WRITTEN SUMMARY OF THE APPLICANT'S ORAL SUBMISSIONS AT COMPULSORY ACQUISITION HEARING 2 (CAH2) APPENDICES A - H: 9.24

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations, 2009 – Regulation 5(2)(b)

CORY

APPENDIX A: THAMES WATER ACCESS ROAD COMPELLING CASE NOTE

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

The Infrastructure Planning (Examination Procedure) Rules 2010 - Rule 8(1)(c)

TABLE OF CONTENTS

1. SUMMARY OF CASE INPUT – COMPELLING CASE FOR COMPULSORY ACQUISITION OF THAMES WATER ACCESS ROAD

1.1.1. Compulsory acquisition of the existing Thames Water Access Road is considered essential to the Cory Decarbonisation Project as it is anticipated that, during construction and operation, this road will become an integral part of the Carbon Capture Facility (CCF), and management and control of the road by the Applicant will be essential to the safe, efficient and robust operation and maintenance of the CCF.

1.1.2. It is understood that Thames Water uses the access road on an infrequent basis, for occasional transport of materials on and off-site, and it is also an emergency access route that forms part of Thames Water's management of the sewage treatment works, a registered COMAH site. In addition, it is understood that the Environment Agency use the road infrequently to access the Great Breach Pumping Station. While it is understood that Ms Anderson uses the access road on a more frequent basis, the Applicant proposes to make alternative provision for Ms Anderson so that she will no longer require use of the access road.

1.1.3. To facilitate the development of an integrated Carbon Capture Facility , the Thames Water Access Road will become an integral element of the site as part of the internal circulation road network for the plant. This road network will be in constant daily use for movement of operations and maintenance staff and vehicles around the site, materials and consumables deliveries, disposal of waste materials to appropriate facilities off site, and emergency access provision. Therefore, in order to support safe, efficient, resilient and secure operation of the CCF, the Applicant considers that it is essential that it has ownership of the road, to give full control of its use, access and security, alongside maintenance responsibility.

1.1.4. Should use of the road, as part of the integrated process plant, be interrupted, then this could lead to the inability of staff or vehicles to access plant and equipment for inspection and maintenance, and / or carry out material movements around the site, potentially leading to interruption of operations and / or failure of safety-critical equipment. The nature of the Carbon Capture Plant, as a major process plant installation with numerous items of mechanical and electrical equipment throughout, including pumps, valves, fans, motors, compressors, etc., is such that it requires regular, frequent inspection, maintenance and other intervention to a much greater extent than, for example, a data centre that mostly comprises static equipment with some support services. The road will also form an integral part of emergency evacuation routes to be used by personnel in the event of an incident on site.

1.1.5. In the context of the primary operational requirements of this road by the CCF, relative to its existing uses, it is considered that security controls and access arrangements along the road, to allow occasional closure to plant traffic to allow access by Thames Water and Environment Agency vehicles, can be implemented without disruption to Thames Water and Environment Agency operations. Details of these arrangements are yet to be finalised, but are likely to include normally-open security gates on the plant roads leading on to the access road (which would be closed to prevent access by Thames Water and Environment Agency vehicles to the CCF when they are using the road), normally-closed security gates at either end of the road to facilitate Thames Water and Environment Agency access, communications protocols, and potentially a direct control link to the Thames Water sewage treatment works alarm system to ensure that access is available for emergency vehicles in the event of a major incident on that site.

1.1.6. If the road were retained in Thames Water's ownership then, even with suitable provisions within a shared access agreement, there is an unacceptable risk that the operational requirements of the CCF could be interrupted without sufficiently immediate legal recourse to restore access. Such an arrangement is also likely to lead to uncertainty, ambiguity and / or a lack of clarity in respect of management and control of site safety and operation of the CCF. Access could also be delayed if the Applicant needs to communicate with Thames Water every time they want to use the road; this would be a major concern in an emergency, where any delay could have serious consequences

1.1.7. In this context, it is entirely appropriate that the ownership of the Access Road is held by the Applicant, allowing access for others when it is needed; rather than another party owning it and the Applicant having to have permission to access an area of land that is fundamental to the operation of the Proposed Scheme.

