RESPONSE TO RELEVANT REPRESENTATIONS APPENDICES: 9.2

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

September 2024

The Infrastructure Planning (Examination Procedure) Rules 2010

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APPENDIX A: AIR QUALITY NEUTRAL STATEMENT

DECARBONISATION

Cory Decarbonisation Project

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AIR QUALITY NEUTRAL

1.1. INTRODUCTION

1.1.1. This Technical Note details the Air Quality Neutral Assessment for the Proposed Scheme.

1.2. GUIDANCE

1.2.1. In February 2023 the GLA published London Plan Guidance on Air Quality Neutral[1], which sets new benchmarks for all new developments to ensure that transport and building emissions do not worsen air quality in London. There are two benchmarks that cover the two main sources of air pollution from typical developments; they are:

- *"Building Emissions Benchmark (BEB) - emissions from equipment used to supply heat and energy to the buildings; and*
- *Transport Emissions Benchmark (TEB) - emissions from private vehicles travelling to and from the development."*

1.2.2. Developments that do not exceed these benchmarks (considered separately) will be considered to be 'air quality neutral', whilst developments that exceed the benchmarks will be required to amend the details of the development in the first instance before seeking agreement with the local planning authority to off-set any excess in emissions with on or offsite mitigation measures.

APPLICABILITY OF THE GUIDANCE TO THE PROPOSED SCHEME

1.2.3. The 2023 Air Quality Neutral Guidance[1] is of limited applicability to developments of the nature of the Proposed Scheme. The primary sources of emissions to air from the Riverside 1 and Riverside 2 (once operational) are not building space heating or road transport, but emissions from the Energy from Waste (EfW) processes. The majority of the plant within Riverside 1 and Riverside 2 (once operational) is not heated and heating for office space comes from the processes of Riverside 1 and Riverside 2 (once operational) themselves Furthermore, most of the movements to and from the Riverside 1 and Riverside 2 (once operational) come via the River Thames.

1.2.4. In relation to combustion emissions from Riverside 1 and Riverside 2, the Proposed Scheme is inherently neutral since the Proposed Scheme removes CO_2 from the exhaust gases whilst leaving the mass of combustion-related local air quality pollutants unchanged i.e. a neutral impact.

[1] Greater London Authority. (2023). 'London Plan Guidance Air Quality Neutral [online]'. Available at: https://www.london.gov.uk/sites/default/files/2023-02/Air%20Quality%20Neutral%20LPG.pdf

1.2.5. Notwithstanding this, for completeness, the assessment below considers the buildings and transport emissions associated with the Proposed Scheme against the benchmarks of the Air Quality Neutral Guidance[1].

1.3. ASSESSMENT

1.3.1. The Proposed Scheme will not require any space heating, additional to that generated by the existing process as part of Riverside 1 and Riverside 2 (once operational), and, therefore, does not include any combustion source for heating purposes.

1.3.2. Backup power generators have been provided for in the Proposed Scheme. The generators will only operate for backup purposes and during routine testing, and therefore will not operate more than 50 hours per year. As per section 3.3.1 of the Air Quality Neutral Guidance[1], backup plants installed for emergency and life safety power supply may be excluded from the calculation of predicted building emissions.

1.3.3. Therefore, the Proposed Scheme is air quality neutral in terms of building emissions and is not considered further in the assessment.

1.3.4. It is expected that 27 full-time equivalent staff will be involved with the operation of the Proposed Scheme. As outlined in **Appendix 18-1: Transport Assessment (Volume 3)** of the **Environmental Statement (Document Reference 6.1)**, there will be a total of 26 single trips per day by private vehicles associated with staff movements. The site will be operational seven days per week; therefore, the Proposed Scheme will result in a total of 9,490 trips per year.

1.3.5. In line with the Air Quality Neutral Guidance[1], trips associated with servicing, deliveries and heavy vehicle movements have been excluded from the air quality neutral calculations.

1.3.6. To calculate the benchmark trip rate, the land use class ‘industrial’ has been used. This is the land use class that best describes the Proposed Scheme, but also the use class with the lowest benchmark trip rates and is consequently the most conservative benchmark to assess against.

Air Quality Neutral Land Use Class	Gross Internal Area (m^2)	Number of Trips (trips/year)	Benchmark Trip Rate (trips/m^2/year)	Total Benchmark Trip Rate (trips/year)
Industrial	5,754	9,490	6.5	37,401
Benchmark				37,401
Total Development Trips				9,490

Table 1: Transport Benchmark Trips

1.3.21. As outlined in **Table 1**, the TEB for the Proposed Scheme is 37,401 trips/year. Therefore, the total number of trips is well below the TEB, and the Proposed Scheme is air quality neutral in terms of transport emissions.

1.4. CONCLUSION

1.4.1. This Air Quality Neutral Assessment has been undertaken for the Proposed Scheme in line with current London Plan Air Quality Neutral Guidance[1]. Accounting for both building and transport emissions the Proposed Scheme is better than 'air quality neutral'.

DECARBONISATION

APPENDIX B: CONTOUR PLOTS AND UPDATED TABLES

Cory Decarbonisation Project

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FIGURE

TABLE

1. SPATIAL DISTRIBUTION

1.1. INTRODUCTION

1.1.1. **Figure 1** below shows the Baseline and Full Proposed Scheme Process Contributions (PCs)[1], plus the Full Proposed Scheme Impact for 2020. **Figure 2** below shows the priority habitats for the area, taken from www.magic.gov.uk. **Figure 3** below shows the Full Proposed Scheme Impacts for all years 2018 – 2022.

1.1.2. The maximum impacts (up to 2.7% of the critical load for salt marshes, the most sensitive habitat within the SSSI) occur over grazing marsh habitat towards the north-west of the site in all years.

1.1.3. Over the reedbeds, coastal saltmarsh and mudflats to the south-eastern extreme of the Site, maximum impacts are markedly lower and amount to <0.03kgN/ha/yr (<0.3% of the critical load for salt marshes).

1.1.4. The spatial distribution of acid deposition is similar, although the SSSI species are not listed on APIS as being sensitive to acid deposition.

1.2. CONTOUR PLOTS

[1] Process Contribution (PC) is the Modelled contribution to pollutant concentration/deposition from a specific source or group of sources. Importantly, in the context of this assessment, the term 'PC' should not be equated to the impact of the Proposed Scheme which relates to the change with the Proposed Scheme rather than the PC itself. The definitions of the PC and impacts have significant implications for the spatial distribution of impacts. In particular, it implies that the maximum impact does not equate to the maximum PC with the Scheme minus the maximum PC in the Baseline. This is because all three of these metrics occur in different locations.

Figure 1 - Baseline (a) and Full Proposed Scheme (b) PC, plus Full Proposed Scheme Impacts (c) for nitrogen deposition over Inner Thames Marshes SSSI. Modelled using 2020 meteorological data (worst case). Existing stacks shown as blue circles; Proposed stacks shown as green triangles. Data shown in kgN/ha/yr

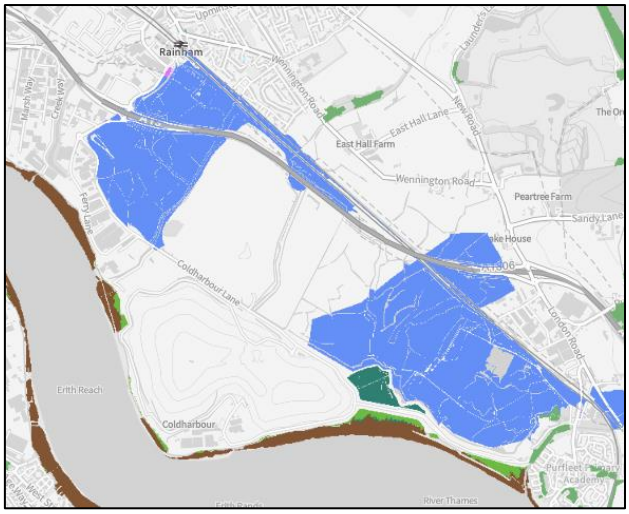

Figure 2 - Priority habitat mapping for Inner Thames Marshes SSSI (www.magic.gov.uk). Blue = Grazing Marsh; Pink = Good Quality Semi Improved Grassland; Dark Green = Reedbeds; Light Green = Coastal Saltmarsh; Brown = Mudflats

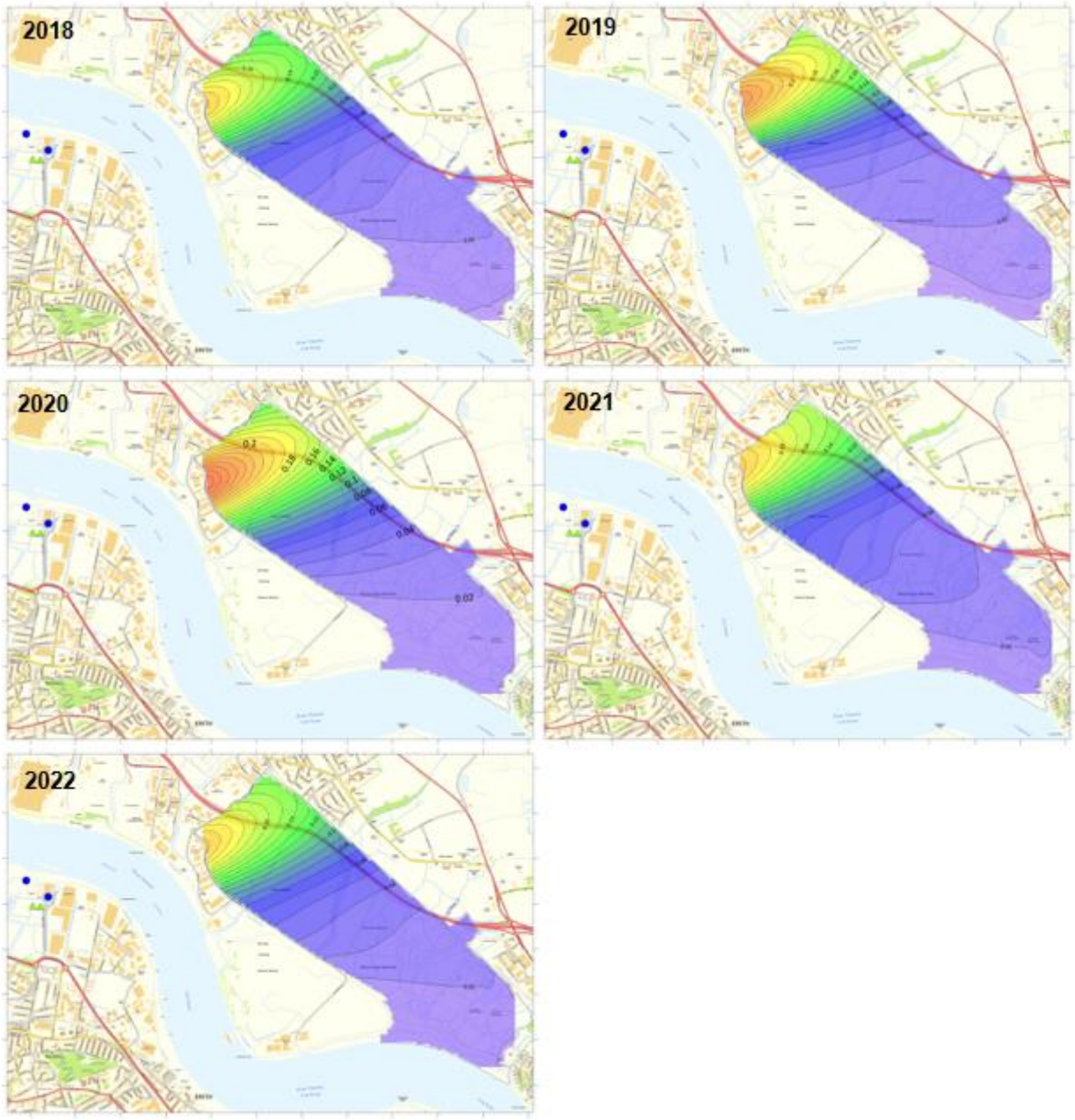

Figure 3 - Full Proposed Scheme Impacts for all years 2018 – 2022. Data shown in kgN/ha/yr

2. CORRECTIONS TO THE IMPACTS OF NITROGEN AND ACID DEPOSITION ON THE PROPOSED SCHEME

2.1. INTRODUCTION

2.1.1. This section sets out details of corrections to the impacts of nitrogen and acid deposition on the Proposed Scheme on presented within the **Chapter 5: Air Quality (Volume 1)** of the **Environmental Statement (APP-054)**.

2.1.2. The corrections are required due to an error in the spatial referencing of amine deposition in the post-processing of model results for ecological impacts. They are not related to methodological changes or to updated model inputs, but simply relate to Excel look-up errors in the existing model results files used to generate data used to inform **Chapter 5: Air Quality (Volume 1)** of the **Environmental Statement (APP-054)**.

2.1.3. The error had a direct impact on the processing of nitrogen deposition and acid deposition at the ecological sites reported in **Chapter 5: Air Quality (Volume 1)**, **Appendix 5-2: Operational Phase Assessment (Volume 3)** and **Appendix 5-3: Detailed Modelled Pollutant Results (Volume 3)** of the **Environmental Statement (APP-054, APP-078** and **APP-079)**, with the following tables affected by this update:

- **Chapter 5: Air Quality (Volume 1) (APP-054):**
  - Table 5-41: Modelled Maximum Operation Phase Impacts at Ecological Receptors for Annual Nitrogen Deposition
  - Table 5-42: Modelled Maximum Operation Phase Impacts at Ecological Receptors for Annual Acid Deposition
- **Appendix 5-2: Operational Phase Assessment (Volume 3) (APP-078):**
  - Table 7-5: Example Source Contributions to Full Proposed Scheme AQ Impact, Nitrogen Deposition During Operation at Ecological Sites
  - Table 7-6: Example Source Contributions to Full Proposed Scheme AQ Impact, Acid Deposition During Operation at Ecological Sites
- **Appendix 5-3: Detailed Modelled Pollutant Results (Volume 3) (APP-079)**:
  - Table 8: Modelled Maximum Baseline and Proposed Scheme PC and Impacts at Ecological Receptors for Annual Mean Nitrogen Deposition
  - Table 9: Modelled Maximum Baseline and Proposed Scheme PC and Impacts at Ecological Receptors for Annual Mean Acid Deposition
  - Table 26: Modelled Maximum Baseline and Full Proposed Scheme PC and Impacts at Ecological Receptors for Nitrogen Deposition during Operation

- Table 27: Modelled Maximum Baseline and Full Proposed Scheme PC and Impacts at Ecological Receptors for Acid Deposition during Operation

2.2. UPDATED TABLES

2.2.1. The updated tables for **Chapter 5: Air Quality (Volume 1), Appendix 5-2: Operational Phase Assessment (Volume 3)** and **Appendix 5-3: Detailed Modelled Pollutant Results (Volume 3)** of the **Environmental Statement (APP-054, APP-078 and APP-079)** are provided on the following pages. Updated values are highlighted in green and the original values are shown in brackets.

2.2.2. The updates do not change any conclusions within **Chapter 5: Air Quality (Volume 1)** of the **Environmental Statement (APP-054)**.

2.2.3. It is reiterated that the Proposed Scheme *Impact* is defined as the *change in deposition* between the future operation of the Applicant's existing Riverside 1 and future Riverside 2 (which is currently under construction) without carbon capture and with capture. Moreover, the maximum impact of the Proposed Scheme does not, in general, occur at the same location as the maximum contribution of the process to deposition (referred to as the Process Contribution (PC)) in either the without carbon capture (baseline) or with carbon capture scenarios. Therefore, in **Tables 8, 9, 26** and **27** of **Appendix 5-3: Detailed Modelled Pollutant Results (Volume 3) (APP-079)**, the Maximum Impact does not equal the Max Proposed Scheme PC minus the Max Baseline PC, since these metrics all occur at different locations. This numerical effect is most noticeable for Crossness Local Nature Reserve (LNR).

2.2.4. The impacts of the Proposed Scheme decrease markedly with this update over Epping Forest Site of Special Scientific Interest/Special Area of Conservation (SSSI/SAC), Oxleas Woodlands SSSI and West Thurrock Lagoon and Marshes SSSI. This is because the Excel lookup error meant that the contribution of amines to deposition was erroneously taken from locations far closer to the Proposed Scheme where amine concentrations and deposition were higher than at the designated sites themselves.

ENVIRONMENTAL STATEMENT - CHAPTER 5 - AIR QUALITY (APP-054)

Table 5-41: Modelled Maximum Operation Phase Impacts at Ecological Receptors for Annual Nitrogen Deposition

Receptor	Critical Load (kgN/ha/yr)	Max Impact (kgN/ha/yr)	Impact as % of CL	At Location of Maximum Impact		
				Max Baseline (PEC) (kgN/ha/yr)	Max Proposed Scheme PEC (kgN/ha/yr)	Max Proposed Scheme PEC as % of CL
Epping Forest – SAC, SSSI	5	0.02 *(0.04)*	0.3% *(0.7%)*	32.27	32.29 *(32.30)*	645.7% *(646.0%)*
Ingrebourne Marshes – SSSI	15	0.10 *(0.08)*	0.7% *(0.6%)*	15.04 *(14.97)*	15.11 *(15.03)*	100.7% *(100.2%)*
Inner Thames Marshes – SSSI	10	0.26 *(0.27)*	**2.6%** *(2.7%)*	15.14	15.40 *(15.41)*	154.0% *(154.1%)*
Oxleas Woodlands – SSSI	15	0.06 *(0.11)*	0.4% *(0.7%)*	28.58 *(28.55)*	28.64 *(28.66)*	190.9% *(191.1%)*
West Thurrock Lagoon and Marshes – SSSI	10	0.01 *(0.03)*	0.1% *(0.3%)*	13.68	13.69	136.9%
Crossness – LNR	10	0.33 *(0.32)*	**3.3%** *(3.2%)*	15.05	15.39 *(15.37)*	153.9% *(153.7%)*
Lesnes Abbey Woods – LNR	10	0.22 *(0.23)*	**2.2%** *(2.3%)*	27.69 *(27.66)*	27.92 *(27.89)*	279.2% *(278.9%)*
Rainham Marshes – LNR	10	0.26 (0.27)	**2.6%** *(2.7%)*	15.14	15.40 *(15.41)*	154.0% *(154.1%)*

Note: The updated values are highlighted in green and the original values are shown in *brackets*

Table 5-42: Modelled Maximum Operation Phase Impacts at Ecological Receptors for Annual Acid Deposition

Receptor	Critical Load (keq/ha/yr)	Max Impact (keq/ha/yr)	Impact as % of CL	At Location of Maximum Impact		
				Max Baseline (PEC) (keq/ha/yr)	Max Proposed Scheme PEC (keq/ha/yr)	Max Proposed Scheme PEC as % of CL
Epping Forest – SAC, SSSI	1.73	0.002 *(0.005)*	0.1% *(0.3%)*	2.48	2.48	143.6% *(143.5%)*
Ingrebourne Marshes – SSSI	Not significant to acid deposition					
Inner Thames Marshes – SSSI						
Oxleas Woodlands – SSSI	2.72	0.008 *(0.016)*	0.3% *(0.6%)*	2.19 *(2.18)*	2.20 *(2.19)*	80.8% *(80.4%)*
West Thurrock Lagoon and Marshes – SSSI	Not significant to acid deposition					
Crossness – LNR						
Lesnes Abbey Woods – LNR						
Rainham Marshes – LNR						

Note: The updated values are highlighted in green and the original values are shown in *brackets*

ENVIRONMENTAL STATEMENT - APPENDIX 5-2 – OPERATIONAL PHASE ASSESSMENT [APP-078]

Table 7-5: Example Source Contributions to Full Proposed Scheme AQ Impact, Nitrogen Deposition During Operation at Ecological Sites

Receptor	Maximum Full Proposed Scheme PC (kg/N/ha/yr)	CCF Stacks PC at location of Max Full Proposed Scheme PC (Proposed Scheme Scenario) (kg/N/ha/yr)	Marine PC at location of Max Full Proposed Scheme PC (Operation only) (kg/N/ha/yr)
Epping Forest – SAC, SSSI	0.07 *(0.08)*	0.07 *(0.08)*	0.00
Ingrebourne Marshes – SSSI	0.79 *(0.76)*	0.78 *(0.76)*	0.00
Inner Thames Marshes – SSSI	1.40 *(1.38)*	1.39 *(1.37)*	0.01
Oxleas Woodlands – SSSI	0.31 *(0.34)*	0.30 *(0.34)*	0.00
West Thurrock Lagoon and Marshes – SSSI	0.15	0.14 *(0.15)*	0.00
Crossness – LNR	0.79 *(0.78)*	0.79 *(0.77)*	0.01
Lesnes Abbey Woods – LNR (comprising Ancient Woodland)	0.64 *(0.59)*	0.63 *(0.58)*	0.00
Rainham Marshes – LNR	1.40 *(1.38)*	1.39 (*1.37)*	0.01

Note: The updated values are highlighted in green and the original values are shown in *brackets*

Table 7-6: Example Source Contributions to Full Proposed Scheme AQ Impact, Acid Deposition During Operation at Ecological Sites

Receptor	Maximum Full Proposed Scheme PC (keq/ha/yr)	CCF Stacks PC at location of Max Full Proposed Scheme PC (Proposed Scheme Scenario) (keq/ha/yr)	Marine PC at location of Max Full Proposed Scheme PC (Operation only) (keq/ha/yr)
Epping Forest – SAC, SSSI	0.010 *(0.012)*	0.010 *(0.011)*	0.000
Oxleas Woodlands – SSSI	0.040 *(0.047)*	0.039 *(0.047)*	0.000
Note: The updated values are highlighted in green and the original values are shown in *brackets*			

ENVIRONMENTAL STATEMENT - APPENDIX 5-3 – DETAILED MODEL POLLUTANT RESULTS [APP-079]

Table 8: Modelled Maximum Baseline and Proposed Scheme PC and Impacts at Ecological Receptors for Annual Mean Nitrogen Deposition

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
Epping Forest - SAC, SSSI	**Baseline**	0.06	0.05	0.04	0.04	0.06
	Proposed Scheme	0.07 *(0.08)*	0.05 *(0.06)*	0.05 *(0.06)*	0.05 *(0.07)*	0.07 *(0.08)*
	Impact	0.01 *(0.03)*	0.01 *(0.02)*	0.01 *(0.03)*	0.01 *(0.04)*	0.02 *(0.03)*
	Impact as % of CL	0.24% *(0.57%)*	0.17% *(0.39%)*	0.19% *(0.52%)*	0.23% *(0.70%)*	0.34% *(0.67%)*
	Baseline	0.58	0.71	0.68	0.68	0.63

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
Ingrebourne Marshes - SSSI	Proposed Scheme	0.65 *(0.63)*	0.78 *(0.76)*	0.74 *(0.73)*	0.78 *(0.75)*	0.70 *(0.69)*
	Impact	0.07 *(0.06)*	0.08 *(0.06)*	0.07 *(0.06)*	0.10 *(0.08)*	0.08 *(0.06)*
	Impact as % of CL	0.47% *(0.39%)*	0.52% *(0.40%)*	0.45% *(0.37%)*	0.65% *(0.55%)*	0.50% *(0.43%)*
Inner Thames Marshes - SSSI	Baseline	0.86	1.00	1.19	0.81	0.87
	Proposed Scheme	1.04 *(1.02)*	1.21 *(1.19)*	1.39 *(1.37)*	1.01 *(0.99)*	1.06 *(1.04)*
	Impact	0.20	0.24	0.26 *(0.27)*	0.21 *(0.20)*	0.20
	Impact as % of CL	2.00%	2.37% *(2.38%)*	2.64% *(2.69%)*	2.07%	2.04% *(2.01%)*
Oxleas Woodlands - SSSI	Baseline	0.21	0.15	0.19	0.25	0.21
	Proposed Scheme	0.26 *(0.28)*	0.17 *(0.20)*	0.24 *(0.26)*	0.30 *(0.34)*	0.26 *(0.29)*
	Impact	0.05 *(0.09)*	0.04 *(0.06)*	0.05 *(0.09)*	0.06 *(0.11)*	0.06 *(0.09)*
	Impact as % of CL	0.33% *(0.62%)*	0.24% *(0.38%)*	0.32% *(0.60%)*	0.42% *(0.73%)*	0.37% *(0.62%)*

