

planning
transport
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Document 3.1 – ES Volume 2

Appendix 5.4: Air Quality - Assessment of Impacts on Ecological Receptors

Wheelabrator Kemsley (K3 Generating Station) and Wheelabrator Kemsley North
(WKN) Waste to Energy Facility DCO

September 2019 -Submission Version

PINS ref: EN010083



Appendix 5.4: Assessment of Ecological Impacts

The following European designated nature conservation sites, within 10 km of the Application Site, have been identified:

- The Swale Special Protection Area (SPA);
- The Swale Ramsar;
- Medway Estuary and Marshes SPA;
- Medway Estuary and Marshes Ramsar;
- Thames Estuary and Marshes SPA;
- Thames Estuary and Marshes Ramsar;
- Queensdown Warren Special Area of Conservation (SAC); and
- Outer Thames Estuary SPA.

The following nationally designated sites, within 2 km of the Application Site, have also been identified:

- The Swale SSSI;
- Milton Creek LWS; and
- Elmley NNR.

For information, the Medway Estuary and Marshes SSSI is 2.9 km from the Application Site (i.e. more than 2 km away) and has been excluded from the assessment. The Swale Marine Conservation Zone (MCZ) has also been excluded as there is no requirement to assess air quality impacts at waterbodies/MCZs.

Approach

This approach to this assessment considers the IAQM 'A guide to the assessment of air quality impacts on designated nature conservation sites'. Concentrations of NO_x, SO₂ and Ammonia have been predicted using the same model as used in the assessment of impacts at human-health receptors. Modelling has been undertaken for a grid of receptor points, with a grid spacing of 200 m, across each identified nature conservation site. The receptor grid points have been modelled at ground level. To ensure that the assessment is conservative, the maximum PC for WKN and K3 (0 – 75MW) the K3 Proposed Development at each site and for all the meteorological datasets has been identified and is presented in this Appendix.

Critical Levels

Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. PCs and, where appropriate, PECs of NO_x, SO₂ and NH₃ have been calculated for comparison with the relevant critical level. Background concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [1].

Critical Loads

Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Nutrient nitrogen deposition and acid deposition are considered in this Appendix.

Critical Loads – Nutrient N Deposition

Percentage contributions to nutrient nitrogen deposition have been derived from the modelled NO_x concentrations. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows:

1. The dry deposition flux ($\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) has been calculated by multiplying the ground level NO₂ concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) by the deposition velocity of 0.003 $\text{m}\cdot\text{s}^{-1}$ for forests/tall habitats and 0.0015 $\text{m}\cdot\text{s}^{-1}$ for grassland/short habitats.
2. Units of $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ have been converted to units of $\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_x.
3. Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads – Acidification

The acid deposition rate, in equivalents $\text{keq}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$, has been calculated by multiplying the dry deposition flux ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$) by a conversion factor of 0.071428 for N. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

Wet deposition in the near field is not significant compared with dry deposition for N [2] and therefore for the purposes of this assessment, wet deposition has not been considered.

Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with the designated site as derived from the APIS database.

Significance Criteria

Maximum PCs and PECs of NO_x, SO₂, NH₃ and N/acid deposition have been compared against the relevant EQS for the relevant habitat type/interest feature. The Environment Agency guidelines [3] state that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

-the short-term PC is less than 10% of the short-term environmental standard

-the long-term PC is less than 1% of the long-term environmental standard

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

It continues by stating that:

"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further."

Where *potentially* significant impacts have been identified, the impacts have been passed to the project's ecologist to allow the significance of the likely effect to be determined.

Results

The ambient NO_x, SO₂ and NH₃ concentrations and existing deposition rates have been obtained from APIS. The highest deposition rates have been obtained taking into account the various habitats across the sites. The lowest critical loads for nitrogen deposition and acid deposition have been also obtained from APIS [4].

The maximum predicted annual-mean NO_x, SO₂ and NH₃ concentrations are compared with the critical level in Tables 5.4.1, 5.4.2 and 5.4.3. The maximum predicted nutrient N deposition rates are compared with the critical load in Table 5.4.4. The maximum predicted acid deposition rates are compared with the critical load function in Table 5.4.5. Only Queendown Warren is sensitive to acid deposition and the other designated sites have not been presented in this table.

For the Outer Thames Estuary SPA, APIS describes the habitat as *inshore sublittoral sediment*, which provides wintering for the red-throated diver. APIS states that this habitat is not sensitive to increases in NO_x, SO₂ or NH₃ concentrations, nitrogen deposition or acid deposition. As such, this site has not been considered further in the assessment.