1.1.8. The rights that would be required by the Applicant to utilise the road, preclude all others without permission and prevent it from being used for any other purposes would be a fundamental change in character from the current environment of it being its own separate road, necessitating acquisition (as another example of the 'principle' discussed in the Written Summary of Oral Submissions at CAH1) (REP1-028).

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX B: EXAMPLE INDICATIVE EQUIPMENT LAYOUT DRAWINGS

DECARBONISATION

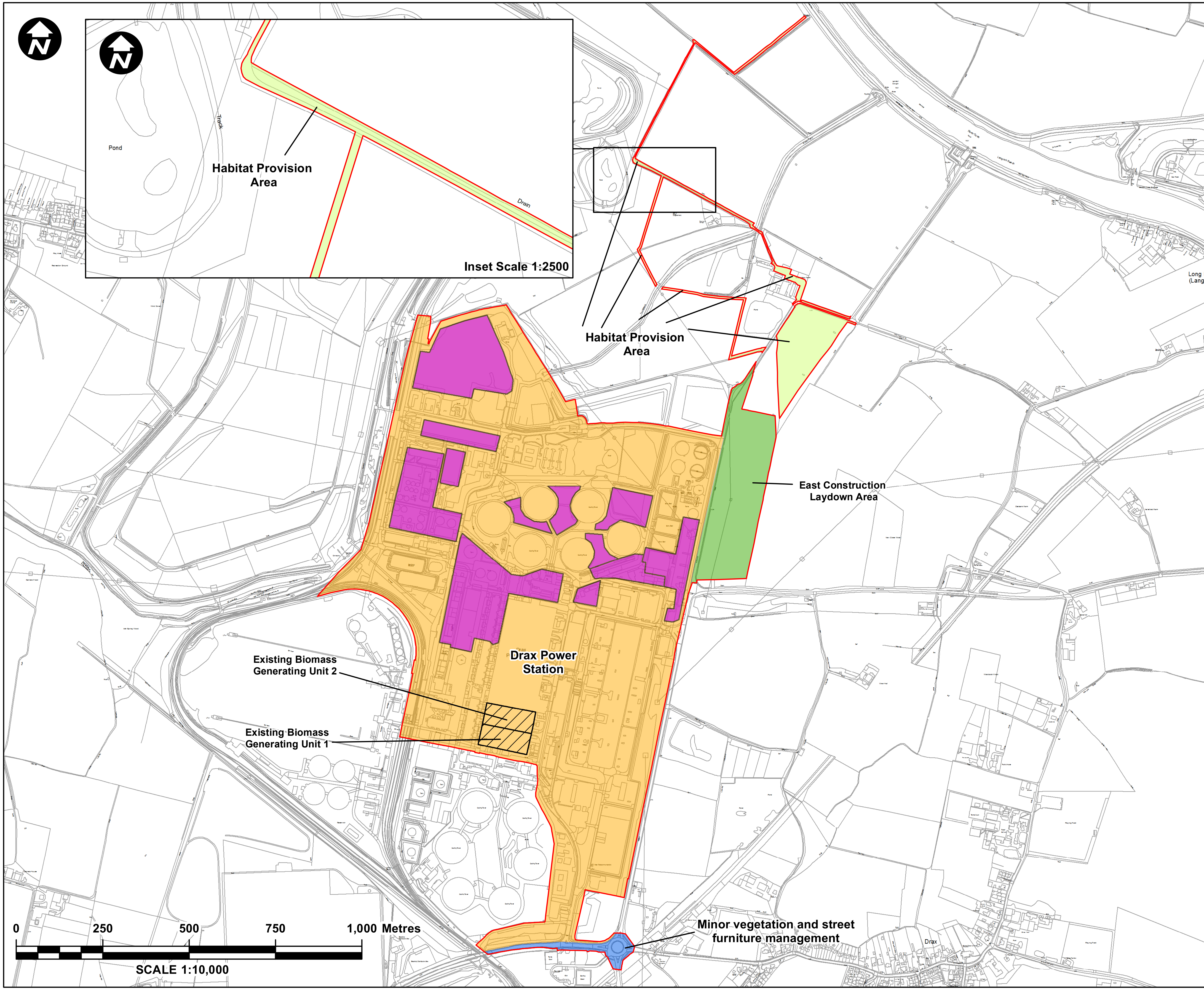
Cory Decarbonisation Project

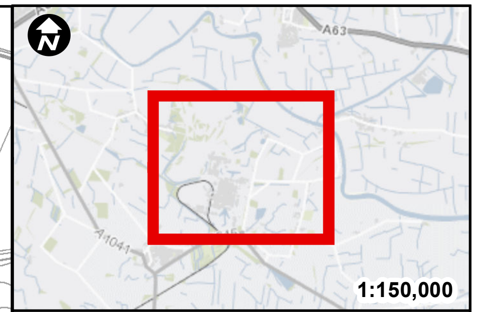
PINS Reference: EN010128

February 2025

Revision A

The Infrastructure Planning (Examination Procedure) Rules 2010 - Rule 8(1)(c)





Key:
- Order Limits
- Drax Power Station Site
- Habitat Provision Area
- East Construction Laydown Area
- Minor Vegetation and Street Furniture Management
- Drax Power Station Site Construction Laydown Areas

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(o)

PROJECT TITLE

DRAX BECCS DCO

DRAWING TITLE

FIGURE 1.2:
INDICATIVE SITE LAYOUT PLAN

DRAWING STATUS
FOR ISSUE

DRAWN	CHECKED	APPROVED	AUTHORISED
LH	BS	MM	NA

SCALE @ A3 SIZE	DATE	REVISION
1:10,000	26/04/2022	P01

DRAWING NUMBER
EN010120-PA-ES-6.2.1.2-Sheet1

KEADBY 3
CARBON CAPTURE
POWER STATION

A collaboration between **SSE Thermal** and **Equinor**

Document Ref: 4.7

Planning Inspectorate Ref: EN010114

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

Land at and in the vicinity of the Keadby Power Station site, Trentside, Keadby, North Lincolnshire

Indicative Proposed Power and Carbon Capture Layout, Elevations and Sections

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(o)