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
West Thurrock Lagoon and Marshes - SSSI	Baseline	0.10	0.14	0.11*	0.11	0.12
	Proposed Scheme	0.11 *(0.12)*	0.14 *(0.15)*	0.13	0.12 *(0.13)*	0.13 *(0.14)*
	Impact	0.01 *(0.02)*	0.01 *(0.02)*	0.01 *(0.02)*	0.01*(0.03)*	0.01 *(0.03)*
	Impact as % of CL	0.08% *(0.21%)*	0.09% *(0.15%)*	0.10% *(0.20%)*	0.12% *(0.28%)*	0.14% *(0.27%)*
Crossness - LNR	Baseline	0.67	0.33*	0.63	0.63	0.53
	Proposed Scheme	0.65	0.41 *(0.43)*	0.64 *(0.65)*	0.79 *(0.77)*	0.63 *(0.64)*
	Impact	0.20	0.16 *(0.18)*	0.19 *(0.21)*	0.33 *(0.32)*	0.28
	Impact as % of CL	2.03% *(2.04%)*	1.61% *(1.80%)*	1.91% *(2.06%)*	3.34% *(3.21%)*	2.77% *(2.76%)*
Lesnes Abbey Woods - LNR	Baseline	0.29	0.17	0.25	0.37	0.31
	Proposed Scheme	0.42 *(0.65)*	0.27 *(0.33)*	0.38 *(0.44)*	0.56 *(0.58)*	0.46 *(0.49)*
	Impact	0.14 *(0.20)*	0.10 *(0.18)*	0.13 *(0.21)*	0.19 *(0.23)*	0.15 *(0.21)*
	Impact as % of CL	1.38% *(2.04%)*	1.01% *(1.78%)*	1.30% *(2.14%)*	1.89% *(2.33%)*	1.51% *(2.06%)*
Rainham Marshes - LNR	Baseline	0.86	1.00	1.19	0.81	0.87
	Proposed Scheme	1.04 *(1.02)*	1.21 *(1.19)*	1.39 *(1.37)*	1.01 *(0.99)*	1.06 *(1.04)*
	Impact	0.20	0.23 *(0.24)*	0.26 *(0.27)*	0.20	0.20

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
	Impact as % of CL	2.00%	2.34% *(2.38%)*	2.64% *(2.69%)*	2.02% *(1.98%)*	2.00% *(2.01%)*
*Updates to rounding has resulted in changes to baseline concentrations at the 4th decimal place, resulting in some slight changes to baseline PC presented in this table.						
Note: The updated values are highlighted in green and the original values are shown in *brackets*						

Table 9: Modelled Maximum Baseline and Proposed Scheme PC and Impacts at Ecological Receptors for Annual Mean Acid Deposition

Ecological Site	Scenario	Max PC 2018 (keq/ha/yr)	Max PC 2019 (keq/ha/yr)	Max PC 2020 (keq/ha/yr)	Max PC 2021 (keq/ha/yr)	Max PC 2022 (keq/ha/yr)
Epping Forest - SAC, SSSI	Baseline	0.01	0.01	0.01	0.01	0.01
	Proposed Scheme	0.01	0.01	0.01	0.01	0.01
	Impact	0.00	0.00	0.00	0.00	0.00
	Impact as % of CL	0.09% *(0.23%)*	0.06% *(0.16%)*	0.07% *(0.21%)*	0.08% *(0.29%)*	0.12% *(0.27%)*
Oxleas Woodlands - SSSI	Baseline	0.03	0.02	0.03	0.03	0.03
	Proposed Scheme	0.03 *(0.04)*	0.02 *(0.03)*	0.03 *(0.04)*	0.04 *(0.05)*	0.04
	Impact	0.01	0.00 *(0.01)*	0.01	0.01 *(0.02)*	0.01
	Impact as % of CL	0.22% *(0.48%)*	0.16% *(0.29%)*	0.22% *(0.47%)*	0.28% *(0.57%)*	0.25% *(0.48%)*

Note: The updated values are highlighted in green and the original values are shown in *brackets*

Table 26: Modelled Maximum Baseline and Full Proposed Scheme PC and Impacts at Ecological Receptors for Nitrogen Deposition during Operation

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
Epping Forest - SAC, SSSI	Baseline	0.06	0.05	0.04	0.04	0.06
	Proposed Scheme	0.07 *(0.08)*	0.05 *(0.06)*	0.05 *(0.06)*	0.05 *(0.07)*	0.07*(0.08)*
	Impact	0.01 *(0.03)*	0.01 *(0.02)*	0.01 *(0.03)*	0.01 *(0.04)*	0.02 *(0.03)*
	Impact as % of CL	0.25% *(0.58%)*	0.17% *(0.39%)*	0.20% *(0.52%)*	0.23% *(0.71%)*	0.35% *(0.67%)*
Ingrebourne Marshes - SSSI	Baseline	0.58	0.71	0.68	0.68	0.63
	Proposed Scheme	0.65 *(0.64)*	0.79 *(0.76)*	0.75 *(0.73)*	0.78 *(0.76)*	0.71 *(0.69)*
	Impact	0.07 *(0.06)*	0.08 *(0.06)*	0.07 *(0.06)*	0.10 *(0.09)*	0.08 *(0.07)*
	Impact as % of CL	0.50% *(0.42%)*	0.54% *(0.43%)*	0.48% *(0.40%)*	0.69% *(0.58%)*	0.54% *(0.45%)*
Inner Thames Marshes - SSSI	Baseline	0.86	1.00	1.19	0.81	0.87
	Proposed Scheme	1.04 *(1.03)*	1.22 *(1.20)*	1.40 *(1.38)*	1.02 *(1.00)*	1.07 *(1.05)*
	Impact	0.21	0.25	0.27 *(0.28)*	0.22 *(0.21)*	0.21
	Impact as % of CL	2.08%	2.46%	2.72% *(2.77%)*	2.16% *(2.06%)*	2.13% *(2.09%)*

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
Oxleas Woodlands - SSSI	Baseline	0.21	0.15	0.19	0.25	0.21
	Proposed Scheme	0.26 *(0.28)*	0.17 *(0.20)*	0.24 *(0.26)*	0.31 *(0.34)*	0.26 *(0.029)*
	Impact	0.05 *(0.09)*	0.04 *(0.06)*	0.05 *(0.09)*	0.07 *(0.11)*	0.06 *(0.10)*
	Impact as % of CL	0.34% *(2.08%)*	0.25% *(0.39%)*	0.33% *(0.61%)*	0.44% *(0.75%)*	0.39% *(0.64%)*
West Thurrock Lagoon and Marshes - SSSI	Baseline	0.10	0.14	0.11*	0.11	0.12
	Proposed Scheme	0.11 *(0.12)*	0.15	0.13 *(0.14)*	0.13 *(0.14)*	0.14 *(0.15)*
	Impact	0.01 *(0.02)*	0.01 *(0.02)*	0.01 *(0.02)*	0.01 *(0.03)*	0.02 *(0.03)*
	Impact as % of CL	0.09% *(0.22%)*	0.11% *(0.16%)*	0.13% *(0.21%)*	0.14% *(0.29%)*	0.16% *(0.28%)*
Crossness - LNR	Baseline	0.67	0.33*	0.63	0.63	0.53
	Proposed Scheme	0.66 *(0.65)*	0.41 *(0.43)*	0.64 *(0.66)*	0.76 *(0.78)*	0.64
	Impact	0.16 *(0.21)*	0.15 *(0.19)*	0.13 *(0.21)*	0.27 *(0.33)*	0.23 *(0.28)*
	Impact as % of CL	1.60% *(2.09%)*	1.53% *(1.85%)*	1.29% *(2.12%)*	2.74% *(3.29%)*	2.34% *(0.28%)*

Ecological Site	Scenario	Max PC 2018 (kg/N/ha/yr)	Max PC 2019 (kg/N/ha/yr)	Max PC 2020 (kg/N/ha/yr)	Max PC 2021 (kg/N/ha/yr)	Max PC 2022 (kg/N/ha/yr)
Lesnes Abbey Woods - LNR	**Baseline**	0.29	0.17	0.25	0.37	0.31
	Proposed Scheme	0.42 *(0.46)*	0.27 *(0.34)*	0.38 *(0.45)*	0.56 *(0.59)*	0.46 *(0.50)*
	Impact	0.14 *(0.19)*	0.10 *(0.18)*	0.13 *(0.22)*	0.19 *(0.24)*	0.15 *(0.21)*
	Impact as % of CL	1.38% *(1.94%)*	1.01% *(1.81%)*	1.30% *(2.18%)*	1.89% *(2.38%)*	1.51% *(2.83%)*
Rainham Marshes - LNR	**Baseline**	0.86	1.00	1.19	0.81	0.87
	Proposed Scheme	1.04 *(1.03)*	1.22 *(1.20)*	1.40 *(1.38)*	1.02 *(1.00)*	1.07 *(1.05)*
	Impact	0.21	0.24 *(0.25)*	0.27 *(0.28)*	0.21	0.21
	Impact as % of CL	2.08%	2.42% *(2.46%)*	2.72% *(2.77%)*	2.12% *(2.06%)*	2.08% *(2.09%)*
*Updates to rounding has resulted in changes to baseline concentrations at the 4th decimal place, resulting in some slight changes to baseline PC presented in this table.						
Note: The updated values are highlighted in green and the original values are shown in *brackets*						

Table 27: Modelled Maximum Baseline and Full Proposed Scheme PC and Impacts at Ecological Receptors for Acid Deposition during Operation

Ecological Site	Scenario	Max PC 2018 (keq/ha/yr)	Max PC 2019 (keq/ha/yr)	Max PC 2020 (keq/ha/yr)	Max PC 2021 (keq/ha/yr)	Max PC 2022 (keq/ha/yr)
Epping Forest - SAC, SSSI	Baseline	0.008	0.006	0.006	0.006	0.009
	Proposed Scheme	0.009 *(0.011)*	0.007 *(0.008)*	0.007 *(0.008)*	0.007 *(0.010)*	0.010 *(0.012)*
	Impact	0.002 *(0.004)*	0.001 *(0.004)*	0.001 *(0.004)*	0.001 *(0.005)*	0.002 *(0.005)*
	Impact as % of CL	0.09% *(0.23%)*	0.06% *(0.21%)*	0.07% *(0.21%)*	0.08% *(0.29%)*	0.13% *(0.27%)*
Oxleas Woodlands - SSSI	Baseline	0.029	0.020	0.027	0.034	0.029
	Proposed Scheme	0.035 *(0.039)*	0.024 *(0.037)*	0.032 *(0.037)*	0.041 *(0.047)*	0.035 *(0.041)*
	Impact	0.006 *(0.013)*	0.005 *(0.013)*	0.006 *(0.013)*	0.008 *(0.016)*	0.007 *(0.013)*
	Impact as % of CL	0.24% *(0.49%)*	0.17% *(0.48%)*	0.23% *(0.48%)*	0.30% *(0.58%)*	0.27% *(0.50%)*

Note: The updated values are highlighted in green and the original values are shown in *brackets*

DECARBONISATION

APPENDIX C: AIR QUALITY – ASSESSMENT OF NITROSAMINES

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1. SUMMARY OF ASSESSMENT UNDERTAKEN FOR ENVIRONMENTAL STATEMENT

1.1. OVERVIEW

1.1.1. This technical note has been prepared in response to a request within the Relevant Representations from London Borough of Bexley to consider the cancer risk associated with amine degradation products from the Proposed Scheme. The following **Section 1.2** and **Section 1.3** provide a summary of the methodology and results of the assessment presented in **Chapter 5: Air Quality** of the **Environmental Statement (Volume 1) (APP-054)**. **Section 2** of this note considers the modelled impact in the context of cancer risk.

1.2. METHODOLOGY

1.2.1. The assessment of impacts from nitrosamines, as reported in **Chapter 5: Air Quality** of the **Environmental Statement (Volume 1) (APP-054)** and supporting appendices in **Environmental Statement (Volume 3) Appendix 5-2: Operation Phase Assessment (APP-078)** and **Appendix 5-3: Detailed Model Pollutant Results (APP-079)**, was undertaken on the basis of:

- Dispersion modelling of emissions from the Carbon Capture Facility, using ADMS v6 and including the amine chemistry module.
- A worst case of the continuous operation of the Carbon Capture Facility (with emissions released through separate stacks for Riverside 1 and Riverside 2), with waste throughput at permitted limits.
- Emissions of all existing pollutants at their currently permitted limits at all times.
- Emissions of newly introduced pollutants at their stated limit at all times.
- Amine emissions of proxy compounds (monoethanolamine (MEA) and dimethylamine (DMA)).
- Direct emissions of nitrosamines as N-nitrosodimethylamine (NDMA), with indirect nitrosamines considered via the ADMS module.
- Sensitivity testing of amine reaction rates and ADMS chemistry module input parameters.
- Assessment of concentrations of nitrosamines (and nitramines) against the Environment Agency's Environmental Assessment Level (EAL) for NDMA ($0.2ng/m^3$)[1].

[1] Environment Agency, 2024, Air emissions risk assessment for your environmental permit (Environmental standards for air emissions), available at www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

1.2.2. The assessment was designed to be conservative and representative of a worst-case scenario.

1.2.3. In particular, total nitrosamines, total nitramines and total nitrosamines plus total nitramines were all assessed against the EAL for NDMA. NDMA is acknowledged to be among the most toxic nitrosamines. No account was taken of the fact that primary amines, such as MEA, do not form stable nitrosamines.

1.3. RESULTS

1.3.1. **Table 1** summarises the assessment findings. The modelled concentrations of nitrosamines and nitramines are well within the Environmental Assessment Level ('EAL').

1.3.2. On this basis, the conclusion of assessment is that the residual significance of effects for impacts from exposure to nitrosamines is **Slight Adverse (Not Significant)**.

Table 1: Summary Findings of Impacts on Nitrosamines and Nitramines from the Carbon Capture Facility, assuming full load operation of Riverside 1 and Riverside 2

Metric	Total Nitrosamines	Total Nitramines	Total Nitramines + Nitrosamines
Pollutant Concentration (ng/m^3)	0.013	0.015	0.025
Impact as % of EAL ($0.2ng/m^3$)	6.5%	7.7%	12.5%

2. DISCUSSION ON CANCER RISK

2.1. OVERVIEW

2.1.1. Nitrosamines and nitramines are possible carcinogens. They are formed primarily by the reaction of amines with oxidising agents including nitrogen oxides.

2.1.2. Whilst the Proposed Scheme is a potential new source of emissions to air of amines and nitrosamines, they are currently widely detected in the environment in drinking water, food stuffs, personal care products, tobacco smoke and as drug contaminants.

2.1.3. NDMA itself is classified as an 1B carcinogen (European Classification)[2], which means that is presumed to cause cancer in humans. It is also classified as a 2A carcinogen by the International Agency for Research on Cancer (IARC)[3] meaning that there is strong evidence that it can cause cancer in humans but at present the evidence is not conclusive.

2.1.4. Other nitrosamines potentially associated with carbon capture, such as NDELA (N-Nitrosodiethanolamine), are also classified as EC 1B (presumed carcinogenic, some of which are adopted in regulations), whereas N-Nitrosomethylethylamine (NMA-C2), N-Nitrosomethyl-propylamine (NMA-C3) and others, are classified by IARC as 2B (possibly carcinogenic).

2.2. ENVIRONMENTAL ASSESMENT LEVEL ('EAL')

2.2.1. The only nitrosamine for which the Environment Agency has set an EAL is NDMA.

2.2.2. The evidence base for the EAL is set out in Appendix C: summary of toxicological evidence for MEA and NDMA, Environment Agency, Sept 2021[4].

2.2.3. The pivotal study used by the Environment Agency in setting the EAL was Klein *et al* (1991)[5], which looked at dose-related incidences of nasal tumours in rats by the inhalation route. The Environment Agency calculated a benchmark dose ($BMDL_{10}$) of 0.023mg/m^3, corresponding to the 95% lower bound on the dose corresponding to a 10% additional risk of tumours in the Klein data. This was then adjusted for continuous exposure, and divided by a factor of 10,000, which is "*a suitable margin of safety for minimal risk for a genotoxic carcinogen".*

2.2.4. It is noteworthy that the Klein study reported increased incidence of nasal tumours compared to other tumours with exposure in the rats generated via the inhalation

[2] Table 3 of Annex VI to Regulation (EC) No 1272/2008/EC on classification, labelling and packaging of substances and mixtures, December 2008
[3] World Health Organisation, IARC Monographs on the identification of carcinogenic hazards to humans, available at https://monographs.iarc.who.int/list-of-classifications (accessed September 2024)
[4] Available at www.gov.uk/government/consultations/environmental-assessment-levels-eals-used-in-air-emissions-risk-assessments/public-feedback/appendix-c-summary-of-toxicological-evidence-for-mea-and-ndma
[5] R G Klein, I Janowsky, B L Pool-Zobel, P Schmezer, R Hermann, F Amelung, B Spiegelhalder, W J Zelle, 1991, Effects of long-term inhalation of N-nitrosodimethylamine in rats. IARC Sci Publ. (105):322-8. PMID: 1855872

route i.e. the route by which the population may be exposed to emissions from the Proposed Scheme. The Environment Agency suggest that this finding may have contributed to earlier studies concluding the NDMA may be a more potent carcinogen through inhalation as opposed to other exposure routes such as ingestion.

2.3. OTHER STUDIES

2.3.1. The Environment Agency's EAL is comparable to that derived in an earlier study by NIPH (2011)[6], which specified a Derived Minimal Effect Level (DMEL) and a Health Based Guidance Value (HBGV) for an excess lifetime cancer risk of 1 in 100,000 or lower at 0.3ng/m^3 for NDMA. The US EPA (1987)[7] concluded that an excess lifetime cancer risk of 1 in 100,000 corresponded to an air concentration of 0.7ng/m^3.

2.3.2. The European Parliament aims to establish limit values to ensure workers' protection against risks arising from exposure to non-threshold carcinogens. The limit values are based on the scientific evaluation of evidence by the Risk Assessment Committee (RAC) of the European Chemicals Agency (ECHA). The RAC provides an assessment of exposure levels associated with a series of pre-determined risk levels between excess lifetime cancer risks of 4 in 100 exposed workers and 4 cases in 100,000 exposed workers. Whilst they do not offer an opinion on the acceptability of such risks, the occupational exposure limits (OEL) cannot be set at a risk level above 4 in 1,000. Further, it is agreed that action is needed if the risk is between 4 in 1,000 and 4 in 10,000, whereas if the risk is in the range 4 in 10,000 and 4 in 100,000, there is 'less need for a review action'. Risks below 4 in 100,000 are not considered at all.

2.3.3. In November 2023, the RAC published a draft opinion on its scientific evaluation of occupation exposure limits for Nitrosamines[8]. This draft opinion placed a specific focus on five nitrosamines, including NDMA.

2.3.4. Some studies considered by the RAC suggested a threshold for toxicity, but the RAC considered the data too limited to define thresholds and therefore a default linear approach was proposed for the derivation of OEL.

2.3.5. The carcinogenicity of nitrosamines was considered to have been unequivocally confirmed in animal studies, but the RAC concluded that whilst studies in human populations support a carcinogenic effect, they do not provide the definitive evidence base to derive an exposure risk relationship for any specific nitrosamine.

2.3.6. Notwithstanding this, the RAC offered a draft opinion on the excess life-time cancer exposure risk relationship for NDMA as shown in **Table 2**. The risk relationship was based on occupational exposure over a 40 year working life, five days a week, eight

[6] NIPH, 2011, Health effects of amines and derivatives associated with CO_2 capture: Nitrosamines and Nitramines. Norwegian Institute of Public Health.
[7] US EPA, 1987, Chemical assessment summary for N-Nitrosdimethylamine.
[8] European Chemicals Agency, Report ECHA/RAC/OEL-O-0000007382-75-01/F.

hours a day. The lower risk threshold of four cases per 100,000 exposed is equivalent to an air concentration of 0.7ng/m^3.

Table 2: Excess Lifetime Cancer Risk Exposure-risk Relationship for NDMA in Occupational Setting

Excess Lifetime Cancer Risk (Cases per 100,000 exposed)	Air Concentration (ng/m^3)
4	0.7
40	7
400	70
4,000	700
RAC Opinion on scientific evaluation of occupational exposure limits for Nitrosamines, Nov 2023, European Chemicals Agency.	

2.3.7. If the dose received is adjusted to account for exposure in a worst case residential setting, with 24 hours per day exposure, seven days per week, the air concentration representing the lower risk threshold is 0.2ng/m^3, equivalent to the Environment Agency's EAL

2.3.8. The maximum modelled contribution of the Proposed Scheme to concentrations of nitrosamines anywhere within the Study Area is 0.013ng/m^3. Using the above scaling of the RAC draft opinion on the inhalation exposure risk for NDMA, this is equivalent to an excess lifetime cancer risk of two in one million people exposed (2 in 1,000,000). If nitramines are included in the risk assessment (despite being acknowledged to be less toxic than nitrosamines), the risk is 4 in 1,000,000.

2.3.9. Therefore, the RAC scientific evaluation of evidence corroborates the Environment Agency's assertion that setting the EAL for NDMA at 0.2ng/m^3 as an annual mean represents 'minimal risk for a genotoxic carcinogen'.

2.3.10. Moreover, the RAC evaluation, and a paper released by European Medicines Agency in October 2023 on an approach to carcinogenic potency categorisation for nitrosamines[9], provide corroborative evidence that NDMA is among the most potent nitrosamines.

[9] European Medicines Agency, 2023, Appendix 2 to Questions and answers for marketing authorisation holders/applicants on the CHMP Opinion for the Article 5(3) of Regulation (EC) No 726/2004 referral on nitrosamine impurities in human medicinal products.

2.3.11. Therefore, assessing the sum of all nitrosamines resulting from the Proposed Scheme against the EAL for NDMA, and even more so the sum of total nitrosamines and nitramines against NDMA, is a demonstrably conservative approach.

2.4. CONCLUSIONS

2.4.1. The Carbon Capture Facility is designed to minimise emissions of amines and their degradation products to air.

2.4.2. The conclusion of assessment presented in **Chapter 5: Air Quality** of the **Environmental Statement (Volume 1) (APP-054)** states that the residual significance of effect for impacts from exposure to nitrosamines is **Slight Adverse (Not Significant)**. This note demonstrates that this assessment is robust.

2.4.3. The assessment has been undertaken conservatively, including but not limited to modelling of impacts at maximum output levels and assessing all nitrosamines against the EAL for NDMA.

2.4.4. The modelled concentrations indicate minimal excess lifetime cancer risk for the local population.

APPENDIX D: PROPOSED SCHEME AND LBB POLICY DP12

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"The Infrastructure Planning (Examination Procedure) the Rules 2010"

APPENDIX D: PROPOSED SCHEME AND LBB POLICY DP12

The Applicant notes that LBB considers that the Proposed Scheme is not in compliance with policy DP12 of its Local Plan. The Applicant considers that this is not the case, because the policy needs to be read as a whole. The Applicant has done this below with commentary accompanying each section of the policy:

1. **The proposed heights for buildings should reflect other design and policy requirements, including the requirement to have regard to the existing or emerging character and context of the area.**

   The proposed heights of the Proposed Scheme reflect design and policy requirements. Government policy in NPS EN-1 sets out the critical national priority for carbon capture infrastructure ('the policy requirement'). The design requirement for carbon capture infrastructure necessitates absorber towers of substantial height in order for the process to work, and also to account for environmental policy requirements, such as air quality (which has informed minimum and maximum heights, as well as distances from the existing Riverside Campus facilities). The Design Approach Document (APP-044 to 046) sets out how the Proposed Scheme has been designed to be mindful of the context of the area - which is industrial facilities in all directions, including structures of substantive height immediately adjacent.

2. **Subject to part 1 above, the maximum height of buildings shall not normally be more than: a. 45 metres within and near the town centres of Abbey Wood Village and Lower Belvedere, as set out in Part 5 of this policy; b. 25 metres within the borough's identified Sustainable Development Locations, Strategic Industrial Locations (SIL), and the Thamesmead and Abbey Wood London Plan Opportunity Area not covered by Part 2a of this policy; and, c. 15 metres across the rest of the borough (emphasis added).**

   Reading paragraphs 1 and 2 together, the 25-metre height restriction for SIL locations is not a 'closed approach' – the height restriction is subject to the need to reflect other design and policy requirements. Furthermore, it is clear that a carbon capture absorber tower is not a 'normal' tall building, particularly when considering that the contextual text around policy DP12 (and paragraph 3 below) is clear that this policy was particularly directed at residential development.

3. **For development proposals that include buildings taller than 15 metres, applicants must submit design appraisals with alternative options to demonstrate whether similar densities can be achieved using more traditional and human-scaled typologies including terraced housing, maisonettes, and courtyard apartments.**

   Not applicable to this type of development.

4. Tall buildings in Bexley are considered to be more than 25 metres in height and must comply with the tall buildings policy in the London Plan. In addition, the applicant must demonstrate that:

Requirement	Proposed Scheme Response
There is sufficient access to public transport	Although not directly applicable, the Proposed Scheme is sufficiently close to bus and rail links (see the Transport Assessment **(APP-114).**
There is access to local services and facilities, depending on the number and type of residents expected	Although not directly applicable, the Proposed Scheme is located close to facilities in Thamesmead and Belvedere.
The proposal will not have an unacceptable adverse impact on local character, including heritage assets	The Environmental Statement confirms that no likely significant effects are identified to arise for local townscape character or heritage assets as a result of the Proposed Scheme.
The design considers topography	As described in the Design Approach Document, the Proposed Scheme has been designed mindful of the topographical nature of the views, with larger, taller buildings, closer to existing industrial facilities, and a 'stepped down' approach taken as the Proposed Scheme moves towards communities.
The proposal will not create unacceptable adverse environmental impacts, including flood risk, creation of a wind tunnel, loss or lack of daylight and sunlight	The Applicant considers that there are no unacceptable adverse environmental impacts, with limited residual effects identified in the ES, with those that remain being restricted to localised impacts.
The design is of high architectural quality	In the context of the industrial and technical requirements of the Proposed Scheme, good design will be achieved pursuant to the Design Principles and Design Code (APP-047).
The proposal will integrate into its surroundings at all levels, particularly at street level and into the skyline.	The Applicant considers this to be the case given the baseline environment and the commitments given in the Design Principles and Design Code (see e.g. 'Design and Layout' and 'Materiality and Colour').