Table 5.4.1 Predicted Annual-Mean NO_x Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC ($\mu\text{g.m}^{-3}$)	WKN + K3 PC ($\mu\text{g.m}^{-3}$)	WKN + K3 PC/CL (%)	WKN + K3 PEC ($\mu\text{g.m}^{-3}$)	WKN + K3 PEC as % of CL ($\mu\text{g.m}^{-3}$)
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	30	12.3	3.2	11	15.5	52
Medway Estuary and Marshes SPA/Ramsar		24.4	0.4	1	24.8	83
Thames Estuary and Marshes SPA/Ramsar		18.3	0.1	0	18.4	61
Queendown Warren SAC		18.7	0.1	0	18.9	63

Table 5.4.2 Predicted Annual-Mean SO₂ Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC ($\mu\text{g.m}^{-3}$)	WKN + K3 PC ($\mu\text{g.m}^{-3}$)	WKN + K3 PC/CL (%)	WKN + K3 PEC ($\mu\text{g.m}^{-3}$)	WKN + K3 PEC as % of CL ($\mu\text{g.m}^{-3}$)
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	20	0.29	0.80	4	1.09	5
Medway Estuary and Marshes SPA/Ramsar		0.36	0.09	0	0.45	2
Thames Estuary and Marshes SPA/Ramsar		0.32	0.03	0	0.35	2
Queendown Warren SAC		0.34	0.04	0	0.38	2

Table 5.4.3 Predicted Annual-Mean NH₃ Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC	WKN + K3 PC ($\mu\text{g.m}^{-3}$)	WKN + K3 PC/CL (%)	WKN + K3 PEC ($\mu\text{g.m}^{-3}$)	WKN + K3 PEC/CL (%)
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	3	0.88	0.080	3	0.96	32
Medway Estuary and Marshes SPA/Ramsar		0.77	0.009	0	0.78	26
Thames Estuary and Marshes SPA/Ramsar		0.76	0.003	0	0.76	25
Queendown Warren SAC		1.01	0.004	0	1.01	34

Notes:

The Swale SPA, Medway Estuary and Marshes SPA and Thames Estuary and Marshes SPA all cover the same geographical areas as the corresponding Ramsar and SSSI designations. Therefore, the values set out in Tables 5.4.1 to 5.4.3 represent the pollutant concentrations at all of these sites. Elmley NNR is within The Swale SPA/Ramsar/SSSI. APIS does not provide data for NNRs so the ambient concentrations and critical levels/loads have been assumed to be the same as The Swale SPA. Milton Creek LWS is an extension of the Swale SPA and the project's ecologist has advised that the same habitats, ambient concentrations and critical levels/loads apply. The Milton Creek LWS is mostly upwind of the Proposed Development; the nearest part of the LWS downwind of the site is to the east and covers a similar geographic area as the Swale SPA/Ramsar/SSSI. Milton Creek is a LWS and so the impact would only be significant if the PC exceeds 100% of the CL. Therefore considering the LWS to be the same as the Swale SPA/RAMSAR/SSSI is a conservative approach.

Consistent with the Institute of Air Quality Management's "A guide to the assessment of air quality impacts on designated nature conservation sites" [Error! Bookmark not defined.], the PC as a % of the CL has been rounded to the nearest integer.

Table 5.4.4 Predicted Nutrient N Deposition at Designated Sites

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC/CL (%)	WKN + K3 PEC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PEC/CL (%)
The Swale SPA/Elmley NNR/Milton Creek LWS	Breeding Lapwing	20	14.2	0.9	4	15.1	75
	Ringed plover	20	14.2	0.9	4	15.1	75
	Eurasian reed warbler	15	14.2	0.9	6	15.1	101
	Eurasian curlew	20	14.2	0.9	4	15.1	75
	Reed bunting	15	14.2	0.9	6	15.1	101
	Dark-bellied brent goose	20	14.2	0.9	4	15.1	75
	Common shelduck	20	14.2	0.9	4	15.1	75
	Eurasian teal	20	14.2	0.9	4	15.1	75
	Mallard	Not available	14.2	0.9	-	15.1	-
	Common moorhen	Not available	9.8	0.9	-	10.7	-
	Gadwall	Not available	9.8	0.9	-	10.7	-
	Grey plover	20	14.2	0.9	4	15.1	75
	Dunlin	20	14.2	0.9	4	15.1	75
	Common coot	Not available	9.8	0.9	-	10.7	-
	Common redshank	20	14.2	0.9	4	15.1	75
Eurasian oystercatcher	20	14.2	0.9	4	15.1	75	
Medway Estuary and Marshes SPA	Common tern	8	13.2	0.10	1	13.3	166
	Red-throated diver	Not sensitive	10.8	0.10	-	10.9	-
	Eurasian curlew	20	13.2	0.10	1	13.3	67