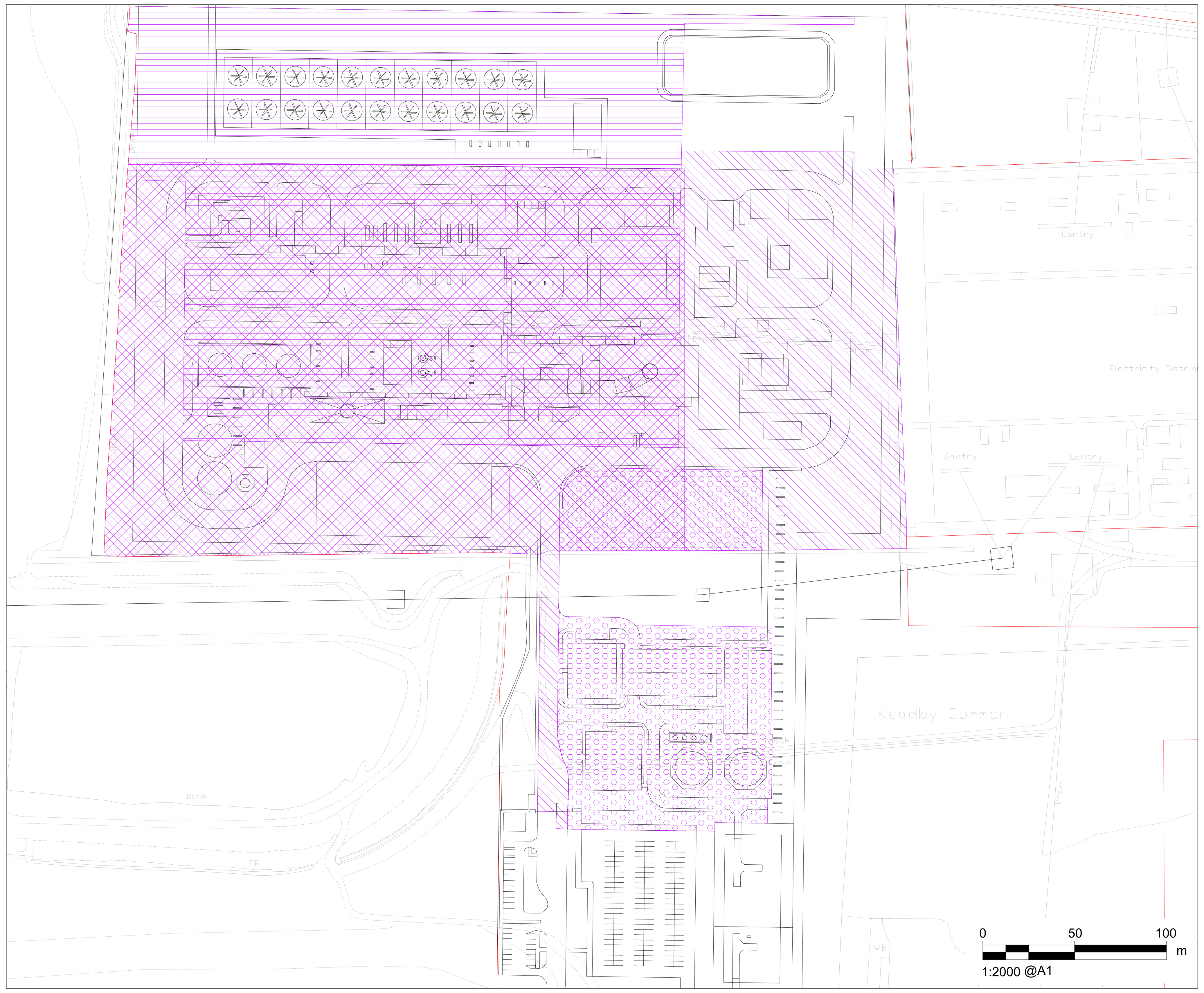
Applicant: Keadby Generation Limited

Date: May 2022

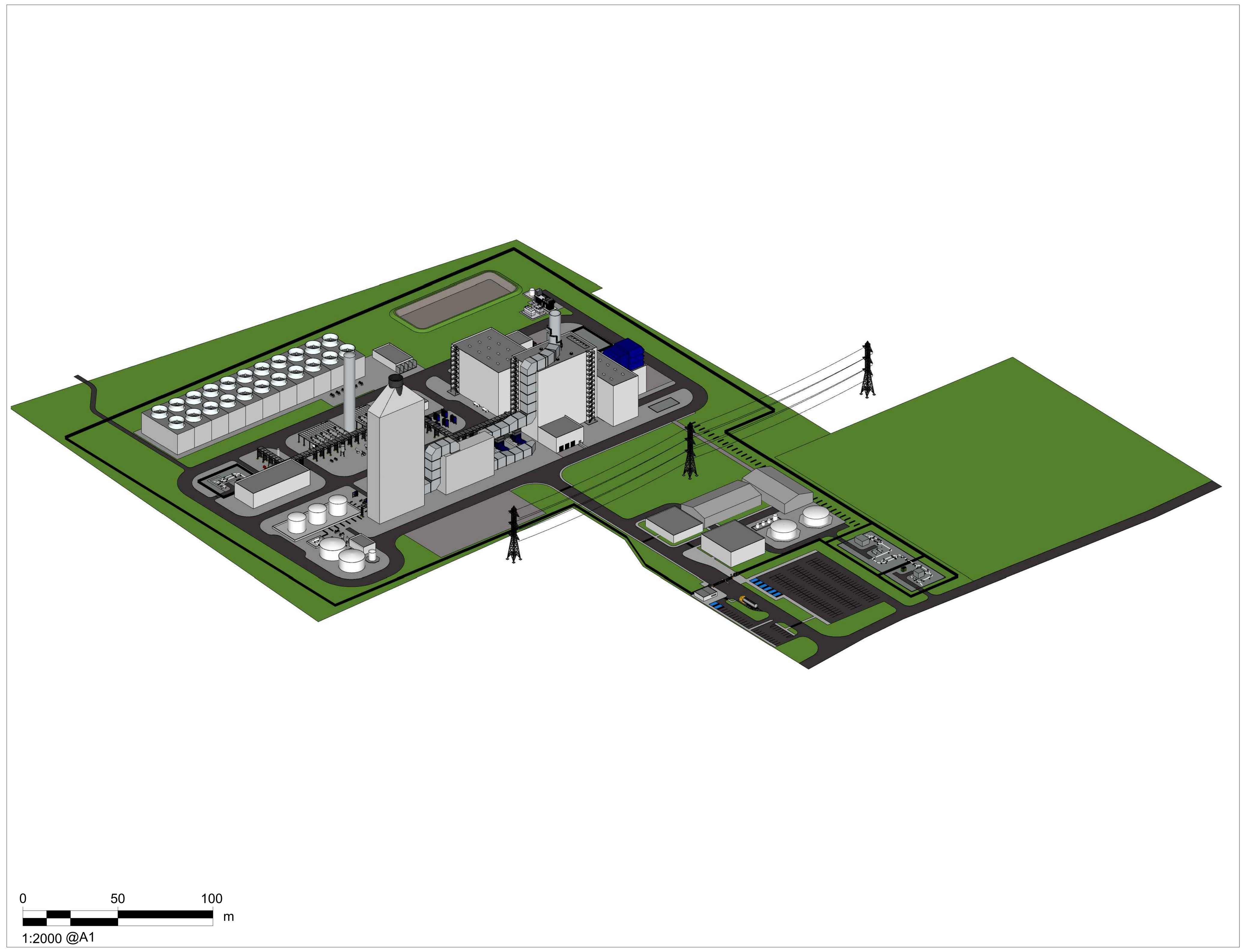
DOCUMENT HISTORY

Document Ref	4.7
Revision	VP2.0 –Change Request
Content	Sheets 1-5: Key Plan and Plans and Elevations of Single Absorber Option Sheets 6-10: Key Plan and Plans and Elevations of Twin Absorber Option
Document Owner	AECOM