The London Plan Requirements are set out below:

Requirement	Proposed Scheme Response
Applications for tall or large buildings should include an urban design analysis that demonstrates the proposal is part of a strategy that will meet the criteria below. This is particularly important if the site is not identified as a location for tall or large buildings in the borough's LDF. **Tall and large buildings should:**	The Design Approach Document sets out the spatial and design context for the Proposed Scheme, and how the tall elements of the Proposed Scheme fit into a wider design strategy, that meets the criteria below (as highlighted below).
Generally, be limited to sites in the Central Activity Zone, opportunity areas, areas of intensification or town centres that have good access to public transport	The Proposed Scheme is located in an Opportunity Area and has good access to public transport (both bus and the nearby Belvedere Station).
• **Only be considered in areas whose character would not be affected adversely by the scale, mass or bulk of a tall or large building**	In this Strategic Industrial Location adjacent to other industrial facilities, it is considered that the local character would not be adversely affected by the Proposed Scheme, as confirmed by the ES. The Design Approach Document explains how the step-down, and eastern focussed approach to development within the Order limits, means that the Proposed Scheme 'fits' to the facilities and highways around it, with coherent design intended to enhance the Riverside Campus – leaving the Mitigation and Enhancement Area to blend into the adjacent Local Nature Reserve, facilitating access improvements and enhancing the overall visitor experience of the area.
Relate well to the form, proportion, composition, scale and character of surrounding buildings, urban grain and public realm (including landscape features) particularly at street level	

Requirement	Proposed Scheme Response
• **Individually or as a group, improve the legibility of an area, by emphasising a point of civic or visual significance where appropriate, and enhance the skyline and image of London**	The Proposed Scheme, working alongside Riverside 1, Riverside 2 and the Thames Water facilities to the west, strengthens this location (which is also adjacent to a safeguarded wharf) as a river-focussed and river-supported location, building on Belvedere's history (including the historic presence of a Power Station).
• **Incorporate the highest standards of architecture and materials, including sustainable design and construction practices**	These matters are delivered by the measures set out in the Design Principles and Design Code and the outline LaBARDS – the Proposed Scheme has been designed to interact with its local environment in the best way possible in the context of it being an operational plant, not a residential tower. In particular, the Proposed Scheme will deliver access improvements both in the immediate vicinity of the Proposed Scheme and in the local area more generally (via its proposed Access Contribution).
• **Have ground floor activities that provide a positive relationship to the surrounding streets**	
• **Contribute to improving the permeability of the site and wider area, where possible**	
• **Incorporate publicly accessible areas on the upper floors, where appropriate**	It would not be appropriate for the Proposed Scheme's upper floors to be publicly accessible, particularly the tallest elements such as the absorber columns.
• **Make a significant contribution to local regeneration**	The Proposed Scheme does do this, as set out in the Project Benefits Report.
Tall buildings should not affect their surroundings adversely in terms of microclimate, wind turbulence, overshadowing, noise, reflected glare, aviation, navigation and telecommunication interference	No such effects arise from the Proposed Scheme.
Tall buildings should not impact on local or strategic views adversely	The Proposed Scheme does not impact on local or strategic views adversely, as set out in the ES.

Requirement	Proposed Scheme Response
The impact of tall buildings proposed in sensitive locations should be given particular consideration. Such areas might include conservation areas, listed buildings and their settings, registered historic parks and gardens, scheduled monuments, battlefields, the edge of the Green Belt or Metropolitan Open Land, World Heritage Sites or other areas designated by boroughs as being sensitive or inappropriate for tall buildings.	Whilst the tallest aspects of the Proposed Scheme are located on a small element of Metropolitan Open Land, this should be seen in the context of the overall improvements that the Applicant will be making to the MOL in this area.

5. Suitable Locations for Tall Buildings are within and near the town centres of Abbey Wood Village (defined in Figure 5) and Lower Belvedere (defined in Figure 6)

As noted above, this paragraph needs to be seen in the context of paragraphs 1 and 4.

Taken as a whole, therefore, the Applicant considers it is clear that the Proposed Scheme is in compliance with policy DP12 and is a tall building in a suitable location.

CORY

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APPENDIX E: PLANS OF EXISTING RIVERSIDE CAMPUS

Cory Decarbonisation Project

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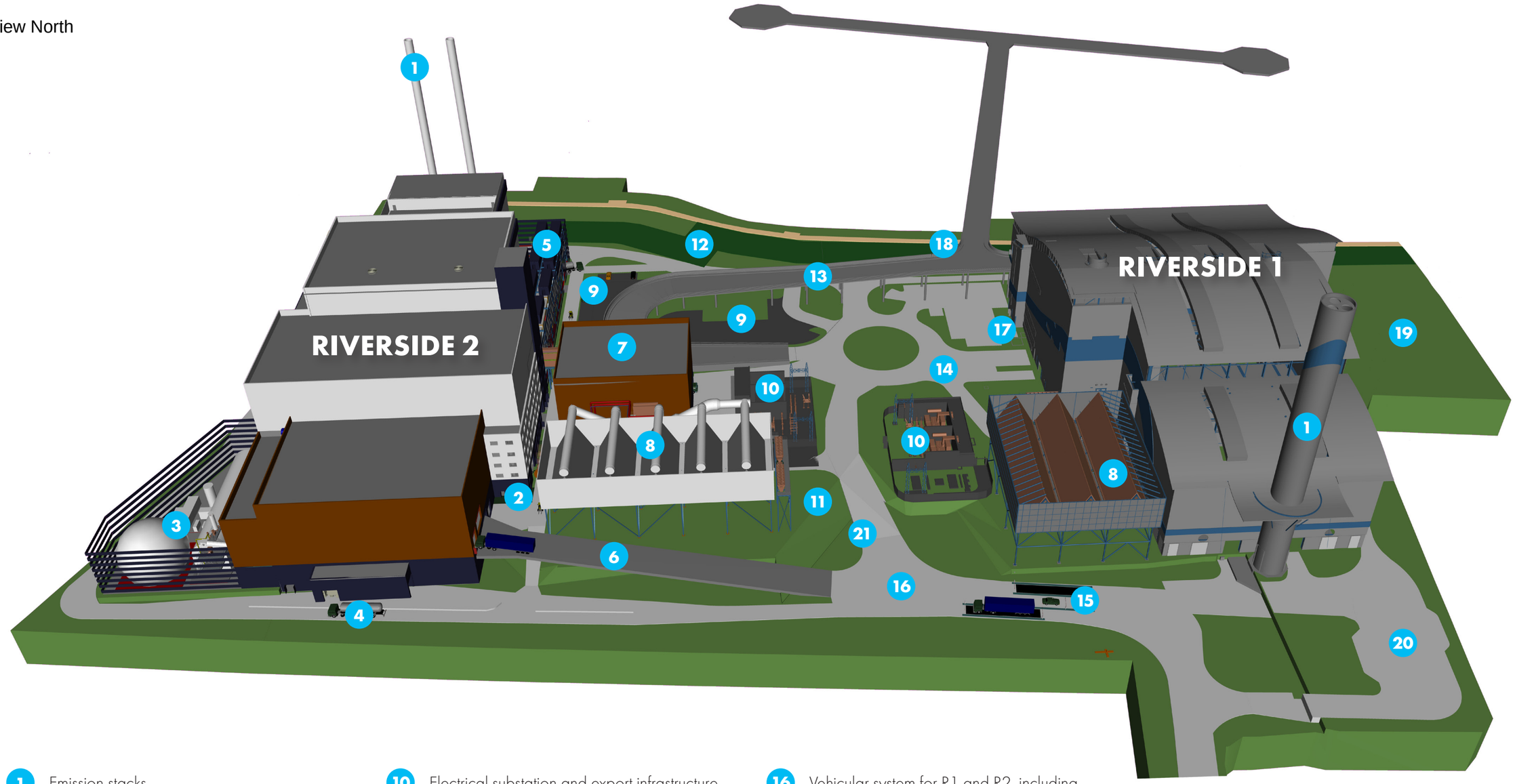
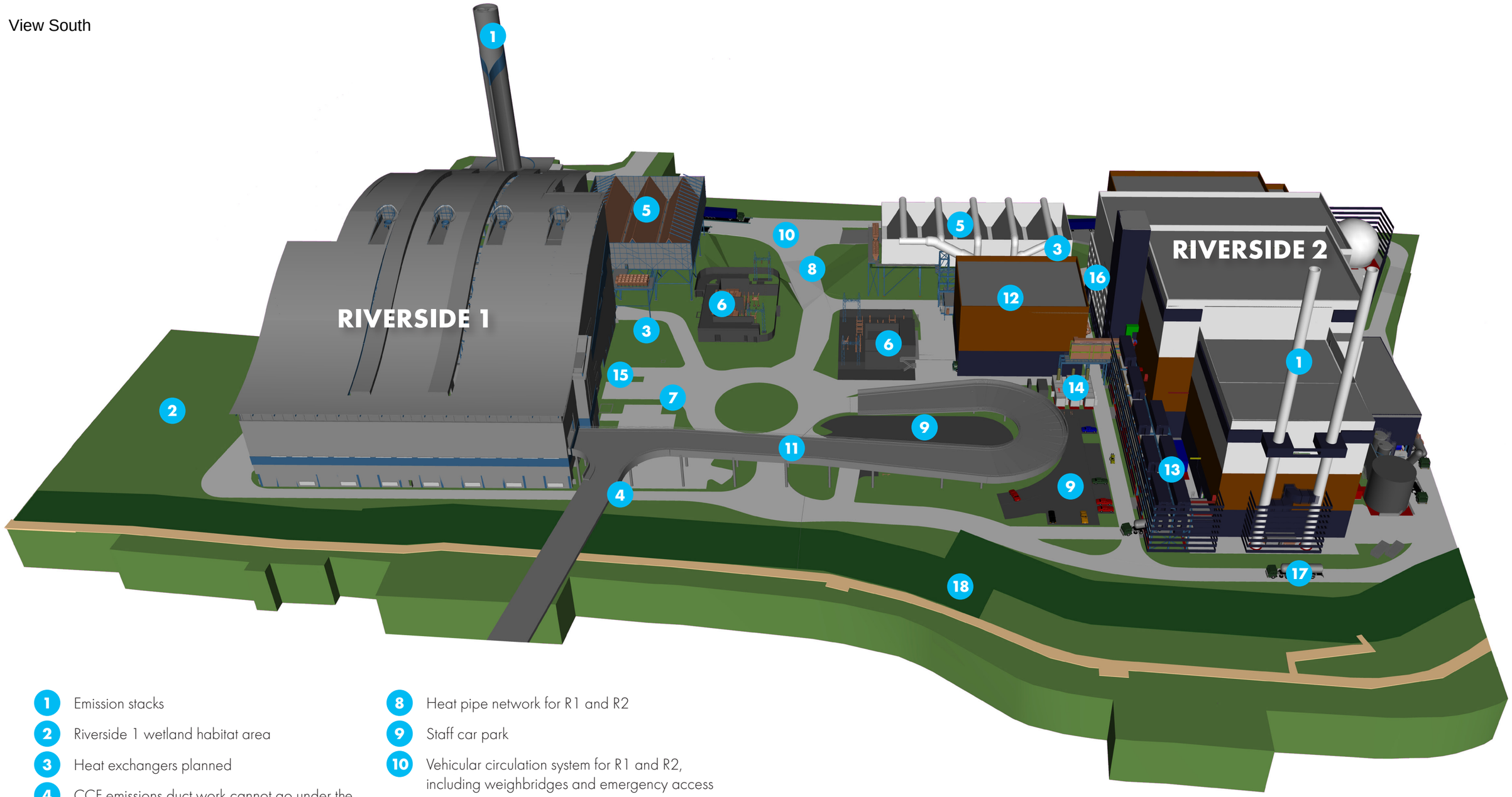
View North



1. Emission stacks
2. Space needed around the perimeter of R2 for emergency services, operational maintenance, and for natural light in to the admin block
3. Consented AD phase 2
4. Operational deliveries and maintenance
5. Batteries
6. Riverside 2 ramp to tipping hall
7. Turbine hall
8. Air cool condenser
9. Staff car park
10. Electrical substation and export infrastructure
11. Operational laydown maintenance area
12. Floodbank and 15m from top of embankment is EA's safeguarded FRAP Area
13. Raised ramp serving R1 for jetty and road waste, and R2 for jetty waste movements
14. Dense network of above/below ground utilities (media, communications, power, water etc) throughout the site including 132 KV export cables from R1 and R2, as well as fire fighting equipment
15. Combined weighbridges
16. Vehicular system for R1 and R2, including weighbridges and emergency access
17. Space needed around the perimeter of R1 for emergency services and operational maintenance
18. CCF emissions duct work cannot go under the jetty ramp and would need to be very high above the ramp to allow for safe clearance of HGVs and jetty crane maintenance
19. Riverside 1 wetland habitat area
20. Existing gatehouse
21. Heat pipe network for R1 and R2

View South



1. Emission stacks
2. Riverside 1 wetland habitat area
3. Heat exchangers planned
4. CCF emissions duct work cannot go under the jetty ramp and would need to be very high above the ramp to allow for safe clearance of HGVs and jetty crane maintenance
5. Air cool condensers
6. Electrical substation and export infrastructure
7. Dense network of above/below ground utilities (media, communications, power, water etc) throughout the site including 132 KV export cables from R1 and R2, as well as fire fighting equipment
8. Heat pipe network for R1 and R2
9. Staff car park
10. Vehicular circulation system for R1 and R2, including weighbridges and emergency access
11. Raised ramp serving R1 for jetty and road waste, and R2 for jetty waste movements
12. Turbine hall
13. Batteries
14. Electrical houses
15. Space needed around the perimeter of R1 for emergency services and operational maintenance
16. Space needed around the perimeter of R2 for emergency services, operational maintenance, and for natural light in to the admin block
17. Operational deliveries and maintenance
18. Floodbank and 15m from top of embankment is EA's safeguarded FRAP Area

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APPENDIX F: GREENHOUSE GAS WASTE THROUGHPUT SENSITIVITY ANALYSIS

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FIGURE

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1. CONTEXT

1.1.1. In determining likely carbon emissions associated with the 'With Proposed Development' and 'Without Proposed Development' cases, the Greenhouse Gas (GHG) assessment of the operational effects have been based on the maximum consented waste throughput for Riverside 1 and for Riverside 2 (once operational) (**Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**). This represents the worst-case scenario for emissions from waste combustion; however, by consequence represents an assessment of potentially the highest quantity of CO_2 emissions that would be captured by the Proposed Scheme.

1.1.2. It is recognised that there is potential for variation in the waste throughput quantities and composition used in the GHG assessment, both under current conditions and in the future. This sensitivity test outlines the result of running three scenarios relating to variations in waste throughput quantities and its impact on the assessment presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**, and its conclusion on significance.

2. METHODOLOGY

2.1. DATA

2.1.1. To assess the potential effect of GHG emissions attributable to the Proposed Scheme sensitivity testing has been carried out based on waste throughput quantities determined by the Applicant for three scenarios which are identified in **Table 2-1** below. **Table 2-1** also presents the related GHG emissions associated with processing the waste throughputs determined for Riverside 1 and Riverside 2 (once operational) for each scenario.

Table 2-1: Waste Throughput Scenarios and Associated GHG Emissions for Riverside 1 and Riverside 2

Scenario	Description	Waste Throughput (tonnes/yr)			GHG Emissions for Riverside 1 and Riverside 2 (once operational) Combined Waste Throughput			
		Riverside 1	Riverside 2	Combined	Fossil (tCO_2/yr)	Biogenic (tCO_2/yr)	N_2O (tCO_2e/yr)	Total (tCO_2e/yr)
1	Maximum Consented Throughput	850,000	805,920	**1,655,920**	857,882	880,834	488	**1,739,204**
2	Typical Operation (Anticipated Throughput)	789,000	655,000	**1,444,000**	748,093	768,107	425	**1,516,625**
3	Low Throughput (10% Below Anticipated Throughput)	710,100	589,500	**1,299,600**	673,284	691,296	383	**1,364,963**

2.1.2. **Scenario 1** represents the waste throughput (tonnes per year) that the assessment is based on, as presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062).** The tonnes identified for Scenario 1 are the maximum consented annual throughput for each of Riverside 1 and Riverside 2 (once operational). This is the basis against which comparisons for the sensitivity analysis have been made.

2.1.3. **Scenario 2** accounts for the waste throughput quantities during 'typical' operation. The tonnage for Riverside 1 is the actual amount received during 2022, the tonnage for Riverside 2 (once operational) is the nominal throughput for that facility, as set out in the associated application documents. Scenario 2 represents a reduction of 13% on combined Riverside 1 and Riverside 2 (once operational) waste throughput compared to Scenario 1.

2.1.4. **Scenario 3**, the low throughput scenario is based on an indicative 10% reduction in waste throughput quantities compared to anticipated operation (Scenario 2). This is simply an assumed indicative reduction to provide a sensitivity scenario.

2.1.5. It is relevant to note that this sensitivity assessment has been undertaken in response to the Relevant Representations received, particularly LBB (RR-124, page 15) which seeks consideration of the evolution of waste throughput and composition as a consequence of changes to policy, legislation and practice. The Applicant does not foresee residual waste quantities varying to the extent explored through the three scenarios; even accounting for ambitious recycling targets. For context, since 2010/11, household recycling in London has plateaued at around 33%.

2.1.6. It is relevant to note that this sensitivity assessment has been undertaken in response to the Relevant Representations received, particularly LBB (**RR-124**, page 15) which seeks consideration of the evolution of waste throughput and composition as a consequence of changes to policy, legislation and practice. The Applicant does not foresee residual waste quantities varying to the extent explored through the three scenarios; even accounting for ambitious recycling targets. For context, since 2010/11, household recycling in London has plateaued at around 33%.

2.1.7. In any event, even if challenging municipal waste recycling targets are achieved, full capacity at all of London's residual waste management facilities, including Riverside 1 and Riverside 2 (which comprise some 50% of that capacity in the capital) will be required to enable London to meet its sustainable waste management policies in diverting residual waste from landfill.

2.1.8. The Climate Change Committee, the UK's independent advisor on climate change has said that CCUS is a 'necessity, not an option' for the transition to net zero. And, with respect to residual waste in particular, the UK Government's 'Carbon Capture Usage and Storage: A Vision to Establish a Competitive Market' published in 2023 states 'CCUS is also needed to reduce emissions from our residual waste sector. There are government policies in place aimed at reducing waste by preventing waste from being produced in the first instance and by increasing recycling and reuse. For

the remaining residual waste, energy generation and the application of CCUS to capture the carbon that would otherwise be emitted into the atmosphere are ways to reduce the impact of managing and utilising the waste we do produce.'

2.1.11. Operation of the Proposed Scheme is proposed from 2031 inclusive and the purpose of the sensitivity analysis (and in line with the methodology in **Section 13.4** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**), it is assumed that the waste throughput (tonnes per year) would remain constant for each scenario for the operational lifetime of 50 years.

2.1.12. **Table 2-2** below outlines the percentage change in total waste throughput relative to **Scenario 1** (the results presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**).

Table 2-2: Percentage Change of Waste Throughput Quantities Relative to Scenario 1

Scenario	Description	Percentage Change in Waste Throughput Quantities Compared
1	Maximum Consented Throughput	-
2	Typical Operation (Anticipated Throughput)	-13%
3	Low Throughput (10% Below Anticipated Throughput)	-22%

2.2. CALCULATION METHODOLOGY

2.2.1. The sensitivity analysis uses the same methodology for determining GHG emissions outlined in **Section 13.4** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062),** allowing for variation in waste throughput quantities.

2.2.2. For the purposes of the sensitivity analysis the waste emissions factor per tonnes for CO_2 and N_2O remain the same as reported in **Section 13.4** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**. It is also assumed there would be no change to the CO_2 capture rate of 95%, as described in **Paragraph 1.1.15** of **Chapter 1: Introduction** of the **Environmental Statement (Volume 1) (APP-050)**.

2.2.3. In addition, a review of potential changes in waste composition attributable to the delivery of upcoming waste policies and legislation, has identified that these will be designed to remove both plastics (fossil carbon sources) and food waste (biogenic carbon sources), from the residual waste stream through waste prevention initiatives

such as taxation, and increased recycling. However, there is not expected to be a material change in the composition of residual waste received by Riverside 1 and Riverside 2 (once operational) as the removal of both plastics and food waste in tandem will effectively cancel each out; it is therefore anticipated that there would be no change to biogenic/fossil composition of the waste (51%/49% respectively) used in the assessment as presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**.

2.2.4. Construction phase GHG emissions (lifecycle stages A1-5) are not affected by the waste variation scenarios in the sensitivity analysis, so will remain the same for all three scenarios. The change in waste throughput quantities for the scenarios affects the following operational lifecycle stages:

- Operation – net residual CO_2 emissions from Riverside 1 and Riverside 2 (B1)
- Residual N_2O emissions from Riverside 1 and Riverside 2 (B1)
- Operation – avoid emissions - Fossil: reduction (B1)
- Operation – avoid emissions - Biogenic: removal (B1)
- End-user Emissions (B9/D) The Carbon Capture and Storage Project (Transport)

2.2.5. For the purposes of the sensitivity analysis it has been assumed that other operational emissions for the Proposed Scheme do not change between the scenarios, for example refrigerant use (B1), operational energy use (B6), operational water use (B7) and process consumables (B8). These emissions sources relative to the lifecycle stages outlined in **paragraph 2.2.4** are low in materiality relative to total lifecycle emissions so are unlikely to impact the results of the sensitivity analysis.

2.2.6. To align with the results presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)** the transport emissions associated with the Carbon Capture and Storage Project (Transport) – End User Emissions (B9/D) are based on the location in the North Sea, approximately 1,150km shipping distance from the Site Boundary.

3. RESULTS

3.1.1. The total whole-life GHG emissions for each of the three sensitivity scenarios are outlined in the **Table 3-1** below. For consistency with the assessment presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)**, the values presented in **Table 3-1** are aligned with the whole-life GHG emission categories identified in **Table 13-11** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)** and represent the total net lifecycle savings in GHG emissions compared to future baseline (including the construction and operation phases). Additionally, Table 3-1 includes the indicative saving in annual operational GHG emissions for each of the waste throughput scenarios. The net lifecycle emissions savings and annual operational emissions savings are also presented graphically in **Figure 1** and **Figure 2** respectively below.