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC/CL (%)	WKN + K3 PEC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PEC/CL (%)
	Common greenshank	20	13.2	0.10	1	13.3	67
	Little tern	8	13.2	0.10	1	13.3	166
	Hen harrier	10	13.2	0.10	1	13.3	133
	Merlin	10	13.2	0.10	1	13.3	133
	Ringed plover	20	13.2	0.10	1	13.3	67
	Short-eared owl	10	Not available	0.10	1	-	-
	Great crested grebe	20	13.2	0.10	1	13.3	67
	Great cormorant	Not available	13.2	0.10	-	13.3	-
	Dark-bellied brent goose	20	13.2	0.10	1	13.3	67
	Eurasian teal	20	13.2	0.10	1	13.3	67
	Mallard	20	13.2	0.10	1	13.3	67
	Northern shoveler	Not available	13.2	0.10	-	13.3	-
	Common shelduck	20	13.2	0.10	1	13.3	67
	Eurasian wigeon	20	13.2	0.10	1	13.3	67
	Northern pintail	20	13.2	0.10	1	13.3	67
	Common pochard	20	13.2	0.10	1	13.3	67
	Eurasian oystercatcher	20	13.2	0.10	1	13.3	67
	Pied avocet	20	13.2	0.10	1	13.3	67
	Grey plover	20	13.2	0.10	1	13.3	67
	Red knot	20	13.2	0.10	1	13.3	67
	Dunlin	20	13.2	0.10	1	13.3	67
	Black-tailed godwit	20	13.2	0.10	1	13.3	67
	Common redshank	20	13.2	0.10	1	13.3	67
	Ruddy turnstone	20	13.2	0.10	1	13.3	67
Tundra swan	Not sensitive	13.2	0.10	-	13.3	-	
Common kingfisher	Not available	10.8	0.10	-	10.9	-	
Thames Estuary and Marshes SPA	Ringed plover	8	12.1	0.03	0	12.1	151
	Hen harrier	10	12.1	0.03	0	12.1	121
	Pied avocet	20	12.1	0.03	0	12.1	60

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PC/CL (%)	WKN + K3 PEC (kgN.ha ⁻¹ .yr ⁻¹)	WKN + K3 PEC/CL (%)
	Grey plover	20	12.1	0.03	0	12.1	60
	Red knot	20	12.1	0.03	0	12.1	60
	Dunlin	20	12.1	0.03	0	12.1	60
	Black-tailed godwit	20	12.1	0.03	0	12.1	60
	Common redshank	20	12.1	0.03	0	12.1	60
Queendown Warren SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates	15	15.4	0.04	0	15.4	103
The Swale Ramsar/SSSI	Intertidal habitats (coastal saltmarsh)	20	14.2	0.9	4	15.1	75
	Saltmarsh (coastal saltmarsh)	20	14.2	0.9	4	15.1	75
	Shingle & sea cliff (dunes, shingle & machair)	10	14.2	0.9	4	15.1	75
	Arable (horticultural & arable)	Not sensitive	-	-	-	-	-
	Standing water (standing open water)	No CL	-	-	-	-	-
	Waste land, industrial (no corresponding APIS)	Not sensitive	-	-	-	-	-
Medway Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	20	13.2	0.1	1	13.3	67
	Saltmarsh (coastal saltmarsh)	20	13.2	0.1	1	13.3	67
	Shingle & sea cliff (dunes, shingle & machair)	10	13.2	0.1	1	13.3	133
	Wet grassland (grazing marsh)	20	13.2	0.1	1	13.3	67
	Dry grassland (grazing marsh)	20	13.2	0.1	1	13.3	67
	Bogs, marshes, fens (fen, marsh & swamp)	15	13.2	0.1	1	13.3	89
	Standing water (standing open water)	No CL	-	-	-	-	-
	Intertidal habitats (coastal saltmarsh)	20	13.2	0.1	1	13.3	67
Thames Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	20	12.1	0.03	0	12.1	60
	Saltmarsh (coastal saltmarsh)	20	12.1	0.03	0	12.1	60
	Shingle & sea cliff (dunes, shingle & machair)	10	12.1	0.03	0	12.1	121
	Wet grassland (grazing marsh)	20	12.1	0.03	0	12.1	60
	Dry grassland (grazing marsh)	20	12.1	0.03	0	12.1	60
	Bogs, marshes, fens (fen, marsh & swamp)	15	12.1	0.03	0	12.1	80
	Standing water (standing open water)	No CL	-	-	-	-	-

Note:

Critical loads (CLs) for nutrient nitrogen deposition are provided as a range. In this case, the lower limit of the CL range has been used in the assessment.

