of the building coming loose and being a falling hazard to on-site workers. There is also some risk to workers stability if they are, for example, climbing one of the stacks. The risk of wind exposure is greater up the stacks due to its height and higher exposure to winds.

The risk of wind damage to on-site workers caused by damage to buildings is reduced by measures such as preventative maintenance and regular inspections of the cladding and building materials. All works would be covered under site specific RAMS. This will include measures such as ensuring that prior to any workers climbing one of the stacks, wind speeds are checked to ensure they are not at dangerous levels. The stacks will each include a hooped ladder and all workers would need to be connected with a harness.

Taking into account this imbedded mitigation:

- The susceptibility of the on-site workers is deemed to be 'low' as the receptor has the ability to withstand any the projected increase in wind speeds due to incorporated design and preventative measures.
- The vulnerability of the workers is considered to be 'moderate' as the receptor is dependent upon climatic factors and may be injured but measures would be in place to minimise the risk.

The on-site workers are high value receptors. The sensitivity of the on-site workers to extreme events is deemed to be medium because the receptor is of high value and climatic factors can affect it, although there is some ability to withstand the projected changes.

The magnitude of effect is determined based on the probability and consequence (including consideration of the mitigation measures). The probability of increased winds speeds is medium (UKCP18 projections do not quantify but predict they will increase), the mitigation measures and preventative measures embedded in the design of the LSEP are such that the likelihood of adverse impacts is low and the overall magnitude is considered to be 'small'. As a result, it is considered that the predicted increase in wind speeds during extreme events leading to increased potential for structural damage to buildings causing damage to on-site workers would have a slight effect and would not be considered significant.

5.3 Summary

The assessment of climate change impacts on on-site workers is summarised in Table 4.

Table 4: Summary of assessment for on-site workers

Predicted change in climate	Impact	Susceptibility	Vulnerability	Resulting sensitivity	Magnitude of effect considering mitigation	Overall significance
Increased winter precipitation	On-site Flooding (fluvial, groundwater or surface water)	Moderate	Low	Low	Small	Negligible
Extreme events	Surges in wind and effects on worker safety	Low	Moderate	Medium	Small	Slight

In summary, the overall significance of effects of climate change on on-site workers is assessed to be negligible to slight. This is not a significant effect.

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