Table 3-1: Total Net GHG Savings from the Proposed Scheme Compared to the Future Baseline for Each Scenario

Scenario	Description	Annual Operational Emissions (tCO_2e/yr)	Net Lifecycle Savings Compared to Future Baseline (tCO_2e)	Percentage Reduction in Net GHG Emissions Compared to Scenario 1
1	Maximum Consented Throughput	-1,620,603	-85,223,660	-
2	Typical Operation (Anticipated Throughput)	-1,350,606	-74,283,321	-13%
3	Low Throughput (10% Below Anticipated Throughput)	-1,271,174	-66,828,692	-22%

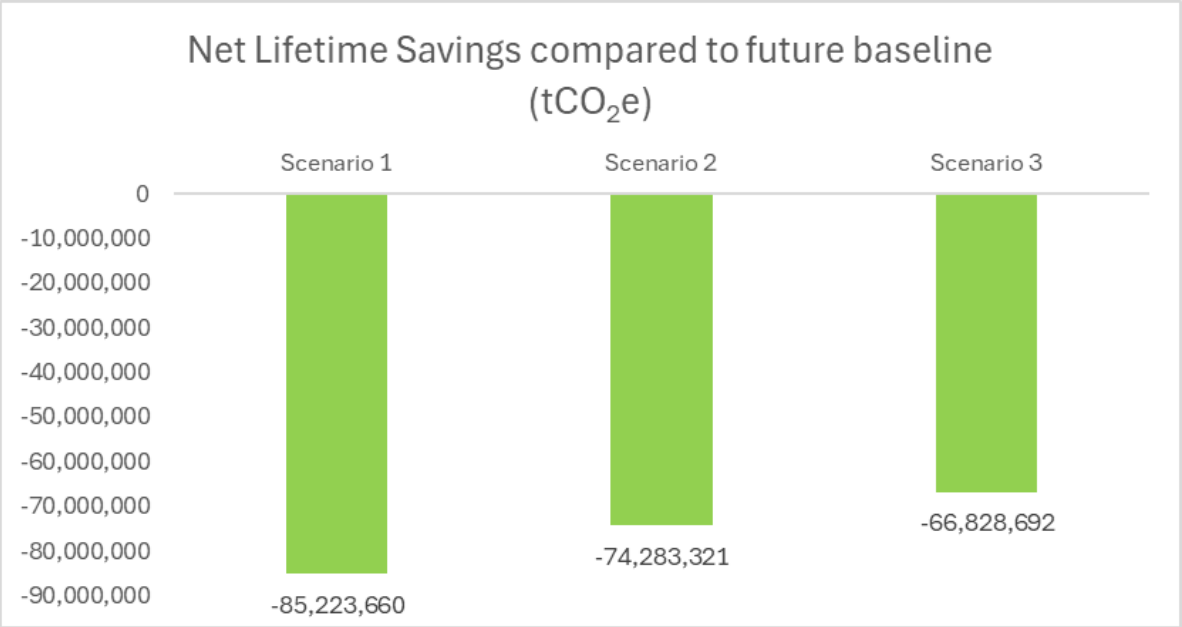

Figure 1 – Total Net Lifecycle Greenhouse Gas Savings Compared to Future Baseline per Scenario

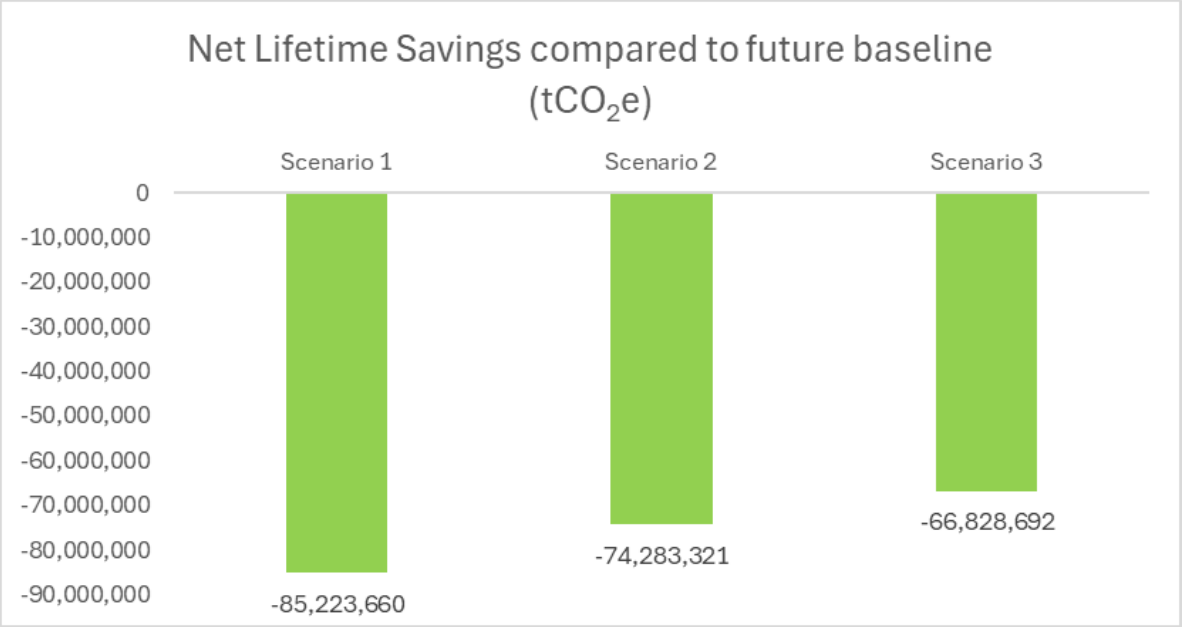

Figure 2 – Annual Operational Greenhouse Gas Savings per Scenario

3.1.2. In relation to the results in **Table 3-1**, as may be expected the percentage reduction in waste throughput for Scenario 2 and 3 relative to Scenario 1 (identified in **Table 2-2**), translates to an equivalent reduction in the total net savings in GHG emissions for each scenario. This is because the emissions sources that have been affected are directly related to the waste throughput quantities.

3.1.3. The results for each scenario have also been compared to both the UK Carbon Budget and the London Carbon Budget, see **Tables 3-2 and 3-3** below.

Table 3-2: Comparison Against the UK Carbon Budget for Each Scenario

Budget (tCO2e)		Scenario 1		Scenario 2		Scenario 3	
		tCO_2e	%	tCO_2e	%	tCO_2e	%
Fourth carbon budget (2023-27)	1,950,000,000	39,333	0.002%	39,333	0.002%	39,333	0.002%
Fifth carbon budget (2028-32)	1,725,000,000	-3,095,442	-0.179%	-2,690,903	-0.156%	-2,415,254	-0.140%
Sixth carbon budget (2033-2037)	965,000,000	-7,886,104	-0.817%	-6,874,755	-0.712%	-6,185,633	-0.641%

Table 3-3: Comparison Against London Carbon Budget for Each Scenario

Budget (tCO_2e)		Scenario 1		Scenario 2		Scenario 3	
		tCO_2e	%	tCO_2e	%	tCO_2e	%
2023-27	22,400,000	39,333	0.176%	39,333	0.176%	39,333	0.176%
2028-32	18,000,000	-3,095,442	-17.197%	-2,690,903	-14.949%	-2,415,254	-13.418%

4. CONCLUSION

4.1.1. It is difficult to predict the exact waste throughput in the future and potential success of policy initiatives to reduce waste and increase recycling, albeit, for the reasons outlined the Applicant does not consider either quantity or composition will vary that greatly. Consequently, the analysis provided here is for sensitivity purposes only, intended to provide an indication of the broad direction and scale of the impact on GHG emissions savings attributable to the Proposed Scheme relative to results presented in the assessment presented in **Section 13.8** of **Chapter 13: Greenhouse Gases** of the **Environmental Statement (Volume 1) (APP-062)** (i.e. Scenario 1).

4.1.2. The key findings of the sensitivity analysis are summarised as follows:

- A reduction in waste throughput quantities as a result of anticipated operation (Scenario 2) and low throughput (Scenario 3), result in a reduction in net GHG emissions savings relative to the maximum consented throughput (Scenario 1).
- Despite the lowering of net GHG emissions savings compared to the future baseline for Scenarios 2 and 3 (relative to Scenario 1), the sensitivity analysis identifies that for each scenario there would continue to be a substantial saving in GHG emissions compared to the baseline scenario.
- Due to the scale of GHG emissions savings identified for each scenario (and with reference to the UK and London carbon budgets within **Table 3-2** and **Table 3-3** above), there is still likely to be a direct, permanent, long term, **Beneficial (Significant) effect** despite the modelled variation in waste throughput quantities. This is because it is anticipated that the net GHG impacts are below zero and will cause a reduction in GHG emissions entering the atmosphere, whether directly or indirectly, compared to the baseline, substantially exceeding net zero requirements with a beneficial climate impact.

APPENDIX G: GOVERNMENT CALL FOR EVIDENCE ON NON-PIPELINE TRANSPORT

DECARBONISATION

Cory Decarbonisation Project

September 2024

Department for Energy Security & Net Zero

Carbon capture, usage and storage (CCUS)

Call for evidence on non-pipeline transport and cross-border CO_2 networks

Closing date: 16 July 2024

May 2024

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Any enquiries regarding this publication should be sent to us at:
NPTandCrossBorderCO2@energysecurity.gov.uk

Contents

General information

Rationale for calling for evidence

Carbon capture, usage and storage (CCUS) will be essential to meeting the UK's 2050 net zero target, playing a vital role in levelling up the economy, supporting the low-carbon economic transformation of our industrial regions, and creating new high value jobs. The Climate Change Committee (CCC) has stated that CCUS is a 'necessity, not an option'[1] for the transition to net zero.

In the 'Carbon capture, usage and storage: a vision to establish a competitive market'[2] (CCUS Vision), government committed to publishing a call for evidence on how it envisages non-pipeline transport (NPT) being delivered in the UK.

NPT can have an important role to play in the development of CCUS, serving as a decarbonisation option in instances where a pipeline is technically and/or commercially unfeasible. NPT will allow capture projects outside of CCUS industrial clusters or in clusters without direct access to a pipeline to take their carbon dioxide (CO_2) to an offshore store. NPT can help achieve decarbonisation across multiple regions and sectors of the economy, helping to meet our decarbonisation targets, net zero and energy security objectives. It will be important to demonstrate NPT technically and commercially in the near term to reduce future costs as the CCUS sector transitions toward becoming self-sustaining.

The CCUS Vision[2] also acknowledges the role that cross-border CO_2 transport and storage (T&S) networks can play, maximising the opportunities presented by the UK's potentially vast offshore storage capacity.

Through this call for evidence, we are now seeking evidence to better understand NPT and cross-border networks. The key areas are:

1. NPT value chain data
2. CCUS policy landscape
3. Wider deployment considerations

Following the call for evidence closing on 16 July, government will look to assess the responses received and use the information gathered to inform policy development, to support the deployment of NPT in the UK and cross-border CO_2 networks, as well as the role these networks can perform within the wider CCUS landscape.

[1] The Climate Change Committee. 'Net Zero - The UK's contribution to stopping global warming' 2019
[2] Department for Energy Security and Net Zero. 'Carbon capture, usage and storage: a vision to establish a competitive market' 2023

Call for evidence details

Issued: 7 May 2024

Respond by: 16 July 2024

Enquiries to:
CO_2 Non-pipeline Transport Policy Team
Carbon Capture, Usage and Storage Programme
Department for Energy Security and Net Zero
6th Floor
3-8 Whitehall Place
London
SW1A 2AW

Email: NPTandCrossBorderCO2@energysecurity.gov.uk

Call for evidence reference: Call for evidence on non-pipeline transport and cross-border CO_2 networks

Audiences:

The government welcomes responses from anyone with an interest in the CCUS policy area. We envisage that this call for evidence will be of particular interest to:

- Those developing and intending to use CO_2 non-pipeline transport routes within the UK
- Those developing or intending to develop cross-border CO_2 networks (via NPT or pipeline)
- UK CO_2 transport and storage network developers and infrastructure providers
- Supply chain companies, trade bodies, academics, and prospective investors.

Territorial extent:

Territorial extent is onshore in the United Kingdom and offshore including above or below the territorial sea adjacent to the United Kingdom and waters in a gas importation and storage zone (within the meaning given by Section 1 of the Energy Act 2008).

How to respond

Your response will be most useful if it is framed in direct response to the questions posed, and with supporting evidence wherever possible. Further comments and wider evidence are also welcome. When responding, please state whether you are responding as an individual or representing the views of an organisation. It is not necessary to answer every question.

However, responses in writing or via email will also be accepted. Should you wish to submit your main response via the e-consultation platform and provide supporting information via hard copy or email, please be clear that this is part of the same response to this call for evidence.

Respond online at: https://energygovuk.citizenspace.com/industrial-energy/non-pipeline-transportation-of-carbon-dioxide-cfe

or

Email to: NPTandCrossBorderCO2@energysecurity.gov.uk

We will conduct engagement while the call for evidence is open. If you want to be included in these engagement events, then please contact the department as soon as possible via email NPTandCrossBorderCO2@energysecurity.gov.uk.

Confidentiality and data protection

Information you provide in response to this call for evidence, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

If you want the information that you provide to be treated as confidential, please tell us, but be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process your personal data in accordance with all applicable data protection laws. See our privacy policy.

As part of this Call for Evidence, we are seeking to gather data on NPT costs and on the project pipeline. We may share relevant data within government and with our technical advisors to aid CCUS policy development. The NPT and Cross-border team may also reach out to clarify responses.

Quality assurance

This call for evidence has been carried out in accordance with the government's consultation principles.

If you have any complaints about the way this call for evidence has been conducted, please email: bru@energysecurity.gov.uk.

Introduction

This call for evidence will set out a long-term vision for the non-pipeline transport (NPT) of carbon dioxide (CO_2) as well as seek to improve the government's understanding of both NPT value chains and cross-border CO_2 T&S networks, the costs associated with them, and the potential barriers to deployment.

CCUS landscape

Carbon Capture, Usage and Storage (CCUS) is the process of capturing CO_2 and permanently storing it deep underground where it cannot enter the atmosphere. CCUS will be essential to meeting the UK's 2050 net zero target, playing a vital role in levelling up the economy, supporting the low-carbon economic transformation of our industrial regions, and creating new high value jobs. The Climate Change Committee (CCC) has stated that CCUS is a 'necessity, not an option'[3] for the transition to net zero.

The Net Zero Strategy[4] and the Industrial Decarbonisation Strategy[5] set out the critical role of CCUS in delivering net zero by 2050. CCUS is important in the decarbonisation of industry (e.g. cement, chemicals, and refining) where in many cases, the process emissions mean that it is the only viable route to decarbonise at the scale required to meet our carbon budget and net zero targets. CCUS is also key to decarbonising the power sector by 2035, kick starting low carbon hydrogen production and engineered greenhouse gas removal (GGR) sectors by 2030.

The CCUS Vision[2] published in December 2023, set out an ambition to create a competitive market in CCUS by 2035. It aims to unlock investment and drive economic growth, potentially supporting up to 50,000 jobs by 2030 and adding up to £5 billion to our economy each year by 2050[6]. To achieve our objective of creating a self-sustaining CCUS sector that can reduce emissions and support thousands of jobs, we describe a three-phase approach. These phases are:

1. Market creation phase until 2030
2. Market transition phase: 2030-2035
3. Self-sustaining market phase: 2035 onwards

In Powering up Britain: Energy Security Plan, published in March 2023, government committed to deploying CCUS in two industrial clusters by the mid-2020s and four clusters by 2030, with the aim of capturing and storing 20-30 million tonnes of CO_2 per year by 2030[7] in the market creation phase. In May 2021 government launched Track-1 Phase-1 of the CCUS cluster sequencing process. Its purpose was to identify at least two CO_2 transport and storage companies (T&SCos), whose readiness suggested that they were most suited for deployment of a CO_2 transport and storage (T&S) network in the mid-2020s. Track-1 was designed to

[3] The Climate Change Committee. 'Net Zero - The UK's contribution to stopping global warming' 2019
[4] Department for Business, Energy and Industrial Strategy. 'Net Zero Strategy: Build Back Greener' 2021
[5] Department for Business, Energy and Industrial Strategy. 'Industrial Decarbonisation Strategy' 2021
[6] Department for Business, Energy and Industrial Strategy. 'Energy Innovation Needs Assessment: Sub-theme Report: Carbon capture, utilisation, and storage' 2019
[7] Department for Energy Security and Net Zero. 'Powering up Britain: Energy Security Plan' 2023

deploy full chain piped T&S networks for simplicity and to support the deployment of CCUS at pace. The two Track-1 clusters selected were the East Coast Cluster and HyNet with eight capture projects selected to proceed to negotiations in March 2023[8].

The second stage of CCUS deployment will look at Track-1 expansion (T1x), where additional capture projects connect to the Track-1 clusters, and Track-2, where two additional clusters were selected: Acorn and Viking. However, to ensure that multiple regions including those outside those four clusters can decarbonise, government recognises that there is a need to expand CO_2 transportation capabilities by deploying NPT alongside piped solutions.

The CCUS Track-2 December 2023 Market Update[9] set out government's proposed Track-2 approach of an 'anchor' and 'buildout' phase and high-level timelines. The anchor plans would need to credibly demonstrate connection via pipeline for an initial phase of capture, facilitating future phases of store and network expansion to enable both additional piped and NPT projects. As stated in the CCUS Vision[2], we anticipate NPT projects will be eligible to apply for emitter selection processes that open from 2025 onwards, to help meet the stated ambitions. Further details on future emitter selection processes will be provided in due course.

The CCUS Vision[2] also sets out how we envisage the market for CCUS developing between 2030 and 2035, with the emergence of a commercial and competitive market that moves towards a self-sustaining market. We will need to expand the CO_2 transport network for both pipeline and non-pipeline solutions to facilitate decarbonisation across multiple regions and sectors of the economy, and to meet the evolving needs of users. During this period, we also assume that cross-border CO_2 T&S networks would be enabled, unlocking additional economic opportunities.

NPT will allow for the deployment of CCUS in areas where a pipeline is technically and/or commercially unfeasible. This will be particularly important as roughly half of the industrial emissions in the UK sit outside industrial clusters[10], and not all clusters have access to a piped T&S solution (e.g. South Wales). Other sectors including power, residual waste management, CCUS-enabled hydrogen and some engineered GGR are also likely to require NPT solutions to achieve our net zero ambition. It is therefore important to demonstrate NPT technically and commercially in the near term to bring down costs in the future. By unlocking CCUS via NPT, it will be possible to secure high value jobs and investment in these areas throughout the UK for years to come.

The scale of NPT deployment is estimated in the Enabling Industry Pipeline Scenario[11] of Carbon Capture and Storage Association's (CCSA's) CCUS Delivery Plan 2035[12]. It is estimated that domestic capture projects using shipping and other NPT infrastructure could help capture a further ~15Mt CO_2/yr by 2035.

NPT infrastructure can also unlock the potential for a new UK market in cross-border CO_2 T&S. For example, by establishing CO_2 shipping and associated receiving and send-out facilities, NPT can open cross-border CO_2 transport networks to regional customers, providing access to

[8] Department for Energy Security and Net Zero. 'Cluster sequencing Phase-2: Track-1 project negotiation list, March 2023' 2023
[9] Department for Energy Security and Net Zero. 'CCUS Cluster Sequencing Track-2: Market update December 2023' 2023
[10] Department for Energy Security and Net Zero. 'Cluster sequencing for CCUS: Track-2 Guidance' 2023
[11] This scenario assumed that the full pipeline of identified CCS projects in the UK are able to deploy.
[12] Carbon Capture and Storage Association. 'CCUS Delivery Plan 2035' 2022

our potentially vast offshore CO_2 storage capacity[13] and supporting regional decarbonisation. The CCSA's CCUS Delivery Plan 2035[12] estimates that the UK has sufficient storage to import a further ~20MtCO_2/yr by 2035 from neighbouring countries.

Unlocking the UK's storage capacity for cross-border CO_2 volumes also has the potential to mutually benefit the UK and its regional partners (e.g. EU Member States), our economies and our CCUS sectors.

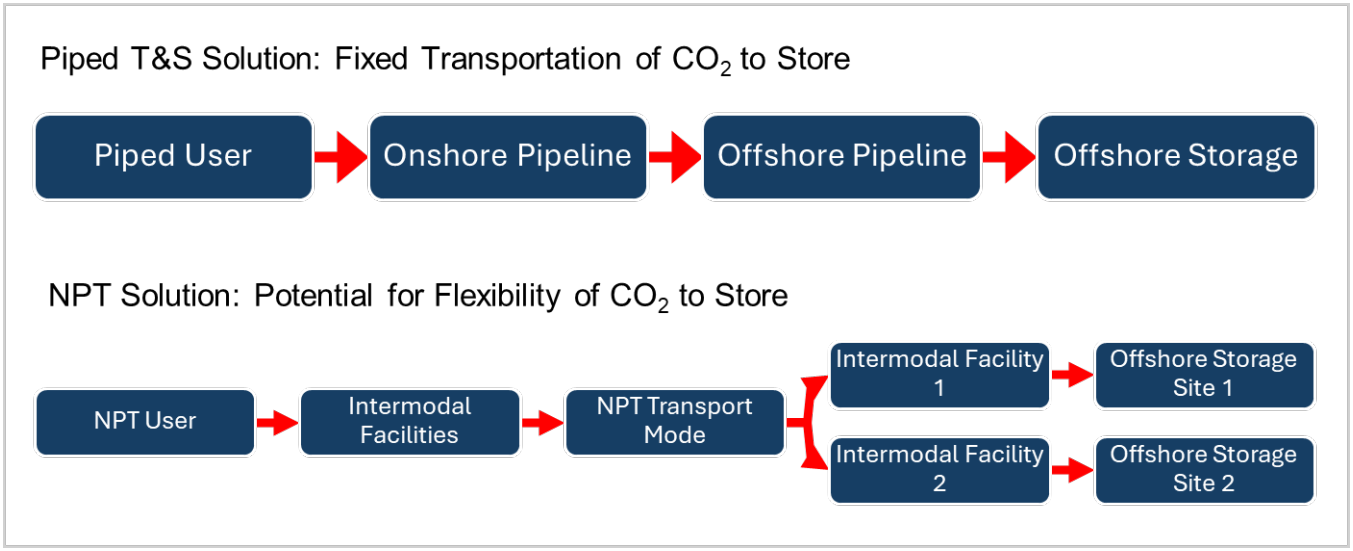
Explanation of NPT

NPT in the CCUS context is the transportation of CO_2 using road, rail, barge, and/or shipping. NPT will unlock CCUS as a potential decarbonisation route for capture projects outside the CCUS industrial clusters or in clusters without direct access to an offshore pipeline. Unlocking CCUS in these locations will be essential for the UK to reach its decarbonisation goals.

NPT solutions and piped T&S networks are likely to deploy in parallel and will be complimentary to one another. Although the piped network and NPT solutions may both be transporting CO_2, there are some key differences which are described below.

In Track-1, CCUS will be delivered by two types of commercial entities: 1) capture projects utilising a pipeline (piped users) and 2) the T&SCo, where the T&SCo delivers the onshore pipeline, offshore pipeline, and offshore storage. Unlike piped solutions, the NPT user and its store are not physically connected, allowing the NPT user flexibility to connect to a number of different stores, as seen in Figure 1.

Figure 1: Comparison of Piped T&S Solution vs NPT Solution



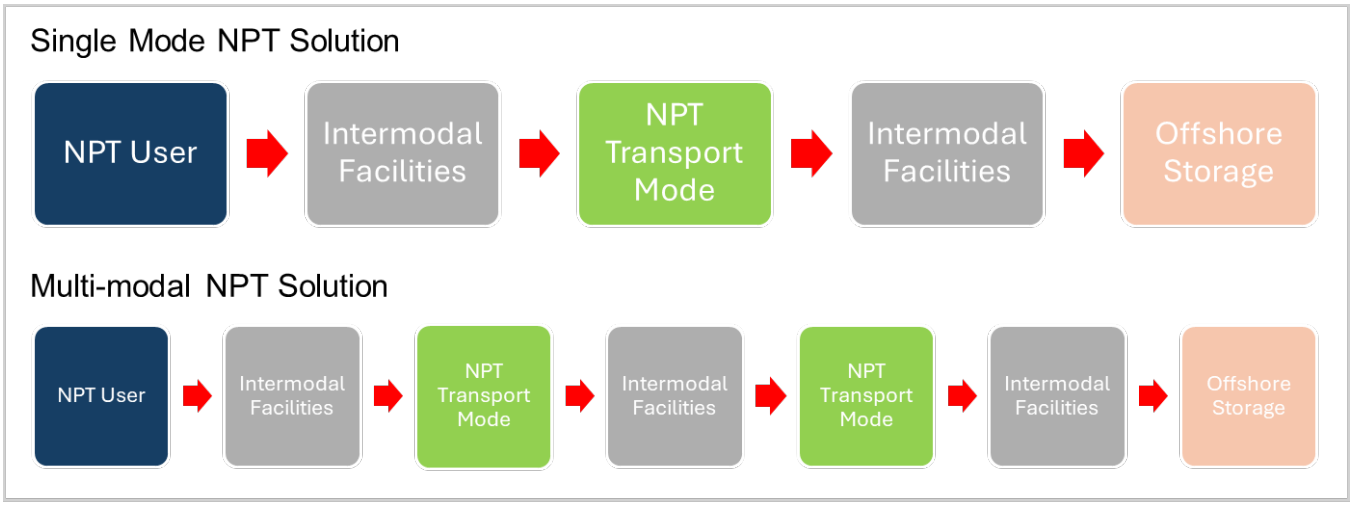
Alongside increased flexibility, NPT value chains may have a greater degree of heterogeneity when compared to piped transportation due to the technical variability between different NPT value chains. Specifically, delivery through different modes of transport (road, rail, barge, ship),

[13] Bentham M and others. 'CO_2 Storage Evaluation Database (CO_2 Stored). The UK's online storage atlas' Energy Procedia 2014: volume 63, pages 5103-5113

and the number of nodes[14] in the transportation chain (including the aforementioned transport modes, pipeline and intermodal facilities (e.g. liquefaction and temporary storage)).

NPT can be delivered via a single mode value chain, or a multi-modal value chain. As demonstrated in Figure 2, in a single mode NPT solution, one method of transportation would be utilised to transport CO_2 from the user to the store. In a multi-modal NPT solution, multiple modes of transportation could be used at different stages of the CO_2 transport process, also demonstrated in Figure 2. Multi-modal NPT solutions could be utilised in instances where it isn't technically or economically viable to deliver CCUS via a pipeline or a single mode NPT chain.

Figure 2: Comparison of Single Mode and Multi-modal NPT Chain



Vision for NPT

Set out below is a potential long-term vision for NPT that may exist during the self-sustaining market phase based upon the prospective benefits that can be realised through the delivery of NPT. We believe the long-term vision for NPT in this chapter will provide the sector with an understanding of the government's aspirations for NPT, whilst the pathway to this long-term vision will be informed by the evidence gathered from this CfE.

Based on government's current understanding of the NPT sector and its strengths, it may be possible to project a future outcome for NPT. As the evidence is collected from this call for evidence, our understanding of the NPT sector may change and with it the potential vision for the sector. It is understood that the vision below is one of multiple potential outcomes for the NPT sector and so the second part of this section will explain the rationale.

As set out in the CCUS Vision[2] our expectation for NPT deployment is during the market transition phase (2030-2035). In the following section we set out our proposal for a long-term vision of a mature NPT sector in the self-sustaining phase of CCUS deployment (e.g. after 2035) is as follows:

[14] Node is derived from telecommunication network nodes and used in this context to mean something capable of creating, receiving or transporting CO_2. In Figure 1 and Figure 2, each box would be considered a node.