Consistent with the Institute of Air Quality Management's "A guide to the assessment of air quality impacts on designated nature conservation sites" [Error! Bookmark not defined.], the PC as a % of the CL has been rounded to the nearest integer.

Table 5.4.5 Predicted Acid Deposition at Designated Sites

Designated Site	Interest Feature	Critical Loads (keq.ha ⁻¹ .yr ⁻¹)			WKN + K3 PC (keq.ha ⁻¹ .yr ⁻¹)		WKN + K3 PC/CLF (%)
		Min N	Max N	Max S	N	S	
Queendown Warren SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates.	0.856	4.856	4	0.003	0.004	0

Notes:

CLF = Critical Load Function.

Consistent with the Institute of Air Quality Management's "A guide to the assessment of air quality impacts on designated nature conservation sites" [Error! Bookmark not defined.], the PC as a % of the CL has been rounded to the nearest integer.

Annual-mean NO_x

The maximum annual-mean NO_x WKN + K3 PCs only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar; the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar the WKN + K3 PC is 11% of the critical level and based on the PC alone the impact is potentially significant; however, when the AC is added to the PC, the PEC is only 52% of the critical level of 30 µg.m⁻³ and the impacts can be screened out as insignificant.

Annual-mean SO₂

The maximum annual-mean SO₂ WKN + K3 PCs only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar and the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar the WKN + K3 PC is 4% of the critical level and based on the PC alone the impact is potentially significant; however, when the AC is added to the PC, the PEC is only 5% of the critical level of 20 µg.m⁻³ and the impacts can be screened out as insignificant.

Annual-mean NH₃

The maximum annual-mean NH₃ WKN + K3 PCs only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar and the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar the WKN + K3 PC is 3% of the critical level and based on the PC alone the impact is potentially significant; however, when the AC is added to the PC, the PEC is only 32% of the critical level of 3 µg.m⁻³ and the impacts can be screened out as insignificant.

Nutrient N Deposition

The maximum nitrogen deposition PC exceeds 1% of the critical load at several interest features however when the AC is added to the PC, the PECs are below the critical loads for all but two interest features and the impacts can be screened out as insignificant. For Eurasian reed warbler and Reed bunting, the PEC is 101% of the critical load and the impacts can't be screened out. The results have been passed to the projects' ecologist to assess the effects.

Acid Deposition

The maximum acid deposition PC is less than 1% of the critical load and the impacts can be screened out as insignificant.

Cumulative Impacts

Section 5.13 of Chapter 5: Air Quality sets out the cumulative developments considered for this assessment. There are four developments where there was sufficient detail to allow a PC to be added to give a cumulative PEC for ecological receptors:

- Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))
- Kemsley AD (SW/11/1291)
- Reserve Power Plant PC (18/500393/FULL)
- Garden of England Energy Facility (15/500348/COUNTY)

The PCs for each of these four developments are outlined in the table below. This has been added to the maximum PEC to give a Cumulative PEC.

Table 5.4.6 Predicted Annual-Mean NO_x Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC ($\mu\text{g.m}^{-3}$)	Proposed K3 PC ($\mu\text{g.m}^{-3}$)	WKN PC ($\mu\text{g.m}^{-3}$)	Kemsley K4 CHP PC (EN010090 (18/501923/ ADJ))	Kemsley AD (SW/11/1 291)	Reserve Power Plant PC (18/500393/ FULL)	Garden of England Energy Facility (15/500348/ COUNTY)	Cumulati ve PC	Cumulati ve PC as % of CL	Cumulati ve PE C	Cumulati ve PEC as % of CL
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	30	12.3	2.0	1.3	0.8	1.38	2.23	1.33	9.0	30	21.3	71
Medway Estuary and Marshes SPA/Ramsar		24.4	0.2	0.2	0.1	0.05	-	0.11	0.6	2	25.1	84
Thames Estuary and Marshes SPA/Ramsar		18.3	0.1	0.1	0.1	0.01	-	0.02	0.3	1	18.5	62
Queendown Warren SAC		18.7	0.1	0.1	0.1	0.01	-	0.02	0.2	1	18.9	63

Table 5.4.7 Predicted Annual-Mean SO₂ Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC ($\mu\text{g.m}^{-3}$)	Propo sed K3 PC	WKN PC	Kemsley K4 CHP PC (EN010090	Kemsle y AD (SW/11/ 1291)	Reserve Power Plant PC	Garden of England Energy Facility	Cumul ative PC	Cumul ative PC as	Cumul ative PEC	Cumul ative PEC as

			($\mu\text{g}\cdot\text{m}^{-3}$)	($\mu\text{g}\cdot\text{m}^{-3}$)	(18/501923 /ADJ))		(18/500393/ FULL)	(15/500348/C OUNTY)		% of CL		% of CL
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	20	0.29	0.49	0.33	-	-	-	0.066	0.89	4	1.18	6
Medway Estuary and Marshes SPA/Ramsar		0.36	0.04	0.05	-	-	-	0.0053	0.10	0	0.46	2
Thames Estuary and Marshes SPA/Ramsar		0.32	0.01	0.02	-	-	-	0.001	0.03	0	0.35	2
Queendown Warren SAC		0.34	0.02	0.02	-	-	-	0.001	0.04	0	0.38	2

Table 5.4.8 Predicted Annual-Mean NH₃ Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g}\cdot\text{m}^{-3}$)	AC ($\mu\text{g}\cdot\text{m}^{-3}$)	Proposed K3 PC ($\mu\text{g}\cdot\text{m}^{-3}$)	WKN ($\mu\text{g}\cdot\text{m}^{-3}$)	Kemsley K4 CHP PC (EN010090 (18/501923 /ADJ))	Kemsley AD (SW/11/ 1291)	Reserve Power Plant PC (18/500393/ FULL)	Garden of England Energy Facility (15/500348/C OUNTY)	Cumulative PC	Cumulative PC as % of CL	Cumulative PEC	Cumulative PEC as % of CL
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	3	0.88	0.05	0.033	-	-	-	0.33	0.412	14	1.29	43
Medway Estuary and Marshes SPA/Ramsar		0.77	<0.005	0.005	-	-	-	0.026	0.035	1	0.81	27
Thames Estuary and Marshes SPA/Ramsar		0.76	<0.005	0.002	-	-	-	0.005	0.008	0	0.77	26
Queendown Warren SAC		1.01	<0.005	0.002	-	-	-	0.005	0.009	0	1.02	34

Notes:

The Swale SPA, Medway Estuary and Marshes SPA and Thames Estuary and Marshes SPA all cover the same geographical areas as the corresponding Ramsar and SSSI designations. Therefore, the values set out in Table 5.4.6, 5.4.7 and 5.4.8 represent the concentrations at all of these sites. Elmley NNR is within The Swale SPA/Ramsar/SSSI. APIS does not provide data for NNRs so the ambient concentrations and critical levels/loads have been assumed to be the same as The Swale SPA. Milton Creek LWS is an extension of the Swale SPA and the project's ecologist has advised that the same habitats, ambient concentrations and critical levels/loads apply. The Milton Creek LWS is mostly upwind of the Proposed Development; the nearest part of the LWS downwind of the site is to the east and covers a similar geographic area as the Swale SPA/Ramsar/SSSI.

Milton Creek is a LWS and so the impact would only be significant if the PC exceeds 100% of the CL. Therefore considering the LWS to be the same as the Swale SPA/RAMSAR/SSSI is a conservative approach.

Consistent with the Institute of Air Quality Management's "A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites", the PC as a % of the CL has been rounded to the nearest integer.

Table 5.4.9 Predicted Nutrient N Deposition at Designated Sites

Designated Site	Interest Feature	CL (kgN .ha ⁻¹ .yr ⁻¹)	AC (kgN .ha ⁻¹ .yr ⁻¹)	Proposed K3 PC (kgN .ha ⁻¹ .yr ⁻¹)	WKN PC (kgN .ha ⁻¹ .yr ⁻¹)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PC/CL (%)	Cumulative PEC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PEC/CL (%)
The Swale SPA/Elmley NNR/ Milton Creek LWS	Breedin	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Ringed	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Eurasia	15	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	32	19.0	127
	Eurasia	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Reed	15	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	32	19.0	127
	Dark-bellied	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Commo	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Eurasia	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Mallard	Not avail	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	-	19.0	-
	Common moorhen	Not avail	9.8	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	-	14.6	-
	Gadwall	Not avail	9.8	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	-	14.6	-
	Grey	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Dunlin	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
	Common coot	Not avail	9.8	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	-	14.6	-
	Common	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95
Eurasian	20	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	24	19.0	95	