Variety of NPT chains

- NPT is expected to be delivered by all NPT transport modes (road, rail, barge and ship)
- NPT is expected to include multi-modal solutions to help realise CCUS decarbonisation in harder to access locations
- NPT will likely result in the creation of specialist service providers across the NPT value chain to facilitate NPT solutions
- Different NPT value chains are likely to have a number of different commercial arrangements to best manage the chain's NPT challenges, and NPT service providers'[15] expertise and risk appetite

Operational flexibility

- Each CCUS cluster would have NPT connectivity, unlocking further flexibility between clusters, NPT users, and stores. This web of interconnected NPT users and stores could then connect with fixed piped T&S networks
- Charging fee structures may develop for NPT users and cross-border users which react to storage market capacity to optimise store use
- Third-party agents may be utilised to support a flexible service provision – potentially as risk taking intermediaries or brokers connecting NPT users, NPT service providers, and stores

Competition fuelling system growth

- NPT service providers are not expected to be economically regulated as it is anticipated there would be competition throughout the NPT service provider network in a self-sustaining market
- Competition between NPT service providers should lower costs
- Shipping may enable direct-to-wellhead CO_2 injection, especially at stores without a local user base. This could potentially be favourable for cross-border users who could reduce costs and travel distances
- NPT users and cross-border users could incentivise storage exploration and appraisal activity

In the following section, we look to provide some additional rationale for this vision for NPT.

Rationale for vision

Allow NPT value chain to self-organise

Government considers that the market is best placed to effectively and efficiently resolve their specific NPT challenges. In Track-1, the full-chain approach of piped user and T&SCo meant that the CCUS regulatory regime (TRI Model, Network Code and user business models (BMs))

[15] NPT service providers are defined here as the Entities delivering those services that are required specifically to deliver an NPT solution. In other words, any Entity which provides a service in the transfer of CO_2 from the NPT user following capture and before being delivered to the piped T&S network.

was designed to manage one specific organisational and commercial structure. It will be important to allow self-organisation across the NPT value chain without the CCUS policy landscape dictating particular organisational and commercial structures, delivering effective and efficient NPT solutions. As a result of this self-organisation, there is expected to be significant variation in the delivery models and commercial arrangements between different NPT value chains.

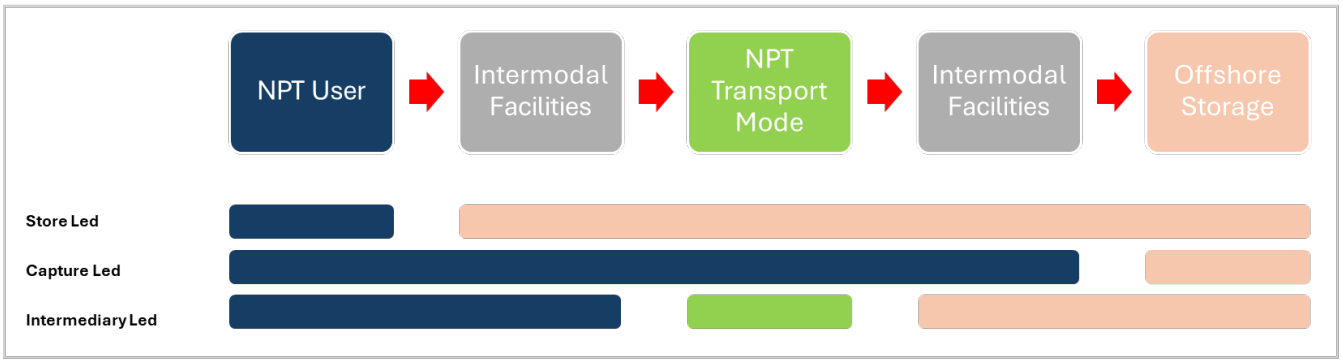
NPT solutions will have technical variability including: scale, mode of transport (road, rail, barge and ship), temporary storage requirements at each node, and potentially be multi-modal. Allowing NPT value chains to self-organise will help to maximise delivery expertise, by matching technical expertise with the delivery of those elements of the NPT value chain.

Government understands there to be several different archetypes for the delivery of NPT. These can largely be explained through three lenses, as shown in Figure 3:

- Capture Led
- Intermediary Led
- Store Led

These archetypes each have different strengths and weaknesses making them suitable for different scenarios. As a result, a variety of archetypes may exist simultaneously, or the archetypes may change over time as the CCUS and NPT markets develop.

Figure 3: NPT Delivery Archetypes



Store Led

This may also be known as a collection model, with the store holding responsibility for the collection of CO_2. Under a store led model, NPT and intermodal receiving/storage services act as an analogue of a pipeline within the piped T&S regime. Whilst mirroring the operation of the current T&S BM, this model may not allow the full flexibility of NPT solutions to be realised, but it is possible that prior to multiple clusters being NPT enabled this flexibility may not be required. This archetype may have a role in a transitionary capacity in the near term, but the other archetypes (capture led and intermediary led) may provide better flexibility as they do not link the NPT user to a specific store.

Capture Led

A capture led model is one where the capture project carries the responsibility for delivering the CO_2 to the store. It is likely that a capture led model can provide greater flexibility of CO_2 to store than a store led model, as a capture project is likely to have greater flexibility to select

which store it connects with and can utilise alternative stores where necessary. Alongside this, a capture led model may align well with the current piped T&S regime, with the NPT user effectively delivering CO_2 to a T&S delivery point within the piped T&S network.

Intermediary Led

Intermediary led models utilise third parties separate from the users and T&SCos to provide NPT solutions. Under this model, a third-party entity facilitates the connection between the capture project and T&SCo. The intermediary acts as a bridge, managing the coordination and efficient transfer of CO_2. Government believes that this model may become more attractive as the NPT market matures and the risks attached to the emerging market become better understood. It could be envisaged that these models naturally evolve out of some of the capture led or store led models, which may look to subcontract some of the NPT value chain.

Operational flexibility

NPT solutions can deliver operational flexibility as the physical link between the capture project and the store does not exist as it does in piped T&S networks. This operational flexibility may create potential benefits of increased resilience[16] and T&S network utilisation[17]. These benefits may be provided by NPT users but would be reliant on numerous clusters being NPT enabled[18]. The more CCUS clusters that are NPT enabled, the greater the potential benefits.

NPT can provide resilience to the CCUS sector and improve security of sequestration. In the event of T&S unavailability within an NPT enabled cluster, NPT solutions could provide access to alternative stores for both piped users and NPT users (subject to capacity and interoperable infrastructure and CO_2 specifications).

Operational flexibility has the potential to increase T&S utilisation across multiple T&S networks by matching excess storage capacity with CO_2 volumes. Under-utilisation of the network may occur in different scenarios, including: the peaks and troughs of a user's normal operational CO_2 delivery to the piped T&S network; scheduled or unscheduled user downtime; or prolonged capture project underperformance leading to reduced CO_2 delivery to the piped T&S network.

To optimise T&S utilisation, NPT service providers could be reactive to the T&S networks by delivering CO_2 volumes to the T&S network when it is under-utilised. By increasing utilisation in this way, the T&S fees for all network users would be reduced by decreasing the need for mutualisation[19] and reducing reliance on revenue support as the CCUS sector transitions towards a self-sustaining market. In order for NPT users and cross-border users to play a role in improving T&S network utilisation rates, they may require a dynamic and responsive set of charging structures to incentivise NPT service providers to deliver CO_2 to the store with most excess capacity. As the CCUS market becomes more dynamic, it may require third-party actors with this expertise to facilitate such a role, especially if the expertise does not reside with the NPT users, cross-border users, NPT service providers or storage operators.

[16] Resilience being defined as the ability to overcome a single point failure and continue to be operational.
[17] Utilisation rates being defined as the CO_2 volumes being processed compared with network capacity.
[18] NPT Enabled means that the cluster has the infrastructure (temporary storage, loading/unloading equipment and transport node infrastructure (e.g. jetty)) to allow for both transport of CO_2 to occur in and out of that cluster.
[19] Mutualisation refers to the rebalancing of User charges to address any shortfall in regulated allowed revenue arising from network underutilisation. Underutilisation may arise from uncontracted network capacity and/or different load factors of Users like peaking power stations. The final rebalanced price for those Users that were originally below the carbon futures price before rebalancing is capped at the carbon futures price.

Competition

The government response to the consultation on economic regulation[20] stated that it does not expect NPT service providers to be required to be economically regulated. This is unlike piped transportation which is expected, at least initially, to have monopolistic characteristics and therefore will be regulated through the economic licence. Government believes that NPT service providers are likely to be in competitive markets where they compete to provide a lower cost solution, leading to cost reductions. As NPT service providers begin to compete on price this will likely incentivise additional actors to enter the CCUS sector further reducing costs and supporting the transition towards a self-sustaining market.

As NPT and cross-border users deploy, this will create an increase in the volumes of CO_2 that need to be permanently geologically stored. This increase in demand has the potential to be a catalyst for store appraisal. Store locations without a local user base could be made economically viable by NPT and cross-border users creating a demand for storage capacity that would otherwise have been unable to link storage capacity demand with CO_2 supply. This is especially true through shipping solutions and is subject to the barriers of cross-border CO_2 T&S networks being resolved. If additional stores are economically viable as a result, this will likely increase competition leading to cost reductions, as well as improve the probability of reaching our legally binding carbon budgets by improving resilience.

[20] Department for Business, Energy and Industrial Strategy. 'Duties and Functions of the Economic Regulator for Carbon Dioxide Transport & Storage Networks' 2022

Call for evidence questions

We are calling for evidence to better understand the role that HMG will need to play within a new NPT sector deploying during the market transition phase, only intervening where it is necessary. To do this government needs to:

- Increase our understanding of the costs associated with the deployment of potential NPT value chains to improve confidence in costs
- Confirm our understanding of the technical and commercial variability that exists within potential NPT value chains to test and confirm our view that industry is best placed to manage that complexity without restrictions to self-organisation within the CCUS policy landscape
- Understand the changes that may be required to the CCUS policy, legislative, and regulatory landscapes to allow for NPT and cross-border CO_2
- Understand the potential project funnel and deployment timelines for NPT and cross-border CO_2 to inform future CCUS deployment
- Understand if there are other factors that could influence NPT deployment timelines.

This call for evidence is important to understand the views of all potential stakeholders and not just the views of the potential first movers. This is significant to ensure that the policy developed for first-of-a-kind (FOAK) deployment aligns with government's long-term vision for a self-sustaining CCUS sector, whilst reducing the risk of locking into inefficient and less value for money FOAK NPT solutions.

To facilitate the aims of this call for evidence, in the following sections, we will ask questions in the following areas:

- Respondent data
- Views on the potential vision for the sector
- NPT value chain data
- CCUS policy landscape
- Wider deployment considerations.

Government understands that there are many questions in this call for evidence, and we are trying to gather evidence from a wide range of stakeholders. As a result, there may be questions within this call for evidence that are not relevant to all respondents. Therefore, there is no requirement to provide a response to all questions. To better manage the responses that are received, please make clear which question(s) a response is in relation to. Government thanks participants in advance for their cooperation as it will expedite the analysis of the data and responses provided by respondents.

Please note, that there is a sub-section within the 'Wider deployment considerations' section to add comments on areas that this call for evidence does not directly cover.

Please can participants provide the data for questions 6-10 and 13 in the template provided, to facilitate efficient analysis and future policy development.

Respondent data

We are collecting information on the respondent to better understand any trends that may exist from different stakeholder groups. Additionally, we are looking for permissions on how the data provided can be used for future analysis. Further analysis may be required from third-party contractors (who have the expertise to assess the data provided) to ensure robustness. The team may also reach out to clarify responses.

1. **Who are you responding on behalf of, and what is your interest in this call for evidence?**

2. **If you consent to members of the team reaching out for clarifications on responses provided, please provide contact details.**

3. **Do you give permission for your anonymised evidence to be shared with external advisors for the purpose of technical analysis?**

View on the potential vision for the NPT sector

In the section 'Vision for NPT' has set out a potential vision for a mature NPT sector during the self-sustaining market phase and the rationale behind that vision. Government also understands that NPT should unlock CCUS in regions and sectors of the economy that would have struggled to deploy CCUS via pipeline access, noting that some regions and sectors will rely more heavily on NPT solutions than others.

4. **Please provide views on the potential long-term vision for the NPT sector.**

5. **Which regions and sectors of the economy will benefit most from NPT solutions unlocking CCUS? Which regions and sectors of the economy will continue to struggle to deploy CCUS? Should the government look to prioritise any particular regions or sectors of the economy for NPT?**

NPT value chain data

In the following section government is keen to better understand NPT value chains, including:

- Project data
- Costs
- Financing.

Project data

Government is keen to understand the potential funnel of NPT projects and cross-border CO_2 projects that exist, or have the potential to exist, and the deployment timelines for those projects. By providing this data, it will be possible for government to understand the potential demand for NPT solutions and cross-border transport of CO_2 volumes and when that demand arises.

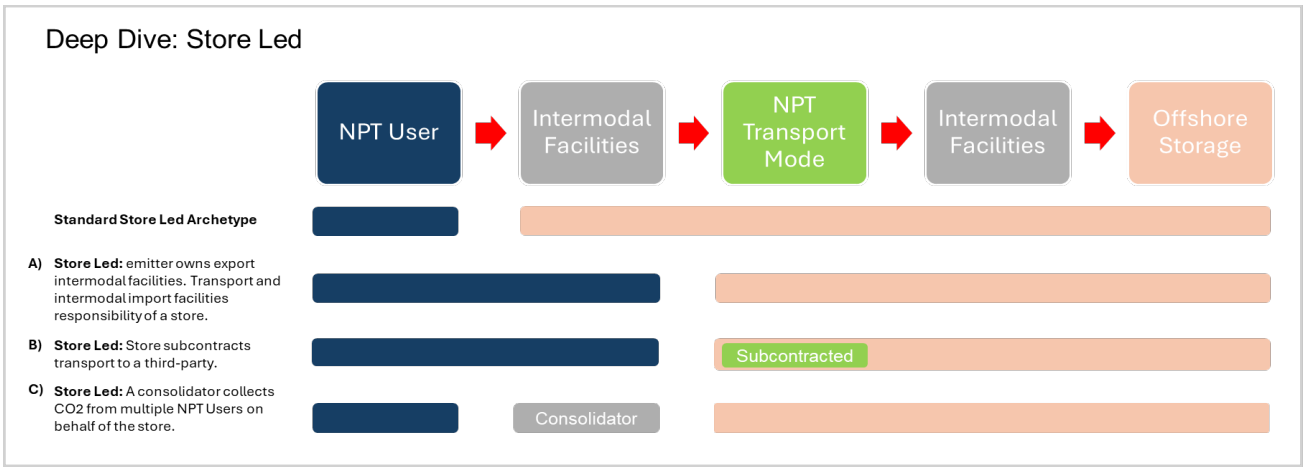
We are keen to see project development plans which highlight the rate determining step of project delivery. For example, if ship building takes 4-years then the NPT value chain cannot deploy quicker than 4-years.

Within the 'Vision for NPT' section, one of the key assumptions is that the NPT value chain is significantly more varied than a piped T&S value chain. This assumption has been arrived at after bilateral engagements with numerous potential projects. The following section is designed to obtain information about potential NPT projects with regard to their technical and commercial delivery. Government would like to understand the key technical elements within the NPT value chain and the variation between different NPT value chains, primarily in relation to infrastructure, equipment, and transport solutions.

Aside from technical variation, NPT value chains may vary in organisational and commercial terms. This may lead to the same technical NPT value chains being delivered differently organisationally and commercially. For piped user and T&SCo relationships, the two entities interact and transfer CO_2 ownership where their infrastructure meets. For NPT, with the potential for additional entities and service providers within the NPT value chain, the transfer of CO_2 ownership could become more complex.

As stated in the Vision for NPT section, there are several key archetypes that have been proposed to deliver NPT solutions by potential NPT sector participants. However, we understand that the simplified archetypes provided do not necessarily show the full extent of the complexity. Within each archetype, the way each element is owned and operated, as well as contractual payment flows, may vary. Government wants to understand the types of commercial arrangements that industry would set up to deliver NPT solutions, including the responsibilities that the different entities would have and the proposed contractual payment structures.

Figure 4: Deep Dive on Store Led Archetype



For instance, under a store led NPT archetype additional entities can be active within the NPT value chain, either as separate entities or subcontracted to another element of the NPT value chain. For example, in Figure 4, sub-option (b) demonstrates instances where the store would be the NPT service provider, despite subcontracting portions of the chain to third parties (such as transport in this instance). There could also be instances where the store contracts with a legally separate consolidator who collects the CO_2 from multiple NPT users on their behalf, Figure 4, sub-option (c).

There are also several different payment structures that could arise within an NPT value chain. In a full-chain piped T&S solution, the transfer of CO_2 and the contractual payment are transactional (i.e. that the capture project pays the T&SCo for the CO_2 it transfers). In a more complex NPT value chain, the transfer of CO_2 and contractual payment may be decoupled. For example, payments could flow from NPT user to each participant in the NPT value chain, or from NPT user to the next entity within the NPT value chain only (for the receiving entity to then pass payment to the next entity in the chain and so on).

Alongside this, government is seeking information on NPT value chain operations and their interaction with the rationale for the technical design of NPT value chains. Government is specifically seeking information in relation to journey times, loading/un-loading times, managing operational risk, economies of scale, and future growth.

Government is keen to understand the net emissions that are stored from the total captured volume by the NPT user. When compared with piped transportation, the NPT value chain is more likely to have emissions associated with the transport mode and fugitive CO_2 losses via leaks. It is important for government to understand the emissions that are associated with NPT value chains to ensure that the strategy for NPT delivery is accounted for within the overall approach to net zero.

6. **Please provide details of your potential NPT or cross-border solution. Please provide any information on the timing of the project through the initial phase and into the future, and the minimum viable project.**

7. **Please provide the technical and operational considerations for the major pieces of infrastructure, equipment, and transportation. Considerations may include information on the sizes and numbers of the above, CO_2 temperature and pressure conditions, loading/un-loading times and NPT journey lengths and duration. Please also provide the rationale for the technical and operational decisions.**

8. **For the above NPT chain, please provide information on the expected ownership/operatorship (e.g. leasing, owned, shared ownership, etc) and expected commercial/contractual arrangements. Please include when equipment is to be shared between multiple entities or for sole use.**

9. **Please provide information on the elements in the NPT chain with the longest lead times which could be rate determining in the deployment of the NPT chain. Please provide any information that you have on timelines for delivery of your NPT chain (e.g. project delivery Gantt charts).**

10. **What are the expected transport emissions and fugitive emissions expected within the NPT value chain? Please provide any information on how these emissions can be minimised.**

Costs

NPT is expected to have far greater technical variation than pipelines. Government is keen to understand the variations in costs that may arise from delivering NPT via a number of different NPT solutions. Although there is some understanding of the costs associated with NPT (e.g. the CCS deployment at dispersed industrial sites report (2020)[21] and the Global CCS Institute Report (2021)[22], it will be important to understand the breakdown of costs in relation to developmental expenditure (devex), capital expenditure (capex) and operational expenditure (opex). Potential further disaggregation is requested in relation to fixed opex and variable opex given that we expect NPT will have relatively higher opex costs than piped transportation, making NPT solutions more susceptible to fluctuations in energy/fuel costs.

For Track-1 clusters which utilise a piped T&S network, the T&S fees are paid to the T&SCo by the capture project, who will pass the T&S fees through from the various capture business models (BMs). Deployment of NPT projects during the market transition phase may mean governmental involvement could also be required, however there will be a need for industry to minimise the costs of NPT to ensure value for money. It will be very challenging to support the deployment of NPT within the market transition phases without having increased confidence in the potential range and variability of NPT costs. It is therefore imperative that sufficient confidence is gained through the data collected from this section.

11. **Could the costs associated with the full NPT value chain prevent investment and deployment of NPT solutions? If so, why?**

12. **If available, please provide any assessments that have been carried out to show an NPT solution is more economically viable than a piped solution for your NPT value chain, or that a piped solution is not technically viable.**

13. **Please provide evidence on the costs associated with NPT. Where possible disaggregated to the nodes delivered by NPT service providers (e.g. after capture plant and before delivery to the T&S network). Where possible, please provide information in relation to the devex, capex and opex of the operation. Please include the stage and Association for the Advancement of Cost Engineering (AACE) Cost Class at which this cost data has been generated, and please share the methodologies and assumptions that have been utilised to generate this data.**

[21] Department for Business, Energy & Industrial Strategy. 'CCS deployment at dispersed industrial sites' 2020
[22] Global Carbon Capture and Storage Institute. 'Technology Readiness and Costs of CCS' 2021

Below is a non-exhaustive list of cost categories (N.B. different archetypes will be made up of different combinations of these categories).

- Any onshore pipeline required to the send-out facility
- Liquefaction
- Buffer storage
- Loading/un-loading infrastructure
- Transport mode (road, rail, barge, ship)
- Pumping and heating.

To help us analyse cost data across various returns, it would be helpful (but not essential) to also provide:

- Undiscounted costs in 2024 prices
- Total/absolute costs (e.g. £m) for the different cost categories
- The annual throughput of CO_2
- A levelised (£/t) cost that includes devex, capex, fixed and variable opex

Financing

In the sections 'Rationale for vision' and 'Project data' we have outlined a non-exclusive selection of archetypes for the delivery of NPT. Government would be keen to understand the views of investors on the different delivery options, particularly in relation to the potential breaking of the full chain and the impact operational flexibility could have. It would be useful to have feedback on the key opportunities and financing risks of these proposals for all the entities within an NPT value chain.

14. **What are the main financing risks with a disaggregated chain, and how do these differ to the full chain piped approach?**

15. **What are the main financing risks associated with operational flexibility, and how do these differ to the full chain piped approach?**

16. **Which archetype do you think would be most attractive to investors? Why?**

17. **What types of financing are best placed to deliver NPT value chains?**

CCUS policy landscape

The current regulatory framework for T&S that has been developed for Track-1 clusters has been designed to support the initial deployment of a full-chain piped T&S network. As NPT is deployed into, and alongside piped T&S networks, changes to the current regulatory framework will be required.

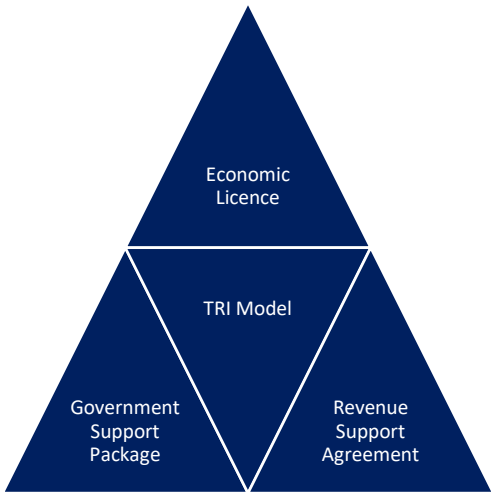
In the following section we will ask questions on potential changes to:

- The TRI Model
- The CCS Network Code
- Capture business models
- Selection process
- Cross-border CO_2
- Storage.

TRI Model

For Track-1, T&SCos are going to deploy utilising the TRI Model (see Figure 5), which combines the Economic Licence, Government Support Package and Revenue Support Agreement. The TRI Model was specifically designed for the market conditions associated with Track-1 deployment.

Figure 5: TRI Model



In Track-1, the T&SCos are economically licensed due to CO_2 pipelines having monopolistic characteristics. In the government response to the consultation on economic regulation[2020], it is stated that NPT does not share the same monopolistic characteristics as pipeline transportation, due to the potentially lower cost of entry for non-pipeline transportation and the ability for multiple assets to run in parallel suggests competitive regional markets should emerge. However, there remains the potential for market dominance, and were this to occur, this would be rationale for regulatory intervention. For example, some elements of the NPT value chain could have the potential to act as local monopolies, as it may not be feasible or realistic for a capture project located close to key hub infrastructure to access another key hub should fees increase. As such, we intend to keep this position under review should non-competitive behaviours emerge.

In the CCUS Vision[2], government stated a desire to transition from a market creation phase to a market transition phase, where we envisage an emerging commercial and competitive market. It is expected that NPT projects will be deployed during the market transition phase, where government's involvement within the CCUS markets is also expected to reduce. The level of government involvement will reduce as the risks that government was providing

protections against within the support agreements[23] also reduce and the market becomes self-sustaining. Government is keen to understand the ability of NPT value chains to manage the risks associated with connecting NPT users to existing CCUS clusters.

18. **Do you agree the rationale for economically licensing NPT service providers does not exist? Or do you believe that some elements in the NPT value chain may still require some kind of economic licencing?**

19. **Considering the expected deployment timelines for potential NPT projects within the CCUS programme, can the risks associated with the deployment of an NPT value chain be effectively managed commercially between the different actors within the NPT value chain? If not, please provide evidence and rationale why these risks cannot be managed commercially.**

CCS Network Code

The Energy Act (2023) enables government to grant economic licences to the UK's first CO_2 T&S network operators. The conditions of this licence will require licensees to maintain and administer a network code. The CCS Network Code (the 'Code') will set out the various commercial, operational, and technical arrangements which will apply between users and operators of T&S networks, together with governance arrangements. Its role is similar to that of the gas and electricity codes that govern arrangements between different actors in the gas and electricity markets respectively. It will therefore form a key component of the BM and regulatory regime currently being developed for the CCUS sector.

Government has worked closely with its advisors, regulatory partners and with industry to develop the Code. The immediate intention is to produce a form of the Code sufficient to support the deployment of the Track-1 clusters (the 'Initial Code'). Accordingly, government and industry are targeting simplicity where possible, seeking to include those elements required by early networks whilst deferring development of other features until more has been learned from initial operations. Nonetheless the Initial Code seeks to establish some of the architecture which may be required to meet future needs in anticipation of the potential for a greater diversity of users and T&S operations in the future.

For example, Section D of the Code distinguishes between the onshore transportation system and the offshore transportation and storage system, which is itself made up of the offshore pipeline infrastructure and the storage complex. Recognising that in future it is possible the onshore and offshore components of the T&S network may be separately licensed and under separate ownership and control, this section includes a placeholder for provisions which may subsequently be added dealing with the interface between the onshore and offshore systems. Relatedly, the design of the charging structure under Section H of the Code splits out onshore and offshore charges in recognition of the possibility that some users, including NPT users, may not utilise the onshore components in future.

20. **Please provide details on how you believe that the CCS Network Code[24] would need to be updated to facilitate NPT.**

[23] Support agreements in this context means: 1) the Revenue Support Agreement (RSA) and 2) the Government Support Package (GSP), providing: 1) demand side protections for the T&SCo and 2) protections against high-impact low probability risks that are not available commercial, respectively.
[24] CCS Network Code: updated Heads of Terms

Capture business models

In Track-1, the capture business models (BMs) (industrial carbon capture (ICC)[25] – including waste ICC[26], Dispatchable Power Agreement (DPA)[27] and hydrogen production BM)[28] were designed on the basis of captured CO_2 being transferred to the T&SCo at a piped delivery point. Additional BMs are also being developed to be available for T1x and Track-2 including the Power Bioenergy Carbon Capture and Storage (BECCS) BM and GGR BM[29].

During the market transition phases, capture BMs may be required to support the deployment of CCUS including NPT users. Therefore, the capture BMs are likely to be amended to accommodate NPT, or developed with NPT in mind for those capture BMs that are not deploying into Track-1 (e.g. power-BECCS and GGR). Some of these changes are likely to be inconsequential updates (e.g. updating definitions to remain relevant for NPT), other changes may be more significant relating to NPT solutions changing the initial policy rationale, or, that the relevance of a provision does not exist for an NPT user in the way that it does for a piped user.

We recognise that wider policy will also need to develop to enable NPT solutions, including the Low Carbon Hydrogen Standard[30] and GGR Standard and Methodologies.

21. **What changes to the Track-1 capture BMs do you envisage being required to make the capture BMs work for NPT solutions? What considerations would be required for power-BECCS and GGR BMs when developing for NPT? Please flag in your response which of the capture BMs you are answering in reference to.**

22. **How important should consistency in approach between capture BMs be? How important is consistency between NPT users and piped users within a specific BM (e.g. ICC via pipeline and ICC via NPT)?**

Future allocation processes

Another key area that needs to be considered is the assessment and selection of projects. The CCUS Vision set out the need for capture project funding allocation processes to transition towards more competition as the CCUS industry evolves.

In Track-1, the T&S networks were selected first in Phase-1, and then the piped users were selected in Phase-2. In Track 2, the T&S systems were selected and will initially choose their piped users for the 'anchor phase'. In both cases, the assessment of the T&S solution was conducted separately of the piped user. For NPT projects the situation is different as the merits of the NPT user is reliant on the merits of their NPT solution. Also, for NPT, the infrastructure and commercial arrangements are far more varied (as described above) which will require consideration within the design of the assessment and selection process.

[25] Department for Energy Security and Net Zero. 'Carbon Capture, Usage and Storage: Industrial Carbon Capture Business Models Update' 2023
[26] Department for Energy Security and Net Zero. 'Waste ICC: Standard Terms and Conditions' 2023
[27] Department for Business, Energy and Industrial Strategy. 'Carbon Capture, Usage and Storage: Dispatchable Power Agreement business model summary' 2022
[28] Department for Energy Security and Net Zero. 'Hydrogen production business model' 2023
[29] Department for Energy Security and Net Zero. 'Greenhouse Gas Removals: Update on the design of the Greenhouse Gas Removals (GGR) Business Model and Power Bioenergy with Carbon Capture and Storage (Power BECCS) Business Model' 2023
[30] Department for Energy Security and Net Zero. 'UK Low Carbon Hydrogen Standard' 2023

Consistent approaches are likely to be required to appropriately assess NPT users across capture BMs despite potentially different technical and commercial arrangements to ensure that comparisons are carried out on a like-for-like basis, especially as the CCUS programme moves towards increasingly competitive selection processes.

23. **If NPT solutions are assessed against pipeline solutions, would this raise any concerns?**

24. **If government is to allow all archetypes of NPT, how should an assessment of an NPT value chain be considered to allow comparisons?**

Cross-border CO_2

As outlined in the CCUS Vision[2], not only can the development of the UK's vast offshore CO_2 subsurface storage potential help to decarbonise key industrial sectors within the UK but it can also open up a new market for CO_2 storage services, bringing with it additional economic opportunities and an ability to support wider international decarbonisation efforts. Any transfer of CO_2 between the UK and a third-party nation would need to be compliant with our GHG emissions framework and future arrangements for carbon trading are under consideration.

The deployment of NPT networks within the UK, specifically those which are underpinned by CO_2 shipping and dedicated port facilities, are likely to be crucial for international cross-border CO_2 T&S networks which we envisage becoming operational during a market transition phase. Interoperable cross-border T&S networks, including potential cross-border pipelines, can facilitate CO_2 imports from international customers but could also improve UK store resilience by providing the option to temporarily export CO_2 for storage in third countries in the event of problems with a store's performance or with flows of CO_2 from domestic capture projects.

Cross-border CO_2 T&S networks are likely to play an essential role in helping industrial operators who capture CO_2 to decarbonise through access to CO_2 storage sites, offering European emitters competitive optionality and resilience in transport routes and in storage site selection. It is anticipated that the growth of this market will initially focus on the European region and most likely in Northwestern Europe, where the UK is well placed both geographically and geologically to play a leading role. Figure 6 provides a visualisation of how expansive these networks could be within the region.

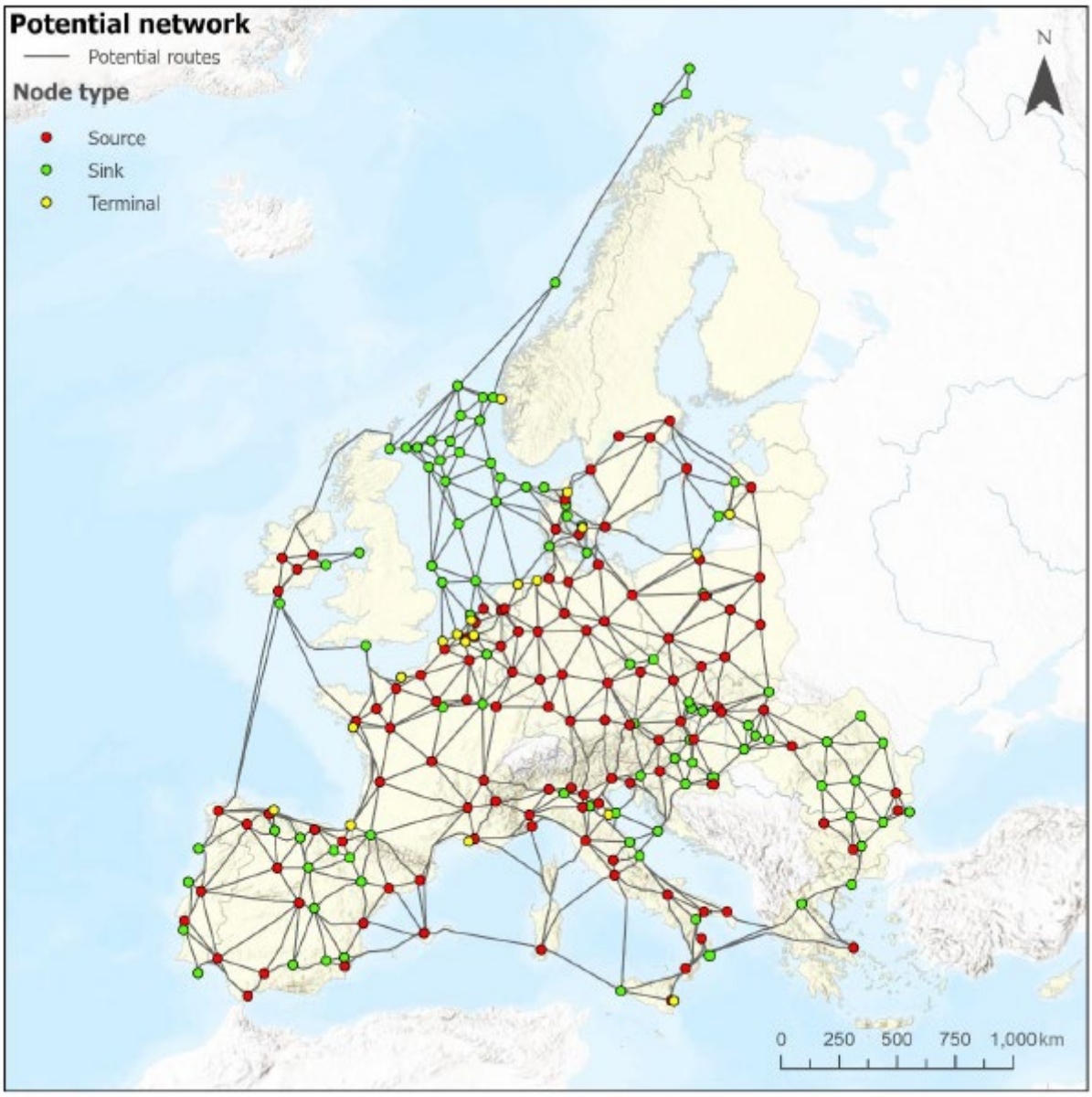
The European Union's Industrial Carbon Management Strategy[31] shares the view that there are clear opportunities to cooperate across borders with regards to CO_2 transport and storage. We are committed to exploring with the EU the conditions which are necessary to facilitate the cross-border movement of CO_2 to enable the permanent, secure, and environmentally safe geological storage of captured CO_2 and which lead to an overall reduction in emissions.

As the pace in which carbon capture is deployed across Europe increases, particularly in hard to abate industrial sectors, the demand for CO_2 T&S capacity is likely to grow significantly. For example, within the EU it has been proposed that the EU develops at least 50 $MtCO_2$ storage capacity by 2030[32]. By 2040, EU analysis suggests this demand for storage capacity will then grow to around 280 $MtCO_2$[31]. A number of networks are already in development within Europe, the first of which is likely to be operational this year[33].

[31] European Commission. 'Towards an ambitious Industrial Carbon Management for the EU' 2024
[32] European Commission. 'Net Zero Industry Act' 2023
[33] Northern Lights. 'What we do'

It is important that the UK has the right regulatory frameworks in place and a commercial landscape conducive to driving investment in CO_2 storage appraisal and in the necessary supporting infrastructure. In this context, we are interested to understand stakeholders' views on how the international CO_2 market might develop, what the necessary conditions should be in the UK to support this network growth, and what steps both government and industry should take to realise this market opportunity.

Figure 6: Network map of potential routes between emissions sources and CO_2 stores in Europe in 2040[34]



As outlined in the CCUS Vision[2] we are keen to understand what actions may be required from government to enable a new commercial framework to support international imports of CO_2. This includes considering how the T&S BM might need to change to account for imports and whether any changes would be needed to support potential CO_2 exports should this be desirable in future.

[34] Tumara D and others. 'Shaping the future CO_2 transport network for Europe' Joint Research Centre, EU Commission 2024

Our desired approach is to transition away from government support as the CCUS market evolves and as projects are deployed during the market transition phase. We expect government's involvement to reduce as the risks against which we are currently providing protections through support agreements[23] diminish.

We would like to understand if there are any unique features of a future commercial framework that can specifically support the development and growth of cross-border CO_2 T&S networks, underpinned by both NPT (i.e. CO_2 shipping) or fixed pipeline connections to international CO_2 markets.

Within this call for evidence, we have sought views on whether NPT service providers, or parts of the NPT chain, require economic licensing (see Question 18). We have also sought views on whether the risks associated with the deployment of an NPT value chain can be effectively managed commercially between the different actors within the NPT value chain (see Question 19).

The Energy Act 2023 provides for the Secretary of State, by regulations, to grant exemptions from the requirement to hold a CO_2 T&S licence. In 2023, we launched a call for evidence on 'Exemptions from the requirement to hold a CO_2 transport and storage licence'[35] to inform policy development. Initial analysis has revealed that some stakeholders expressed a view that there should be an exemption from the requirement to hold a CO_2 T&S economic licence for those T&SCos seeking to establish cross-border CO_2 T&S networks. This view has also been expressed through engagement with some prospective CO_2 T&S projects, who have also indicated that cross-border T&S networks could operate on a merchant basis. Government is currently considering responses received to the exemptions call for evidence and intends to consult on proposed terms of the exemptions regulations.

25. Please provide views on the potential vision for cross-border CO_2 T&S networks in the UK.

26. With regard to Questions 18 and 19 and in the context of establishing cross-border CO_2 T&S networks, do you have a view on:

i) whether an economic licensing framework for CO_2 T&S might need to evolve to accommodate cross-border T&S networks?

ii) how cross-border CO_2 volumes should be viewed within a commercial landscape currently designed for domestically captured CO_2 volumes?

iii) how service providers could manage the risks on a commercial basis that would allow for a merchant delivery model?

iv) whether there are any specific changes needed to the current suite of capture business models if CO_2 cross-border T&S networks are established?

For each answer please provide further explanation.

27. With regard to Question 20 do you think any changes will be required to the CCS Network Code to ensure cross-border CO_2 T&S networks can be established?

[35] Department for Energy Security and Net Zero. 'Exemptions from the requirement to hold a Carbon Dioxide Transport and Storage Licence: Call for Evidence' 2023

Storage

NPT's interaction with the stores is different from piped users. Whereas for piped users there is a fixed physical infrastructure link between piped users and stores which is typically reliant on relative proximity, NPT users and cross-border users have the potential to access any store that is enabled to receive their CO_2. This has the potential to make stores that do not have a local user base viable by creating the demand for that storage capacity. NPT and cross-border CO_2 T&S networks have the potential to be a catalyst for storage appraisal activity, and could potentially reduce the demand pressures for piped users and the linked stores.

The Norwegian Northern Lights CCS project[33] is reliant on shipping CO_2 from capture plants, suggesting that it should be technically feasible to operate a store that is solely reliant on an NPT user base. In the UK context, government is keen to understand any technical complexities that could arise from a store that is reliant solely on NPT users when compared with stores reliant on either solely piped users or a mixture of piped users and NPT users. Government is also keen to understand the potential changes to the risk profile for stores who would operate solely utilising NPT users.

Floating production, storage and offloading is a practice that is performed by the oil and gas industry for hydrocarbon extraction. A similar approach can potentially be utilised for CCUS, shipping CO_2 straight to the well head for subsequent CO_2 injection. There may be a number of potential beneficial reasons for doing this, including reducing journey distances, avoiding potentially constrained piped infrastructure, and avoiding charges that might be associated with shipping and the use of portside facilities.

28. **To what extent would enabling NPT users and cross-border users incentivise storage exploration and appraisal activity? If not, why doesn't it?**

29. **Could a store which is solely reliant on NPT users be viable? What are the technical challenges to operating a store solely reliant on NPT users? How would this operating model impact the risk profile of the project?**

30. **Please provide evidence for the potential viability of shipping CO_2 straight to the wellhead for CO_2 injection. Please expand on the risks/barriers and benefits of straight to wellhead shipping.**

Wider deployment considerations

In the following sections, this call for evidence is intended to gather further evidence on the wider deployment considerations that sit outside government's understanding of NPT value chains and the potential changes required within the CCUS policy landscape. This section is split into:

- Other regulatory controls (i.e. those outside the CCUS policy landscape),
- Delivery
- Further Comments.

Please utilise the questions in 'Further Comments' to flag any areas that have not been covered by specific areas within this call for evidence.

Other regulatory controls

The UK ETS allows for CCS deductions to be made for installations that are capturing and permanently storing CO_2 transported via pipeline. In June 2023, in 'Developing the UK Emissions Trading Scheme: Main Response'[36] it states that the ETS Authority will work with key regulatory partners to establish how NPT should best be integrated into the existing UK ETS framework. The intent and aim will be to enable UK ETS participants who use NPT for CO_2 storage purposes to make deductions from their ETS obligation. The next step agreed by the ETS Authority is to explore options for how NPT emissions can be handled through the inclusion of NPT via an appropriate regulatory model. A consultation on their approach will be published in due course. Government appreciates that any proposals within that consultation could influence the commercial arrangements that could be required along the NPT value chain.

Government is keen to better understand the potential regulatory or legislative provisions that could impede or delay the potential deployment of NPT. It would be useful to understand any particular concerns about current regulations around the operations of the different transportation modes (road, rail, barge and shipping), temporary storage, and any transport infrastructure regulations that may need amending/considering.

Government wants to better understand the planning permission and environmental permitting challenges that may arise across the NPT value chain. NPT may be a solution where pipelines through areas of high population density are not feasible, and therefore the potential regulatory impacts of this should be reviewed. In particular, government is keen to understand the potential health and safety challenges which could influence both NPT value chain planning and permitting.

Once operational, NPT value chains will need to comply with health and safety regulations as CO_2 is an asphyxiant and therefore a potentially hazardous substance in the event of a leakage event, either at intermodal facilities or in transit. This hazard may be particularly acute where the leak is catastrophic in nature resulting in large quantities of CO_2 being released potentially endangering human health and the environment. Government would be keen to understand if particular transportation modes or temporary storage vessels are considered to be riskier in relation to the potential for acute leakage events.

A further consideration is how cross-border CO_2 T&S networks will be regulated and permitted. Sir Patrick Vallance's Pro Innovation (Green Industries) Review acknowledges this, recommending that: '*The government should work with international partners to remove regulatory barriers to the cross-border movement of CO_2 to help ensure that the UK can maximise the economic potential of providing CO_2 transport and storage services*.'[37]

In our CCUS Vision[2], we have outlined some of the steps we are taking to address key regulatory barriers. This includes close engagement with European partners. As part of this call for evidence, we are also keen to improve our understanding from CCUS stakeholders of the key regulatory and permitting controls which must be considered to meet future deployment ambitions.

[36] Department for Energy Security and Net Zero and others. 'Developing the UK Emissions Trading Scheme: Main Response' 2023
[37] HM Treasury 'Pro-innovation Regulation of Technologies Review: Green Industries' 2023

31. **What regulations need to be considered or amended for NPT value chains to deploy (excluding those regulations which are covered in the CCUS policy landscape section)?**

32. **Do the current processes to comply with existing health and safety or environmental regulations or controls create barriers to NPT deployment when transporting CO_2 via road, rail, barge, ship, or processing CO_2 at intermodal facilities? If so, what are those barriers, and what would you suggest as an alternative?**

33. **Are there any specific changes to UK legislation, existing regulations or permitting processes which are necessary to support the development of cross-border CO_2 T&S networks?**

34. **What do you see as the biggest regulatory barriers to the growth of cross-border CO_2 T&S networks?**

Delivery

Government is keen to understand any technical limitations or infrastructure considerations which may hinder the delivery and operation of domestic NPT and cross-border networks.

The growth of interconnected and interoperable domestic NPT and cross-border CO_2 T&S networks require the right infrastructure to be in place, in the appropriate locations at the right time, and with sufficient alignment to other regional CO_2 T&S networks being developed. The CCSA and Zero Emissions Platform (ZEP) recently published a comprehensive paper looking specifically at how a European market for CO_2 transport by ship can be achieved[38]. The paper identifies a series of regulatory and policy steps that governments and policy makers should take to support the development of CO_2 transport by ship as a credible and necessary component of carbon capture and storage and industrial decarbonisation. Standardisation is a key focus, where consistent CO_2 specifications for shipping, liquefaction and onshore storage are recommended to ensure compatibility and consistency between CCUS projects across the region. The importance of CO_2 transport conditions (low pressure, medium pressure, and high pressure) is also highlighted, as is the need for international standard methodologies for CO_2 metering and calibration for mass-balance quantification.

Government is keen to understand the trade-offs between the CO_2 specification being set to allow NPT users and service providers to deliver CO_2 to any store (which could lead to higher operational costs across the NPT sector as higher technical standards could be required) vs being able to manage lower specification CO_2 operationally, potentially through blending with higher specification CO_2 in temporary storage.

To deliver resilience to clusters, the vision for NPT stated that this could be delivered through each cluster being NPT enabled. Within this, there is an assumption that it is technically and operationally feasible to become NPT enabled. However, government is keen to improve its understanding of any technical or operational limitations that would impede the development of NPT enabled clusters. There are also potential technical, access/capacity or operational limitations towards the use of fixed infrastructure that may exist (e.g. ports or railway line capacity) which could impede NPT solutions.

[38] Carbon Capture and Storage Association and others. 'Achieving a European market for CO_2 transport by ship' 2024

We note that NPT and temporary storage may be able to provide a network balancing effect to compliment the variable provision of CO_2 volumes to the T&S network from some piped users, by providing CO_2 volumes to the T&S network from the temporary storage during periods of lower network utilisation. We also recognise that there may be scope for a similar network balancing effect to be provided by piped users to increase network resilience, for example flexible or surge use of technologies such as direct air carbon capture and storage (DACCS).

Finally, delivery of NPT will be reliant on skilled workers delivering across the NPT value chain. The government response to the power CCUS call for evidence[39] highlighted a skills gap as a potential barrier to deployment. Government is keen to understand whether this skills gap also exists when considering NPT delivery. Developing a world leading NPT sector may also present opportunities for UK businesses, so it is useful to understand what areas the UK has a competitive advantage in when compared to other economies (outside of our vast storage potential).

35. **What are your views on the best approach to creating interoperable CCUS networks?**

36. **How should the UK design the standards and specifications for CO_2 T&S which offers network users sufficient flexibility in store choice but also provide sufficient protection to core T&S infrastructure? How can the UK ensure that its T&S network design does not impede access to an interconnected and interoperable European system?**

37. **Are there any technical or operational limitations that may exist that could be a barrier to domestic NPT or cross-border T&S network deployment? Please explain.**

38. **Is there any specific foundational infrastructure that must be operational in the UK before UK stores can offer storage to domestic NPT or international customers? If so, what should the UK prioritise?**

39. **Do you foresee any infrastructure innovations which could speed up the deployment of NPT and cross-border T&S networks and/or reduce associated costs? Please provide any supporting evidence.**

40. **What are your views on other flexible users of CCUS networks, e.g. flexible use of technologies such as DACCS? Do you foresee that NPT and buffer storage could be complimentary to operate alongside a flexible piped user (e.g. projects that could ramp up or ramp down CO_2 output, potentially including technologies such as DACCS).**

41. **Does the UK have the relevant skills and capability to deliver NPT? Does the UK have a competitive advantage to deliver certain elements of the NPT value chain?**

[39] Department for Energy Security and Net Zero. 'Call for evidence on the future policy framework for the delivery of power with Carbon Capture, Usage and Storage: Government response' 2023

Further comments

In the above sections questions have been asked to help answer some of the key areas where we are looking to improve our understanding. This section is for respondents to flag areas that have not been covered in the above sections.

42. **What other areas should government be considering for successful deployment of NPT?**

43. **Please respond with any other comments that are not contained in the above questions.**

Next steps

After the call for evidence closes on 16 July, government will look to assess the responses received and use this to inform policy development. Following the policy development we intend to consult on government's proposals for NPT deployment.

Glossary

Term	Description
Anchor phase	Initial projects connecting to the Transport and Storage (T&S) network.
BECCS	Bioenergy Carbon Capture and Storage
Buildout phase	Increasing the volume of captured, stored & abated CO_2, filling spare Transport and Storage (T&S) capacity and enabling future phases of store and network expansion enabling additional projects.
Call for evidence	An information-gathering exercise that seeks expertise from people, organisations and stakeholders with knowledge of a particular issue.
Capture BM	A business model designed to overcome the barriers to CCUS deployment in a range of sectors supporting the capture and permanent storage of CO_2.
Capture project	A facility with carbon capture installed for future utilisation or storage
Carbon budget	A carbon budget places a restriction on the total amount of greenhouse gases the UK can emit over a 5-year period. The UK is the first country to set legally binding carbon budgets.
CCC	Climate Change Committee
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Usage and Storage
CCUS cluster sequencing process	The process by which Carbon Capture, Usage and Storage (CCUS) industrial clusters are chosen, with two by the mid-2020s, and a further two clusters by 2030 as outlined in the Net Zero Strategy.
CCUS policy landscape	The policy instruments that have been developed, or will be developed, by UK Government, Devolved Administrations and relevant regulatory authorities to aide the deployment of CCUS across the UK.
CCUS value chain	Defined as the full range of activities, from start (e.g. capture) to finish (e.g. geological storage) which are required to provide the CCUS service.