Designated Site	Interest Feature	CL (kgN .ha ⁻¹ .yr ⁻¹)	AC (kgN .ha ⁻¹ .yr ⁻¹)	Proposed K3 PC (kgN. ha ⁻¹ .yr ⁻¹)	WKN PC (kgN .ha ⁻¹ .yr ⁻¹)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393 /FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PC/CL (%)	Cumulative PEC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PEC/CL (%)
Medway Estuary and Marshes SPA	Commo	8	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	4	13.5	169
	Red-throated diver	Not sensitive	10.8	0.05	0.05	0.01	0.0005	-	0.19	0.3	-	11.1	-
	Eurasia	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Commo	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Little	8	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	4	13.5	169
	Hen	10	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	3	13.5	135
	Merlin	10	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	3	13.5	135
	Ringed	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Short-eared	10	Not avail	0.05	0.05	0.01	0.0005	-	0.19	0.3	3	-	-
	Great	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Great cormorant	Not avail	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	-	13.5	-
	Dark-	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Eurasia	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Mallard	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Northern shoveler	Not avail	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	-	13.5	-
	Commo	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Eurasia	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Northern	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Commo	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Eurasian oystercatcher	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
Pied	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68	

Designated Site	Interest Feature	CL (kgN .ha ⁻¹ .yr ⁻¹)	AC (kgN .ha ⁻¹ .yr ⁻¹)	Proposed K3 PC (kgN.ha ⁻¹ .yr ⁻¹)	WKN PC (kgN .ha ⁻¹ .yr ⁻¹)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PC/CL (%)	Cumulative PEC (kgN.ha ⁻¹ .yr ⁻¹)	Cumulative PEC/CL (%)
	Grey	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Red	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Dunlin	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Black-tailed	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Commo	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Ruddy	20	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	2	13.5	68
	Tundra swan	Not sensi	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	-	13.5	-
	Common Linnet	Not avail	10.8	0.05	0.05	0.01	0.0005	-	0.19	0.3	-	11.1	-
Thames Estuary and Marshes SPA	Ringed	8	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	1	12.1	152
	Hen	10	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	1	12.1	121
	Pied	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
	Grey	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
	Red	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
	Dunlin	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
	Black-	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
	Commo	20	12.1	0.02	0.02	0.01	0.0001	-	0.03	0.1	0	12.1	61
Queendown Warren SAC	Semi-natural dry grasslands and	15	15.4	0.02	0.02	0.01	0.0001	-	0.03	0.1	1	15.5	103
The Swale Ramsar/SSSI	Intertidal habitats	20	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	24	4.8	95
	Saltmarsh	20	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	24	4.8	95

Designated Site	Interest Feature	CL (kgN .ha ⁻¹ .yr ⁻¹)	AC (kgN .ha ⁻¹ .yr ⁻¹)	Proposed K3 PC (kgN. ha ⁻¹ .yr ⁻¹)	WKN PC (kgN .ha ⁻¹ .yr ⁻¹)	Kemsley K4 CHP PC (EN01009 0 (18/50192 3/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393 /FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PC (kgN.h a ⁻¹ .yr ⁻¹)	Cumulative PC/CL (%)	Cumulative PEC (kgN.h a ⁻¹ .yr ⁻¹)	Cumulative PEC/CL (%)
	Shingle & sea cliff	10	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	48	4.8	190
	Arable (horticult	Not sensi	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	-	4.8	-
	Standing water	No CL	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	-	4.8	-
	Waste land, industria	Not sensitive	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	-	4.8	-
Medway Estuary and Marshes Ramsar	Intertidal habitats (coastal	20	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	68
	Saltmarsh	20	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	68
	Shingle & sea cliff (dunes	10	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	3	0.3	135
	Wet grassland	20	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	68
	Dry grassland	20	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	68
	Bogs, marshes fens	15	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	90
	Standing water	No CL	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3!	-	0.2	-

Designated Site	Interest Feature	CL (kgN .ha ⁻¹ .yr ⁻¹)	AC (kgN .ha ⁻¹ .yr ⁻¹)	Proposed K3 PC (kgN. ha ⁻¹ .yr ⁻¹)	WKN PC (kgN .ha ⁻¹ .yr ⁻¹)	Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393 /FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PC (kgN.h a ⁻¹ .yr ⁻¹)	Cumulative PC/CL (%)	Cumulative PEC (kgN.h a ⁻¹ .yr ⁻¹)	Cumulative PEC/CL (%)
	Intertidal habitats	20	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	2	0.3	68
Thames Estuary and Marshes Ramsar	Intertidal habitats	20	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	0	0.1	61
	Saltmarsh	20	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	0	0.1	61
	Shingle & sea cliff (dunes)	10	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	1	0.1	121
	Wet grassland	20	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	0	0.1	61
	Dry grassland	20	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	0	0.1	61
	Bogs, marshes	15	12.1	0.02	0.02	0.01	0.0002	-	0.03	0.1	0	0.1	81
	Standing water	No CL	12.1	0.54	0.02-	0.01	-0.002	-	0.03	0.1	-	0.1	-

Note:

Future AC is the AC from the APIS website plus the PC from K3 as permitted

Critical loads (CLs) for nutrient nitrogen deposition are provided as a range. In this case, the lower limit of the CL range has been used in the assessment.