Term	Description
CfD	A Contract for Difference is a private law contract between a low carbon electricity generator and the Low Carbon Contracts Company (LCCC), a government-owned company.
CO_2	Carbon dioxide
Consolidator	A consolidator refers to an entity that combines or aggregates multiple sources of CO_2 emissions.
Cross-border CO_2 T&S network	In this call for evidence, 'cross-border CO_2 T&S network' should be taken to refer to a network which facilitates the transport and storage of CO_2 and which traverses the territory of the UK and a third-party nation. Cross-border transport could be via NPT modes or pipeline.
Cross-border user	A capture project or intermediary which connects into a cross-border CO_2 transport and storage network.
DACCS	Direct Air Carbon Capture and Storage
FOAK	First-of-a-kind
GGR	Engineered Greenhouse Gas Removal technology, e.g. Bioenergy Carbon Capture and Storage (BECCS) or Direct Air Carbon Capture and Storage (DACCS)
ICC Business Model	Designed to incentivise the deployment of carbon capture technology for industrial users, the ICC business model is a common law contract, similar to a CfD, that provides the emitter with a payment per tonne of captured CO_2. Projects looking to retrofit grey hydrogen production will be eligible for support through this scheme.
Intermodal facility	The equipment required to allow for the successful transfer of CO_2 from one mode of transport to another.
Market creation phase	Getting to 20 to 30 megatonnes per annum (Mtpa) CO_2 by 2030.
Market transition phase	Following the market creation phase, the emergence of a commercial and competitive market that efficiently accelerates deployment whilst driving costs reduction and reducing the degree of government support needed.

Term	Description
Mutualisation	The rebalancing of User charges to address any shortfall in regulated allowed revenue arising from network underutilisation. Underutilisation may arise from uncontracted network capacity and/or different load factors of Users like peaking power stations. The final rebalanced price for those Users that were originally below the carbon futures price before rebalancing is capped at the carbon futures price.
Network Code	The Carbon Capture and Storage Network Code is a key component of the business model and regulatory regime for CO_2 transport and storage. It sets out the commercial, operational, and technical arrangements between T&S Co and users, together with governance arrangements.
Net zero	A legally binding target set out in the Climate Change Act to reduce UK greenhouse gas emissions by at least 100% of 1990 levels (net zero) by 2050.
Net Zero Strategy	This strategy, published in October 2021, sets out policies and proposals for decarbonising all sectors of the UK economy to meet our net zero target by 2050.
Node	Node is derived from telecommunication network nodes and used in this context to mean something capable of creating, receiving or transporting CO2.
NPT	Non-Pipeline Transport – the transport of CO_2 by road, rail, barge and ship.
NPT enabled	NPT enabled means that the cluster has the infrastructure (temporary storage, loading/unloading equipment and transport node infrastructure (e.g. jetty) to allow for transport of CO_2 to occur in and out of that cluster.
NPT service provider	An NPT service provider is defined here as the entity delivering those services that are required specifically to deliver an NPT solution. In other words, any entity which provides a service in the transfer of CO_2 from the NPT user following capture and before being delivered to the T&S network.
NPT solution	The delivery of an NPT value chain
NPT storage operator	A commercial operator storing CO_2 which has been transported to the storage site by road, rail, barge or ship.
NPT transport mode	Road, rail, barge and / or shipping.

Term	Description
NPT user	A capture project which connects to a non-pipeline transport CO_2 network
NPT value chain	NPT value chain is the full chain from CO_2 capture via NPT service provider to the geological store.
Phase-1	The cluster selection process used in Track-1.
Piped user	A capture project which connects to a CO_2 transport network via a pipeline.
Receiving facility	A location where CO_2 is unloaded from ships, barges, lorries, or railcars for injection into the piped T&S network.
Resilience	The ability to overcome a single point failure and continue to be operational.
Security of storage	The likelihood that any given unit of CO_2 will be stored.
Send-out facility	A location where CO_2 is loaded into ships, barges, lorries or railcars for onward transportation.
Storage operators	A company who is licensed by the relevant licensing authority to operate a CO_2 store.
Store	A defined volume area within a geological formation used for the geological storage of CO_2
T&SCo	A company licensed to provide transport and storage services.
T&S fees	T&S fees under the TRI model refer to the charges paid by network users (such as power and industrial emitters) for the transport and geological storage of the CO_2 they produce. It follows a user-pays economic regulation approach.
T&S network	A transport and storage network means infrastructure and facilities for: (a) the disposal of carbon dioxide by way of geological storage (or injection for the purposes of geological storage) at a relevant site, or (b) the transportation of carbon dioxide to a relevant site for the purpose of such disposal." (As defined in the Energy Act 2023 - section 1(9))

Term	Description
T&S network user	Transport and storage network user means a person who is, or seeks to be, a party to arrangements for carbon dioxide to be transported to a relevant site for the purpose of disposal by way of geological storage.
Track-1	The two industrial clusters targeting deployment by the mid-2020s.
Track-1 expansion (T1x)	Additional capture projects connecting to the Track-1 cluster.
Track-2	The two additional industrial clusters targeting deployment by 2030.
Transport & Storage Regulatory Investment (TRI) Model	The Regulated Asset Base (RAB) model through which the Track 1 T&S companies were incentivised to deploy CCUS. It combines the Economic Licence, Government Support Package and Revenue Support Agreement. The TRI Model was specifically designed for the market conditions associated with Track-1 deployment.
UK	United Kingdom of Great Britain and Northern Ireland
UK Emissions Trading Scheme (UK ETS)	The UK Emissions Trading Scheme (UK ETS) is the UK's cap-and-trade carbon pricing scheme. The UK ETS sets a cap on the total volume of greenhouse gases that sectors covered by the scheme (currently energy intensive industry, power generation, and aviation), can emit. Participating emitters purchase or receive emissions allowances at a price determined by the UK carbon market. The cap steadily decreases in line with the UK's Net Zero trajectory, providing a long-term signal to decarbonise.

This call for evidence is available from: www.gov.uk/government/calls-for-evidence/carbon-capture-usage-and-storage-ccus-non-pipeline-transport-and-cross-border-co2-networks

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DECARBONISATION

APPENDIX H: TERRESTRIAL SITE ALTERNATIVES REPORT - ADDENDUM

Cory Decarbonisation Project

September 2024

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1. PURPOSE OF THE DOCUMENT

1.1.1. Some Relevant Representations, notably that from the London Borough of Bexley ('LBB') (RR-124) and the Greater London Authority ('GLA') (RR-077) have challenged the consideration of reasonable alternative sites for the proposed Carbon Capture Facility ('CCF'). The criticism is principally that the East and North Zones should have been more fully explored so as to avoid development on the Site of Importance for Nature Conservation ('SINC'), Local Nature Reserve and Metropolitan Open Land ('MOL') designations.

1.1.2. For completeness, the West Zone has also been reviewed within this document.

1.1.3. This addendum extends the consideration of the alternative zones undertaken in the **Terrestrial Site Alternatives Report ('TSAR') (APP-125)**, confirming that all reasonable alternatives have been considered and that the Site chosen for the CCF remains the appropriate, and the only, location that delivers the Objectives of the Proposed Scheme.

2. THE SITE ASSESSMENT PROCESS

2.1.1. The essential requirements of any location to be considered a reasonable alternative, as set out in **Section 2.2** of the **TSAR (APP-125)** remain applicable to the consideration of these additional blocks of land. To this end, as confirmed by NPS EN-1 (paragraph 4.3.22) any alternative that cannot meet the objectives of the Proposed Scheme, need not be considered.

2.1.2. Consequently, and for consistency, this addendum applies the Optioneering Principles as set out in **Section 2** of the **TSAR (APP-125)** to the additional blocks of land in the alternative development zones. For completeness, and to enable this document to be read as a standalone report, they are repeated below:

- **Principle 1**: Seek to avoid or minimise adverse impact to locally important biodiversity sites.
- **Principle 2**: Seek to avoid or minimise adverse impact to protected species.
- **Principle 3**: Seek to avoid or minimise the level of adverse impact on existing businesses/third party landowners.
- **Principle 4**: Seek to avoid or minimise land take within the MOL Accessible Open Land and impacts on Public Rights of Way ('PRoW').
- **Principle 5**: Ease of required connections with the Riverside Campus and the Proposed Jetty.
- **Principle 6**: Seek to minimise engineering complexity and consequent cost.

3. THE ADDITIONAL LAND BLOCKS

3.1.1. As stated in the **TSAR (APP-125)** the Riverside Campus is located in an urban area and site options for the proposed development are not extensive. The zone to the north comprises the River Thames and is limited by existing, safeguarded and operational infrastructure and the England Coast Path (FP3/NCN1). The zone to the east comprises Belvedere Industrial Estate and is limited by existing, operational (including large scale) business. The zone to the west is limited by development constraining policy allocations, PRoW and operational infrastructure associated with the Crossness Sewage Treatment Works (STW). The zone to the south is also substantially limited by development constraining policy allocations and a PRoW, although it does benefit from land with development-promoting allocation and has previously been assessed as the most suitable location for the Proposed Scheme.

3.1.2. There is no unconstrained choice; however, to address the queries raised by the LBB (RR-124), additional land blocks are considered below.

3.1.3. These blocks are illustrated on the drawing annexed to this report and discussed in detail below.

4. DEVELOPMENT ZONES ASSESSMENT

4.1. NORTH ZONE

OVERVIEW

4.1.1. The **TSAR (APP-125)** considered only one site on the Thames. This was because there is no other suitably sized area available for development in proximity to the Riverside Campus as the surrounding area is occupied by or subject to operational requirements, navigational restrictions, safeguarded wharves and associated activities. The location of the existing Middleton Jetty to the west and the ongoing operations of both this and the Thames Water Jetty prohibit the development of a larger zone.

4.1.2. However, LBB (RR-124, page 19) state that the Port of London Authority has highlighted this location in its Thames Tidal Masterplan as an opportunity for the decarbonisation project to bring the Middleton Jetty (disused) into use and suggested that a more detailed consideration of this site be undertaken. An extended block of land, North Zone 1, has therefore been considered to ensure the robustness of the Applicant's decision making.

4.1.3. As explained at **Section 2.4** and **Section 2.6** of the **TSAR (APP-125)** evolution in site design confirmed that approximately 8ha would be required for the CCF. North Zone 1 therefore extends the land parcel originally proposed in the TSAR, to consider a larger area extending to 8ha, incorporating both the River Thames and the Belvedere Industrial Estate (a plot currently occupied by the Iron Mountain Records Storage Facility). It is split by the England Coast Path (FP3/NCN1) and FP4.

SUMMARY OF ASSESSMENT

4.1.4. Locating the CCF in North Zone 1, partially within the River Thames and within land allocated as Strategic Industrial Location ('SIL'), means that it would avoid direct adverse impacts on the Erith Marshes SINC, and the Crossness LNR. However, it would be located within and consequently would have the potential for substantial adverse impacts on, the River Thames and Tidal Tributaries (SINC) due to the need for substantial engineering works and built form to create a development platform for the CCF.

4.1.5. Development of the CCF within North Zone 1 would avoid impact on the MOL. However, the Flue Gas Supply Ductwork from Riverside 2 would need to be located on the western and southern boundaries of the Riverside Campus, with consequent compromise on this designation.

4.1.6. The development would be split by, and wholly visible from, the England Coast Path (FP3/NCN1) and FP4. There would need to be extensive Above Ground Pipelines traversing these PRoW at height to connect the CCF to the Riverside Campus to continue to allow access for vehicles travelling to/ from the existing Riverside Campus.

These PRoW may also need to be permanently diverted to provide for safe and secure operations.

4.1.7. Development of the CCF within North Zone 1 would not form a single homogenous area with the Riverside Campus, as it would be split by the England Coast Path (FP3/NCN1) and FP4 that runs to the east of Riverside 1. Substantial ground works would be required to create a new land parcel in the River Thames and the associated financial requirements and environmental consequences of land reclamation would be substantial. Further, it lies within the preferred area for the Proposed Jetty and would likely prevent the construction of this important element of the Proposed Scheme. There would also be navigational safety concerns with locating this facility immediately adjacent to the operational Middleton Jetty.

4.1.8. As such, North Zone 1 performs poorly against the Optioneering Principles and would therefore fail to meet the Principles and Objectives of the Proposed Scheme. It has therefore been dismissed as a reasonable alternative.

Table 4-1 – North Zone 1 Optioneering Principles Assessment

Optioneering Principle	Analysis
1. Seek to avoid or minimise adverse impact to locally important biodiversity sites.	This zone would result in a direct loss to the River Thames and Tidal Tributaries SINC. Due to the creation of new land in the River Thames, this zone is unable to avoid additional infrastructure in a non-encroachment area (the River Thames). The loss of intertidal habitat would require offsite mitigation. Development of this site would also result in direct impacts to the adjoining Belvedere Dykes SINC, which comprises reedbed, wet woodland and grassland habitats, and has importance at the County level (the Thames Marshes Corridor). No direct impacts to Crossness LNR and Erith Marshes SINC are likely in this zone.
2. Seek to avoid or minimise adverse impact to protected species.	This zone would result in loss of the River Thames and Tidal Tributaries SINC intertidal habitat which is of importance to wintering bird species, and loss of the Belvedere Power Station Jetty (disused) which is recognised to have some heritage and bird roosting value. There is potential for indirect impacts to the Swanscombe Marine Conservation (MCZ) approximately 11km east and downstream as part of the construction phase.

Optioneering Principle	Analysis
	Development and construction activities at this site could also result in impacts to the Belvedere Dykes SINC in particular, reedbed habitat of principal importance (HPI) and water vole. However, as this zone involves reclaimed land in the River Thames, it would not result in direct impacts to, or loss of Crossness LNR habitat or species.
3. Seek to avoid or minimise the level of adverse impact on existing businesses/third party landowners.	With regard to the area north of the England Coast Path (FP3/NCN1), as noted in the TSAR, the Belvedere Power Station Jetty (disused) has been available on the open market for at least eight years. It is understood that the jetty has not been used intensively since the now demolished Belvedere Power Station closed in the 1980s. The associated jetty has been maintained and is commercial in its historical use but does not have riparian land attached to it. Further, it is not a safeguarded wharf because it has little or no prospect of returning to intensive commercial use. The riverbed to the high watermark is owned by the Port of London Authority, a statutory undertaker, but this zone is south of the navigational channel of the River Thames and is burdened by the Belvedere Power Station Jetty (disused) that is owned by Aviva. The Proposed Scheme would return this zone to active use after more than 30 years. The part of the site, north of the England Coast Path (FP3/NCN1), does not disrupt any business activities, other than a section of the Belvedere Power Station Jetty (disused) may require removal over the England Coast Path (FP3/NCN1), which would be needed in the future irrespective of the Proposed Scheme. Given the section of riverbed is currently burdened by this jetty and outside the navigational channel, it is considered that this zone could be acquired without serious detriment to the continuation of the PLA's statutory undertaking. However, as noted in the **TSAR (APP-125)** at paragraph 3.2.1), the northern part of this site only extends to approximately 2.8ha and alone would not be big enough to

Optioneering Principle	Analysis
	meet the operational requirements of the Proposed Scheme. Extending this site area to the south, would encompass the Iron Mountain Records Storage Facility. The Iron Mountain Records Storage Facility comprises a large modern building, operated over two storeys with multi-level racking systems, it is understood to employ approximately 55 staff. It has been designed and operated as a strategic and specialist premises providing clients from government agencies and London's leading finance and law institutions with a confidential storage solution. Acquisition and consequent relocation of this large, fully operational site would be expected to attract a high level of disturbance, and an adverse impact on local employment. The footprint of the built site is also significantly larger than the premises affected by the selected development zone for the Proposed Scheme, and thus appears to be a larger operation to relocate, likely at greater cost.
4. Seek to avoid or minimise land take within the MOL, Accessible Open Land, and impact on PRoW.	The Flue Gas Supply Ductwork from Riverside 2 would compromise MOL, no direct impacts to the Accessible Open Land ('AOL'). The England Coast Path (FP3/NCN1) and FP4 would be significantly affected as described in connection with Principles 5 and 6 below.
5. Ease of required connections with the Riverside Campus and the Proposed Jetty.	Ease of connections between Riverside 1 and Riverside 2 and the CCF for routing of flue gas: • Flue Gas Supply Ductwork from Riverside 1 to North Zone 1 would be relatively short, however, would require a substantial crossing over FP4. • Flue Gas Supply Ductwork from Riverside 2 would require routing around the western and southern boundaries of the Riverside Campus before crossing FP4. Ease of connections between Riverside 1 and Riverside 2 and the CCF for utilities provision (steam, condensate return, power supply):

Optioneering Principle	Analysis
	• The utilities corridor would need to cross the PRoW (the England Coast Path (FP3/NCN1) and FP4). Ease of connections to the location of the Proposed Jetty: • The location of the new land parcel would be in line with the Proposed Jetty location, impacting its design and potentially compromising delivery. If there is space within the River Thames to accommodate the Proposed Jetty on the riverfront of the CCF then piping would be minimal.
6. Seek to minimise engineering complexity and consequent cost.	Site access to North Zone 1 could be via the existing Iron Mountain Records Storage Facility access road spur from Norman Road. However, providing access across the England Coast Path (FP3/NCN1) to the part of the site in the River Thames, or across FP4 to the east of Riverside 1, could present technical challenges as the PRoW would need to be traversed or diverted (potentially permanently). In terms of laydown areas, the Applicant owned (Borax) sites could potentially be utilised for the construction laydown area, moving equipment between the two via Norman Road. The parts of the site within the River Thames, would require substantial and expensive additional ground works to create the new land parcel. The creation of the required land parcel would place significant restrictions on the operation of Middleton Jetty. It is likely current operations would need to be restricted to the western arm of the Middleton Jetty. Additionally, the creation of the parcel would require extensive dredging and piling works in the River Thames. With regard to the Iron Mountain Records Storage Facility part of the Zone, there would be no unique challenges with respect to ground conditions in comparison to the surrounding sites. The existing Iron Mountain Records Storage Facility, incorporating multi-level racking, would need to be demolished prior to commencement of construction. The existing warehouse foundations are unlikely to be suitable for reuse, thus would require replacement. The presence of the England Coast Path (FP3/NCN1) and FP4 which transect the zone would mean that this option

Optioneering Principle	Analysis
	could not present a single homogenous site without either significant disruptive impacts to these PRoW or potential diversion (potentially permanently).

5. EAST ZONE

5.1. OVERVIEW

5.1.1. The **TSAR (APP-125)** considered just one block of land in the East Zone that was considered to be representative of this zone as a whole (existing, operational light industrial land uses and associated supporting infrastructure). Any other site options in this area would be further away from the Riverside Campus and be likely to experience greater challenges. LBB has requested (RR-124, page 19) that additional consideration be given to wider locations within the East Zone.

5.1.2. Consequently, this section considers three additional blocks of land within the East Zone. All are located within the Belvedere Industrial Estate which is allocated as SIL. LBB has confirmed that development of the CCF within land allocated as SIL would be considered policy compliant.

5.2. SUMMARY OF ASSESSMENT

5.2.1. Development of any of the East Zones 1-3 would likely avoid direct adverse impacts on the Erith Marshes SINC, the Crossness LNR and MOL. However, there would be potential for direct impacts on parts of the Belvedere Dykes SINC which comprises a series of drainage ditches bounding each of the blocks.

5.2.2. Development of the CCF within East Zones 1-3 would avoid impact on the MOL. However, the Flue Gas Supply Ductwork from Riverside 2 would need to be located on the western and southern boundaries of the Riverside Campus, with consequent compromise on this designation.

5.2.3. The footprints for East Zone 1 and East Zone 2 comprise the ASDA CDC and ASDA XDC regional distribution facilities respectively (East Zone 2, also includes a smaller warehouse facility which is understood to be currently vacant). These are substantial operating businesses, estimated to support a total of 800 employees.

5.2.4. They are understood to have separate management teams but work in tandem as one facility with one active during the day and one during the night. The direct, adverse impact resulting from removal or relocation of these businesses would be substantial. It is understood that these distribution centres serve a large number of stores across the south and south-east London region.

5.2.5. East Zone 3 comprises Amazon UK DBR1 (estimated 55 employees), the MPS Belvedere Storage Facility (estimated 65 employees) and further infrastructure assumed to be associated with the Lidl Warehouse/Belvedere Regional Distribution Centre to the north.

5.2.6. All these facilities operate complex and sophisticated logistics systems internally, designed to ensure that products can be stored, accessed and distributed efficiently and at short notice. These are substantial operating businesses, and the direct, adverse impacts resulting from the removal or relocation of these businesses would be significant and contribute to the potential for wider socio-economic impacts.

5.2.7. The Belvedere Industrial Area is a well-developed and busy area with many operational businesses. Construction within East Zones 1 and 2 can be supported using laydown facilities on the Borax land parcels, but this would not be readily accessible to East Zone 3 and there are no other appropriate areas available. Construction of the CCF would likely be hampered by the practicalities of needing to enable surrounding businesses to continue to operate throughout the construction phase.

5.2.8. The Applicant has found no options within the East Zone that would provide a site option of 8 ha without substantial, direct and adverse impacts on existing business. Further, the time that would be required to relocate these complex businesses would not enable the CCF to be brought forward in a timely manner responding to the urgency for decarbonisation.

5.2.9. None of these additional East Zone blocks would provide a single homogeneous area with the Riverside Campus as they would be separated by Norman Road, the access road leading off Norman Road (which also serves the Iron Mountain Records Storage Facility) and FP4, which runs to the east of the Riverside Campus. There would be no way of providing safe movement of people and vehicles between the CCF and the Riverside Campus without causing significant disruption to Norman Road and the Iron Mountain Records Storage Facility access road and FP4. In the event that a safe and secure route was found, there would need to be extensive above ground pipework at height across the access roads and PRoW. FP242 may also be affected if East Zone 3 was progressed for the CCF.

5.2.10. The additional distance further south, from the original East Zone and the Riverside Campus, would also substantially extend the length of the required connections (i.e. piping and ducting) between the CCF and Riverside 1 and 2 and the Proposed Jetty. This would increase the costs associated with the Proposed Scheme. East Zone 3 would be particularly unsuitable due to the extended physical separation of the site and the need to negotiate pipework around occupiers of the adjacent blocks of land.

5.2.11. Each of the additional East Zone locations therefore performs poorly against the Optioneering Principles and would fail to meet the Principles and Objectives of the Proposed Scheme. These sites do not therefore provide a reasonable alternative to the site proposed.

Table 5-1 – East Zone 1, 2 & 3 Optioneering Principles Assessment

Optioneering Principle	Analysis
1. Seek to avoid or minimise adverse impact to locally important biodiversity sites.	These sites are separated by drainage ditches forming part of the Belvedere Dykes SINC and so development of any of these options may result in direct impacts to this SINC and the habitats and species it may support, including reedbed habitat of principal importance (HPI) and water vole. No direct impacts to Crossness LNR and Erith Marshes SINC are likely in this zone.
2. Seek to avoid or minimise adverse impact to protected species.	This zone may result in direct impacts to the European protected species, water vole, which are known to be present within the Belvedere Dykes SINC. This zone would not result in direct impacts to, or loss of Crossness LNR and Erith Marshes SINC and the habitats or species they support.
3. Seek to avoid or minimise the level of adverse impact on existing businesses/third party landowners.	East Zone 1 comprises the ASDA CDC distribution facility and East Zone 2 comprises the ASDA XDC distribution facility. These are substantial operating businesses, estimated to support approximately 800 employees. East Zone 3 comprises the Amazon UK DBR1 (approximately 55 employees), the MPS Belvedere Storage Facility (approximately 65 employees) and other facilities associated with Lidl's regional distribution centre to the north. The acquisition and relocation of the businesses which could be affected by each of these options, within their large and fully developed sites, (particularly given the scale of the businesses and the greater number of affected businesses in East Zone 3) would be expected to attract a high level of disturbance, opposition and incur significant cost and time delays to the Proposed Scheme. It would lead to the most acute impact on employment in the Development Zones considered and even if relocation was successful, impacts could be permanent.

Optioneering Principle	Analysis
	As the ASDA CDC and ASDA XDC regional distribution facilities serve wider stores in the south and south-east of London region, the removal or relocation of either of these businesses could also result in wider socio-economic considerations.
4. Seek to avoid or minimise land take within the MOL, Accessible Open Land, and impact on PRoW.	The Flue Gas Supply Ductwork from Riverside 2 would compromise MOL, no direct impacts to the AOL. FP4 and FP242 could be affected as described in connection with Principles 5 and 6 below.
5. Ease of required connections with the Riverside Campus and the Proposed Jetty.	Ease of connections between Riverside 1 and Riverside 2 and the CCF for routing of Flue Gas Supply Ductwork: • Flue Gas Supply Ductwork from Riverside 1 to East Zone 1 would be relatively short but would require a substantial above ground crossing over FP4 at height. The length of the flue gas ducting from Riverside 2 would be substantially longer, requiring routing around the western and southern boundaries of the Riverside campus before crossing FP4. • Flue Gas Supply Ductwork from Riverside 1 and Riverside 2 to East Zone 2 would be substantially longer. It would need to cross Norman Road and the service road, which spurs from Norman Road leading to Iron Mountain Records Storage Facility, which would have significant impacts. • Delivering the necessary connections to East Zone 3 would be particularly challenging due to the extended physical separation of East Zone 3 from Riverside 1 and Riverside 2 and the need to negotiate large scale pipework around the occupiers of adjoining blocks of land. Ease of connections between Riverside 1 and Riverside 2 and the CCF for utilities provision (steam, condensate return, power supply):

Optioneering Principle	Analysis
	• For East Zone 1, the utilities corridor would be slightly longer than for the preferred site but would have the additional complexity of needing to cross Norman Road and the service road leading to Iron Mountain Records Storage Facility. • For East Zone 2, the utilities corridor would be substantially longer than for the preferred site and would have the additional complexity of needing to cross Norman Road and the service road leading to Iron Mountain Records Storage Facility. • For East Zone 3, the utilities corridor would be significantly longer than for East Zones 1 and 2. It would need to cross Norman Road and the service road leading to Iron Mountain Records Storage Facility and would also need to negotiate the occupiers of the adjoining blocks of land. Ease of connections to the location of the Proposed Jetty: • If East Zone 1 were progressed, the Above Ground Pipelines would need to pass through the Iron Mountain Records Storage Facility site and cross the England Coast Path (FP3/NCN1). It may be possible for the Above Ground Pipelines to pass around the existing Iron Mountain Records Storage Facility, but as the Above Ground Pipelines is anticipated to be substantial it retains potential to have significant impacts on operations at Iron Mountain Records Storage Facility and the England Coast Path (FP3/NCN1). • If East Zone 2 were progressed, the Above Ground Pipelines would need to pass through East Zone 1, the Iron Mountain site and then cross the England Coast Path, as per East Zone 1 • If East Zone 3 were progressed, the Above Ground Pipework would need to pass to the east/west of the Lidl site and would likely result in direct impacts to the Belvedere Dykes SINC. Both routes would need

Optioneering Principle	Analysis
	to cross FP4, and the eastern option could also affect the use and amenity of FP242.
6. Seek to minimise engineering complexity and consequent cost.	Site access for East Zone 1 and East Zone 2 could be via the existing access road spur from Norman Road. Site access for East Zone 3 would likely need to be via Crabtree Manorway North. In terms of laydown areas, for East Zones 1 and 2, the Applicant owned (Borax) sites could potentially be utilised for the construction laydown area, moving equipment between the two via Norman Road. For East Zone 3, locating the laydown areas on the Applicant owned land to the south of the Riverside Campus would pose logistics challenges for the safe movement of personnel and equipment as there is no direct link to East Zone 3 from the Borax sites. There are no unique challenges with respect to ground conditions in comparison to the surrounding sites. The existing warehouses/offices on each of the sites would need to be demolished prior to commencement of construction. The existing warehouse foundations are unlikely to be suitable for reuse, thus would require replacement. These blocks would not provide a homogenous site and the development of any of them would result in significant disruptive impacts to Norman Road and the adjoining service road as well as FP4 and FP242.

6. WEST ZONE

6.1. OVERVIEW

6.1.1. The **TSAR (APP-125)** considered just one block of land in the West Zone, because any other site options further west would breach further into the operational area of Crossness STW, which is essential infrastructure.

6.1.2. LBB has requested that additional sites in the North and East Zones be considered and so, for completeness, three additional blocks in the West Zone have also been assessed.

6.1.3. West Zone 1 is located entirely within the operational boundary of Crossness STW, which forms part of Thames Water's statutory undertaking. It is understood to be Europe's second biggest waste treatment plant, serving approximately 2 million customers and has recently been upgraded to increase the capacity of the site by 44% following a £220 million investment[1].

6.1.4. The STW is designated as a Strategic Waste Management Site (SP12 Sustainable waste management) and a SIL in the Bexley Local Plan and is understood to support approximately 52 employees. West Zone 1 is also bound to the north by the Erith Marshes SINC, and by the Erith Marshes SINC and Crossness LNR to the east.

6.1.5. West Zone 2 is located partly within the operational land of the STW and partly within the Erith Marshes SINC and Crossness LNR. The area outside the STW is also designated as MOL, forms part of the Southeast Green Chain and adjoins an area of Functional Floodplain (Flood Zone 3b).

6.1.6. West Zone 3 is within the Erith Marshes SINC, the Crossness LNR, MOL, forms part of the Southeast London Green Chain and forms part of the Functional Floodplain (Flood Zone 3b).

6.1.7. FP2 runs in a north-south direction from the river embankment down through the MOL, down the eastern edge of West Zone 2 and western edge of West Zone 3.

6.2. SUMMARY OF ASSESSMENT

6.2.1. Land within West Zone 1 comprises existing operational plant and infrastructure associated with the STW which is required by Thames Water to fulfil its statutory obligations. Policy SP12 of the Bexley Local Plan notes that Crossness STW comprises a regionally significant waste management site and expressly states that Strategic Waste Management Sites should be safeguarded for waste uses.

6.2.2. The feasibility of relocating the existing operational infrastructure located within West Zone 1 has not been determined but given the space constraints in the wider Crossness

[1] Crossness Sewage Treatment Works Upgrade - Water Technology (water-technology.net)

STW, it is considered highly unlikely that it could be relocated within the boundaries of the existing Crossness STW and a substantial network solution, with very significant cost and time implications, would be required to progress this option.

6.2.3. P**aragraph 3.4.5 of the TSAR (APP-125)** notes that this issue was explained further in relation to the original West Zone, in the **Jetty Site Alternative Report (APP-126)**, and this option was thought highly likely to be considered a serious detriment to the statutory undertaker. Therefore, the development of West Zone 1, could have significant adverse impacts on an existing business which is also a statutory undertaker.

6.2.4. West Zone 2 is partially located within the operational boundaries of the Crossness STW. Whilst the land currently appears undeveloped, it is subject to the same safeguards under policy SP12 as West Zone 1. West Zone 2 also partially utilises land designated as Erith Marshes SINC and the Crossness LNR, the MOL and Southeast London Green Chain. Consequently, development of the CCF within this block would result in direct adverse impacts and losses to these designations. Further, it would result in the direct loss of the Crossness Nature Reserve Members' Area, considered to be a particularly sensitive area of the Crossness LNR. Development in this location would also have a direct impact on FP2.

6.2.5. Development within West Zone 3 would result in substantial direct adverse impacts and losses to the Erith Marshes SINC, Crossness LNR, MOL and severances to the Southeast London Green Chain and FP2. West Zone 3 is also within the Functional Floodplain (Flood Zone 3b). It consists of various water bodies and ditches and provides valuable habitat of importance to a variety of protected species. Development of this block of land would result in adverse ecological and environmental impacts and would pose engineering challenges with respect to ground conditions and drainage.

6.2.6. Development within either West Zone 2 or West Zone 3 would also result in a significant adverse impact on FP2 as the CCF would be highly visible from the PRoW and may require its diversion. Impact to the MOL at either of these locations would be substantial, and result in blocking views (and potentially routes) through to the River Thames.

6.2.7. None of these additional West Zone blocks would provide a single homogenous site with the Riverside Campus. In the event that a safe and secure route could be found for the connecting infrastructure, significant and extensive Above Ground Pipelines would be required to cross the SINC, LNR, MOL and AOL for all three options. This would certainly result in direct adverse impacts on these designations and substantially increase the costs associated with the Proposed Scheme. As with the original West Zone, considered in the **TSAR (APP-125)**, connectivity to the Proposed Jetty would also unlikely be achievable.

6.2.8. As a result of the issues identified, it is considered that each of the additional West Zone options perform poorly against the Optioneering Principles and would therefore fail to meet the Principles and Objectives of the Proposed Scheme. These sites are not therefore considered a reasonable alternative.

Table 6-1 – West 1, 2 & 3 Optioneering Principles Assessment

Optioneering Principle	Analysis
1. Seek to avoid or minimise adverse impact to locally important biodiversity sites.	Placing the built form of the CCF in West Zone 1 would avoid the Erith Marshes SINC and Crossness LNR. However, provision of pipework, utilities and access would have a direct adverse effect on these designations. The development of West Zone 2 and West Zone 3 would result in direct losses to Erith Marshes SINC and Crossness LNR, which may result in direct impacts or loss of its habitats, including loss of reedbed, coastal floodplain grazing marsh and a large waterbody (pond).
2. Seek to avoid or minimise adverse impact to protected species.	Placing the built form of the CCF in West Zone 1 would avoid the Erith Marshes SINC, protecting the species it accommodates. However, provision of above ground pipework, utilities and access could have a direct adverse effect. Development of West Zone 2 and West Zone 3 would result in direct impacts and losses to Crossness LNR and Erith Marshes SINC and the habitats and species they support. In particular, development would result in the loss, or culverting, of ponds and ditches, resulting in direct impacts to water vole, a European protected species which are known to be present. These ditches may also have the potential to provide important habitat for European eel which is also a European protected species.
3. Seek to avoid or minimise the level of adverse impact on existing businesses/third party landowners.	Crossness STW is a regionally significant waste management site and Policy SP12 expressly states that Strategic Waste Management Sites should be safeguarded for waste uses. West Zones 1 and 2 are both within the operational boundaries of the Crossness STW.

Optioneering Principle	Analysis
	West Zone 1 accommodates a range of existing plant and infrastructure required by Thames Water to fulfil its statutory undertaking. The feasibility of relocating the existing operational infrastructure has not been determined, but given the space constraints in the wider STW, it is considered highly unlikely that it could be relocated within the boundaries of the existing STW and a substantial network solution may be required to progress this option. This is considered likely to have substantial cost and time implications and would likely lead to TWUL making a serious detrimental representation for this proposal (which would make obtaining powers over that land difficult). Whilst the area of West Zone 2 within the STW appears to be currently undeveloped, as the STW comprises essential infrastructure, this land may be required to facilitate future expansion of the STW and is safeguarded under Bexley Local Plan policy SP12.
4. Seek to avoid or minimise land take within the MOL, Accessible Open Land, and impact on PRoW.	The development of either West Zone 2 or 3 would result in direct impact and loss to MOL, though this is largely not accessible to the general public. Further, as none of the additional West Zone blocks would provide a single homogenous site with the Riverside Campus, the connections required for the development of any of these blocks would also likely directly impact upon this designation and AOL. The development of West Zone 2 and 3 would have a direct impact on FP2, as the CCF would be visible to the PRoW which runs along the edge of these zones. Further, the development of West Zone 1 and 2 would necessitate the crossing of FP2. Development of all West Zones would necessitate the crossing of the MOL and AOL, with substantial over ground pipework to provide the required connections between the CCF and Riverside Campus. The built form of the CCf, the connections and access required would have substantial impact on the MOL blocking off views to the River Thames. West Zone 3 would also likely require a substantial diversion to FP2.

Optioneering Principle	Analysis
5. Ease of required connections with the Riverside Campus and the Proposed Jetty.	Ease of connections between Riverside 1 and Riverside 2 and the CCF for routing of flue gas ducting: • The route of the Flue Gas Supply Ductwork from Riverside 1 would need to be routed through the congested Riverside Campus site or to the south (running parallel to the southern fence line). This option would be constrained by the need for continued free movement of vehicles, including waste delivery lorries, throughout the site. Each option would result in direct adverse impacts to the SINC, LNR, MOL and AOL, with greater impacts for West Zone 2 and West Zone 3. West Zones 1 and 2 would also likely require pipework crossings over FP2. • The route of the Flue Gas Supply Ductwork from Riverside 2 would be substantially longer than for the original West Zone considered in the **TSAR (APP-125)**. It would result in direct, adverse impacts to the SINC, LNR, MOL and AOL and would require large scale ductwork crossings over PRoW (FP2). Ease of connections between Riverside 1 and Riverside 2 and the CCF for utilities provision (steam, condensate return, power supply): • The utilities corridor from Riverside 1 would need to be routed through the congested Riverside Campus to access each of the West Zone options. It would be substantially longer than for the original West Zone option considered in the **TSAR (APP-125)**. Each option would result in direct adverse impacts to the SINC, LNR, MOL and AOL, with greater impacts for West Zone 2 and West Zone 3. All of the additional sites would require a crossing over the PRoW (FP2). Ease of connections to the location of the Proposed Jetty: • The Above Ground Pipelines would need to be routed east, either through the congested

Optioneering Principle	Analysis
	Riverside Campus or routed to the south of Riverside 1 and Riverside 2 (running parallel to the existing fence line). • This connection would have direct impact on the SINC, CLNR, and PRoW.
6. Seek to minimise engineering complexity and consequent cost.	Site access for all additional West Zones could be through the Crossness STW (which could raise security concerns for both parties) or via Norman Road and the Thames Water Access Road. In terms of laydown areas, the Applicant owned Borax sites could be used for the construction laydown area, transferring equipment and materials via the Thames Water Access Road. With regard to West Zone 1, the existing and operational sewage treatment plant and infrastructure located within West 1, would need to be demolished prior to commencement of construction of the CCF. The presence of below ground waste infrastructure in this location could pose challenges with regard to ground conditions and potential contamination. Additionally, given the spatial constraints within the STW, it is considered unlikely that the existing infrastructure within West Zone 1 could be relocated within the existing boundaries of the STW and a substantial network solution may be required to release this land, raising significant cost and time implications. This is likely to result in this site taking significantly longer to deliver (if feasible) than other options considered. There are no known unique challenges with respect to ground conditions in West Zone 2 in comparison to the surrounding sites. West Zone 2 has a number of waterbodies and ditches which may need to be filled and habitats compensated for elsewhere. The implications for drainage and the adjoining area of Functional Floodplain (Flood Zone 3b) are unknown. As West Zone 3 is within the Functional Floodplain (Flood Zone 3b) and consists of various waterbodies and ditches, development of this plot may pose

Optioneering Principle	Analysis
	engineering challenges with respect to ground conditions and drainage.

7. CONCLUSION

7.1.1. As set out within the **TSAR (APP-125)** the CCF, including its supporting plant and ancillary infrastructure needs to be located in the vicinity of the source of the carbon dioxide emissions it seeks to capture at Cory's Riverside Campus and also to the associated Proposed Jetty.

7.1.2. Following a rigorous site assessment process illustrated in the **TSAR (APP-125)** and this Addendum, and the consideration of the additional land blocks discussed in this document, the Applicant believes that there are no reasonable alternative sites on which the CCF could be brought forward and that the preferred development zone, South Zone 1, remains the only reasonable location.

CORY

DECARBONISATION

APPENDIX J: THE SPANGLED WATER BEETLE

Cory Decarbonisation Project

September 2024

SPECIES DOSSIER

Creating ponds for the Spangled Water Beetle *Graphoderus zonatus*

MILLION PONDS PROJECT

Freshwater Habitats Trust

A 50-YEAR PROJECT TO CREATE A NETWORK OF CLEAN WATER PONDS FOR FRESHWATER WILDLIFE

1. The Spangled Water Beetle

The Spangled Water Beetle *Graphoderus zonatus* is an impressive diving beetle, up to 15mm in size. The elytra have an intricate pattern of black and brown marks, coupled with a broad yellow band across the centre of the pronotum and a further narrow yellow band behind the eyes (Figure 1). Two other Graphoderus species have been recorded in this country - *G. bilineatus* which is now extinct and *G. cinereus* which is also very rare. Careful identification is required to tell these three species apart.

This beetle has been found at only one site in the UK, Woolmer Forest, in north-east Hampshire which is also an important site for the Natterjack Toad (Figure 2). It is classified as Critically Endangered under the IUCN threat criteria. New ponds created at Woolmer Forest have been colonised by the Spangled Water Beetle, which suggests that there is potential for it to disperse and use suitable habitat when it is available.

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Figure 1. The Spangled Water Beetle *Graphoderus* zonatus and the large, shallow Woolmer Pond (right).

2. Key habitat requirements

The exact habitat requirement of the Spangled Water Beetle are unclear. It occupies a number of heathland pools within Woolmer which vary considerably in age, pH, depth, permanence and vegetation structure. However there are some characteristics which may be important:

- **Dystrophic water low in nutrients**. Clean water ponds in heathlands are dependent on water draining from a low intensity landscape.
- **Low pH.** Whilst this species has been recorded in ponds with a circumneutral pH; low pH is beneficial because it is unsuitable for fish which predate on the larvae of the Spangled Water Beetle.
- **Open water.** The larvae need open water with abundant water flea *Daphnia* to feed on. They are free swimming and use their natural boyancy to float in the water waiting for passing prey.
- **Vegetation structure and debris in the drawdown zone**. The larvae need bare sandy ground at the base of rushy tussocks in which to develop. The adults need refuge sites adjacent to the pond, therefore it is important not to disturb or tidy-up debris in the pond margin.

Key messages

- **Locate ponds away from intensive landuse areas - this species is intolerant of pollution and eutrophication.**
- **Create large shallow ponds on acidic sandy soils on heathlands.**
- **Create a complex of different ponds with a range of different profiles.**
- **Manage sites by grazing at moderate stocking densities to maintain a short turf and create patches of bare ground.**
- **Monitor new ponds for invasive non-native plants. Once established they are difficult to remove successfully.**

Data supplied by The Aquatic Coleoptera Conservation Trust

Figure 2. Current distribution for the Spangled Water Beetle in the UK.

3. The ponds at Woolmer

Woolmer Forest is considered to be the most important area of lowland heathland in Southern England, outside of the New Forest. It is owned by the Defence Infrastructure Organisation (DIO) who manages the site in consultation with a conservation group made up of government organisations, NGOs and local naturalists. The ponds on the heathland were first created as a result of peat cutting, but more recently they have been created for conservation or during military activities - including gun emplacements, pits dug during the construction of a railway and even a swimming pool.

Woolmer Pond

The largest pond, Woomer Pond (at one time >20ha), was created as a result of peat cutting over 1,000 years ago. The pond has had a chequered history. Its pH has fluctuated markedly; around 6.0 in the 1700s but declining to 4.5 by the turn of the 20th century due to atmospheric pollution. The pond was also drained during the 1940s which lead to encroachment by uniform stands of Purple Moor-grass *Molinia caerulea*. In recent years conservation work has dug out the acidic sediments and restored the pond to some of its former size (Figure 3). Numbers of Spangled Water Beetle in this pond have varied depending on the pond's condition – at one time fish were present in the pond and the water beetle was absent.

Cranmer Pond

Cranmer Pond is also large, but a deeper pond than Woolmer Pond, and it has a pH of around 4. It was created in 1895 at the end of the period when turf cutting was as an economic activity on the heath. The pond basin is covered in a carpet of *Sphagnum* mosses, and both larvae and adults of Spangled Water Beetle are often recorded in the pond. It may have acted as a refuge for the beetle when conditions in the surrounding water bodies were unsuitable.

Natterjack Toad ponds

In recent years, pond creation has taken place for Natterjack Toad *Epidalea calamita*. Woolmer was the only remaining inland site for this species in England until a programme of reintroduction began in the 1980s. These ponds are much smaller than the two lakes mentioned above, normally less than 10m in diameter and approximaely 0.5m deep. The fact that they are temporary eliminates the chance that fish will colonise which creates suitable conditions for the Spangled Water Beetle. The Natterjack ponds are also limed to increase their pH above pH 7.0, a fact that does not seem to affect the presence of the Spangled Water Beetle, although the ponds are probably not optimum breeding habitats.

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Figure 3. Army tanks restoring Woolmer Pond in the 1980's (left) and how the pond looks today (right).

Important species at Woolmer

In addition to the Spangled Water Beetle and the Natterjack Toad, the ponds at Woolmer also support other Biodiveristy Action Plan pond species including Coral-necklace *Illecebrum verticillatum*, Marsh Clubmoss *Lycopodiella inundata*, Grass Snake *Natrix natrix* and Great Crested Newt *Triturus cristatus*. Any pond creation at the site is likely to benefit a wide range of species. Separate *Species Dossiers* are available for these species from the *Pond Creation Toolkit*.

4. Pond designs for the Spangled Water Beetle

We still don't fully understand why the Spangled Water Beetle is only found at Woolmer. It may be that a combination of habitat loss and acidification drove it to this one remaining site. Whatever the underlying cause, the existence of only one site makes this population very vulnerable to extinction.

Spangled Water Beetles were translocated from Woolmer into adjacent heathland sites, but these were apparently unsuccessful. If existing ponds did not provide suitable conditions, creation of new ponds which have been shown to be successful at Woolmer may help to establish new populaitons elsewhere.

Pond location and finding a clean water source

In north-east Hampshire there are still relatively large, although often isolated, tracks of heathland habitat. Pond creation should not damage habitats with existing biodiversity value, but there are opportunities to create ponds as part of heathland restoration schemes.

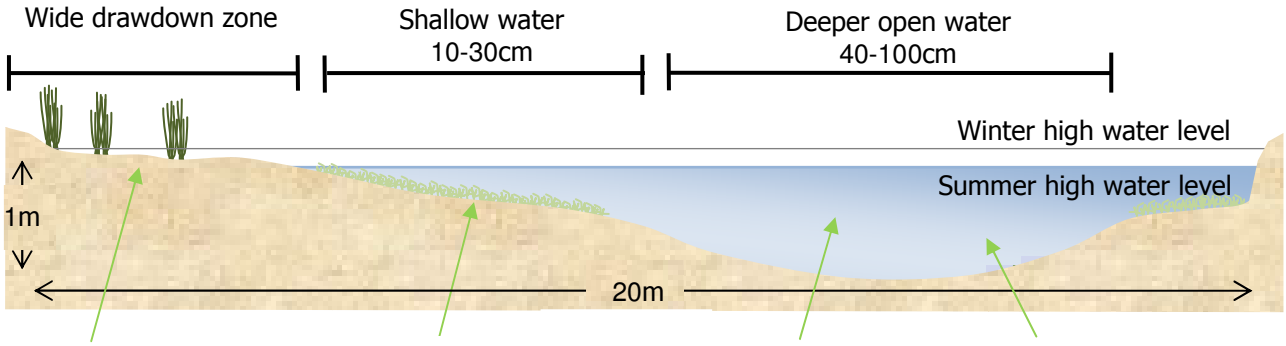
The most important factor determining pond location will be finding a clean water source. Heathland catchments are naturally very low in nutrients and are a very good source of unpolluted water (see *Pond Creation Toolkit Factsheet 2* and *Supplementary Habitat Factsheet: Heathland ponds* for further information). However, these small water bodies are highly sensitive to pollution, and therefore particular attention should be paid to the water source (i.e. avoid creating ponds near to any sources of pollution, such as roads, drains, car parks, etc.).

- Groundwater-fed ponds can be a very good source of unpolluted water provided the surrounding catchment is not managed intensively. These ponds are likely to be permanent providing habitat for the larvae of Spangled Water Beetle.
- Surface water-fed ponds and direct precipitation will also be good sources of clean water and on heathlands are likely to be temporary ponds which will prevent colonisation by fish.

Pond designs for Spangled Water Beetle

- **Create a complex of ponds.** The range of different pond types at Woolmer appears to be critical in the survival of the Spangled Water Beetle. It is able to move between ponds as conditions change. The greater the number of ponds the less chance there is that the population will become extinct.
- **Small pond profiles.** Create ponds which are less than 10m in diameter and less than 0.5m deep which have broad shallow margins. Although not optimum habitat for larvae of the Spangled Water Beetle they may provide refuge sites for adult beetles outside of the breeding season.
- **Large pond profiles.** Create ponds up to 2ha or small lakes where space allows or at least some ponds with a diameter of 20-30m. Design ponds with broad, shallow margins (<1:20), sloping to deeper water (up to 1m deep). Shallow margins with fluctuating water levels will suppress the growth of dominant plants and in combination with grazing provide patches of bare ground for pupation. Deeper shallows develop *Sphagnum* moss carpets. Deeper open water is suitable habitat for the larvae (Figure 4).

Figure 4. Profile of ponds for Spangled Water Beetle



Pupation sites. Margin of rushes, sedges and patches of bare ground

Broad shallow margins. Carpet of *Sphagnum* mosses and other submerged

Deeper open water. Habitat for water flea and Spangled Water Beetle larvae.

Asymmetric profile. Allow the pond to have both a shallow margin and deeper water.

Management and safeguarding of Woolmer

- Despite a history of quite dramatic changes at Woolmer including forestry planting of Scots Pine *Pinus sylvestris* and periods without grazing management the Spangled Water Beetle has managed to hold-on. Woolmer Pond is now designated as a Site of Special Scientific Interest (SSSI) and Woolmer Forest a Special Area of Conservation and the importance of the site is well understood.
- The restriction on public access due to the active firing range is almost certainly beneficial to reduce public pressure on this fragment of lowland heathland.
- Grazing management is seen as the most sustainable way to manage Woolmer's heaths, grasslands and ponds. Grazing need to be at moderate stocking densities to slow down pond succession and eliminate woody scrub. However, grazing should be controlled to allow some patches of sedges and rushes to develop.
- Debris such as logs adjacent to the pond are important for adult Spangled Water Beetle, as they leave the pond and spend time on land. In this way they are able to withstand periods when the pond dries out during the summer months.

5. Further reading

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For further information about the Million Ponds Project and to consult other factsheets in the Pond Creation Toolkit, please visit *www.freshwaterhabitats.org.uk* or email enquiries to *info@freshwaterhabitats.org.uk*

Freshwater Habitats Trust

The Aquatic Coleoptera Conservation Trust

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