Consistent with the Institute of Air Quality Management's "A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites", the PC as a % of the CL has been rounded to the nearest integer.

Table 5.4.10 Predicted Acid Deposition at Designated Sites

Designated Site	Interest Feature	Critical Loads (keq.ha ⁻¹ .yr ⁻¹)			WKN PC (keq.ha ⁻¹ .yr ⁻¹)		Kemsley K4 CHP PC (EN010090 (18/501923/ADJ))		Kemsley AD (SW/11/1291)		Reserve Power Plant PC (18/500393/FULL)		Garden of England Energy Facility (15/500348/COUNTY)		Cumulative PC		PC as % of CLF (%)	Cumulative PEC WKN + Increase in K3 PC/CLF (%)		Cumulative PEC as % of CLF
		Min N	Max N	Max S	N	S	N	S	N	S	N	S	N	S	N	S				
Queen down Warren SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates.	0.856	4.856	4	0.001	0.002	0.0005	-	0.0001	0.000	-	-	0.001	-	0.004	0.003	0	1.10	0.21	27

Notes:

* Habitat in parenthesis is the corresponding APIS broad habitat for which critical loads are available

dune/shingle/marsh systems in this location are calcareous and therefore well buffered

CLF = Critical Load Function.

Consistent with the Institute of Air Quality Management's "A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites", the PC as a % of the CL has been rounded to the nearest integer.

Annual-mean NO_x

The maximum annual-mean NO_x cumulative PC only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar and the Medway Estuary & Marshes SPA/Ramsar; the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar and the Medway Estuary & Marshes SPA/Ramsar the cumulative PC is 30 and 2% of the critical level and based on the cumulative PCs alone the impact is potentially significant; however, when the AC is added to the PCs, the cumulative PECs are only 71 and 84% of the critical level of 30 µg.m⁻³ and the impacts can be screened out as insignificant.

Annual-mean SO₂

The maximum annual-mean SO₂ cumulative PC only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar and the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar the cumulative PC is 4% of the critical level and based on the cumulative PC alone the impact is potentially significant; however, when the AC is added to the PCs, the cumulative PEC is only 6% of the critical level of 20 µg.m⁻³ and the impacts can be screened out as insignificant.

Annual-mean NH₃

The maximum annual-mean NH₃ cumulative PC only exceeds 1% of the critical level at the Swale SPA/SSSI/Ramsar and the effects can be screened out as insignificant at the other sites. At the Swale SPA/SSSI/Ramsar the cumulative PC is 14% of the critical level and based on the cumulative PC alone the impact is potentially significant; however, when the AC is added to the PCs, the cumulative PEC is only 43% of the critical level of 3 µg.m⁻³ and the impacts can be screened out as insignificant.

Nutrient N Deposition

The maximum nitrogen deposition cumulative PC does not exceed 1% of the critical load for a number of interest features and the effects can be screened out as insignificant. Where the cumulative PC exceeds 1% of the critical load, the impact is potentially significant; however if the cumulative PEC is less than the CL, the impacts can be screened out as insignificant. For the following interest features, the cumulative PC exceeds 1% of the CL and the cumulative PEC exceeds the CL and the impacts are potentially significant. The results have been passed to the projects' ecologist to assess the effects in Chapter 11.

Table 5.4.11 Predicted Nutrient N Deposition at Designated Sites

Designated Site	Interest Feature	CL (kgN.ha-1.yr-1)	AC (kgN.ha-1.yr-1)	Proposed K3 PC (kgN.ha-1.yr-1)	WKN PC (kgN.ha-1.yr-1)	Kemsley K4 CHP PC (EN010090 (18/501923 /ADJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/ FULL)	Garden of England Energy Facility (15/500348/COU NTY)	Cumulative PC (kgN.ha-1.yr-1)	Cumulative PC/CL (%)	Cumulative PEC (kgN.ha-1.yr-1)	Cumulative PEC/CL (%)
The Swale SPA/Elmley NNR/ Milton Creek LWS	Eurasian reed warbler	15	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	32	19.0	127
	Reed bunting	15	14.2	0.54	0.36	0.1	0.0142	1.92	1.9	4.8	32	19.0	127
Medway Estuary and Marshes SPA	Common tern	8	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	4	13.5	169
	Little tern	8	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	4	13.5	169
	Hen harrier	10	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	3	13.5	135
	Merlin	10	13.2	0.05	0.05	0.01	0.0005	-	0.19	0.3	3	13.5	135
The Swale Ramsar/SSSI	Shingle & sea cliff (dunes, shingle & machair)	10	14.2	0.54	0.36	0.1	0.0174	1.92	1.87	4.8	48	4.8	190
Medway Estuary and Marshes Ramsar	Shingle & sea cliff (dunes, shingle & machair)	10	13.2	0.05	0.05	0.01	0.0007	-	0.19	0.3	3	0.3	135

Acid Deposition

The maximum acid deposition cumulative PC does not exceed 1% of the critical load at Queendown Warren SAC and the impacts can be screened out as insignificant.

Cumulative Impacts at Sensitive Receptors

The above assessment does not consider the impacts of cumulative traffic as the areas of maximum impact will be different for stack and traffic emissions. Traffic emissions have been modelled at a selection of discrete receptor points at the closest point of the habitat site to a road adjacent to roads affected by the WKN and K3 proposed development. Only the Swale SPA/SSSI/Ramsar and the Medway Estuary and Marshes SPA/Ramsar are within 200 m of a road affected by the WKN and K3 proposed development.

The A249 passes through the Medway Estuary and Marshes SPA/Ramsar so receptors were selected at the roadside.

Cumulative traffic data for the WKN and K3 Proposed Development in the opening year of WKN, 2024 was modelled. The PC from the WKN and K3 stack emissions at each of the sensitive receptors was added to the road contribution to give a 'WKN + K3' PC that considers both stack and traffic emissions. To calculate the cumulative PEC, the maximum PCs for the developments in Table 5.4.5 were added to the highest AC for each habitat site and the WKN + K3 PC. These were compared with the lowest CL for each habitat site. The results are presented in Table 5.5.13 and 5.5.14.

Table 5.4.13 Cumulative NOx Predicted Environmental Concentrations – Sensitive Receptors

Habitat Site	WKN + K3 Proposed Development + Other cumulative developments Road Contribution ($\mu\text{g.m}^{-3}$)	WKN + K3 PC (stack emissions) ($\mu\text{g.m}^{-3}$)	WKN + K3 Proposed Development + Other cumulative developments PC as % of CL	Kemsley K4 CHP PC (EN010090 (18/501923/A DJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PEC ($\mu\text{g.m}^{-3}$)	Cumulative PEC as % of CL
The Swale SPA/SSSI/Ramsar	3.23	0.75	13	0.80	1.69	2.23	1.33	22.33	74
Medway Estuary and Marshes SPA/Ramsar	1.03	0.35	5	0.10	0.07	0.00	0.11	26.07	87

*Critical level is $30 \mu\text{g.m}^{-3}$

Table 5.4.14 Cumulative N Deposition Predicted Process Contributions – Sensitive Receptors

Habitat Site	WKN + K3 PC (Traffic and Stack Emissions) ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	Minimum CL	WKN + K3 PC as % of CL (Traffic and Stack Emissions) ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	Kemsley K4 CHP PC (EN010090 (18/501923/A DJ))	Kemsley AD (SW/11/1291)	Reserve Power Plant PC (18/500393/FULL)	Garden of England Energy Facility (15/500348/COUNTY)	Cumulative PEC ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	Cumulative PEC as % of CL
The Swale SPA/SSSI/Ramsar	0.40	15	3	0.1	0.0174	1.92	1.87	18.51	123
Medway Estuary and Marshes SPA/Ramsar	0.14	8	2	0.01	0.0007	-	0.19	13.55	169

For NO_x, the cumulative PC as % of the CL exceeds 1% but, the PEC is less than the CL. On that basis, the cumulative effects are considered insignificant.

For N deposition the cumulative PC as % of the CL exceed 1% and the PEC is greater than CL and the impacts are potentially significant. The results have been passed to the projects' ecologist to assess the effects.

The cumulative PECs presented in Tables 5.4.13 and 5.4.14 can be considered highly conservative as the PCs from the other developments are the maximum impacts across a grid and are unlikely to occur at the same location as the maximum road contribution.

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- 1 Air Pollution Information Systems, www.apis.ac.uk
 - 2 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4
 - 3 Air emissions risk assessment for your environmental permit
 - 4 Data downloaded from APIS December 2017