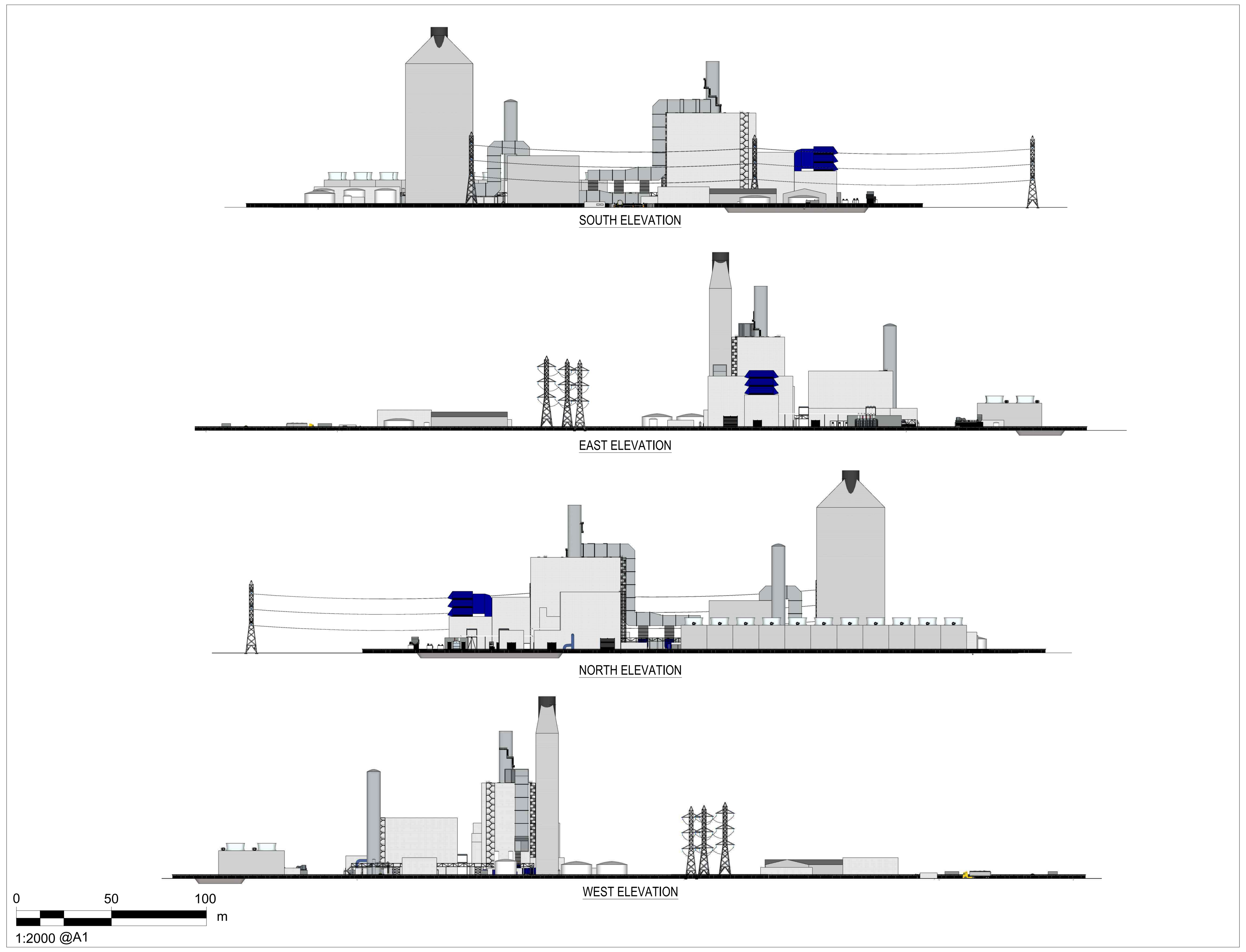
SHEET 2 OF 10 - LAYOUT VIEW SINGLE LARGE ABSORBER



SHEET 3 OF 10 - LAYOUT VIEW SINGLE LARGE ABSORBER



SHEET 4 OF 10 - 3D AERIAL VIEW SINGLE LARGE ABSORBER



SHEET 5 OF 10 - ELEVATIONS VIEW SINGLE LARGE ABSORBER

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____

Last saved by: JAMIE.CALVERT(2022-01-27) Last Plotted: 2022-01-27 AutoCAD Version: 23.1S (LMS TECH)
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-001.DWG

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

- THE ORDER LIMITS

Works Plan:

- WORK NO. 1A CCGT PLANT
- WORK NO. 1B CCGT COOLING INFRASTRUCTURE
- WORK NO. 1C CARBON CAPTURE PLANT
- WORK NO. 1E GENERATING STATION SUPPORTING USES

ISSUE/REVISION

I/R	DATE	DESCRIPTION
02	05/04/2022	DCO APPLICATION
01	01/06/2021	DCO APPLICATION

NOTES

The Keadby 3 Low Carbon Generating Station Order
Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Single Large Absorber
Sheet 1 of 10 - Key Plan

SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-001

#	Area
A	Natural Gas Receiving Area
B	Gas Turbine and Auxiliaries
C	HRSG and Auxiliaries
D	Steam Turbine and Auxiliaries
E	Power Island Electrical Equipment
F	Flue Gas Fans and Ducting
G	Flue Gas Cooling
H	Absorber
I	Stripping and Reclaiming
J	Storage and offsites
K	Compression and Dehydration
L	National Grid CO2 AGI
M	Cooling Towers
N	Gate house, security and parking
O	Admin, control room and stores buildings
P	Raw water treatment
Q	Attenuation pond

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

THE ORDER LIMITS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
02	05/04/2022	DCO APPLICATION
01	01/06/2021	DCO APPLICATION

NOTES

Reproduced from Ordnance Survey digital map data © Crown copyright 2021. All rights reserved. Licence number 0100031673.

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Single Large Absorber
Sheet 2 of 10 - Layout View

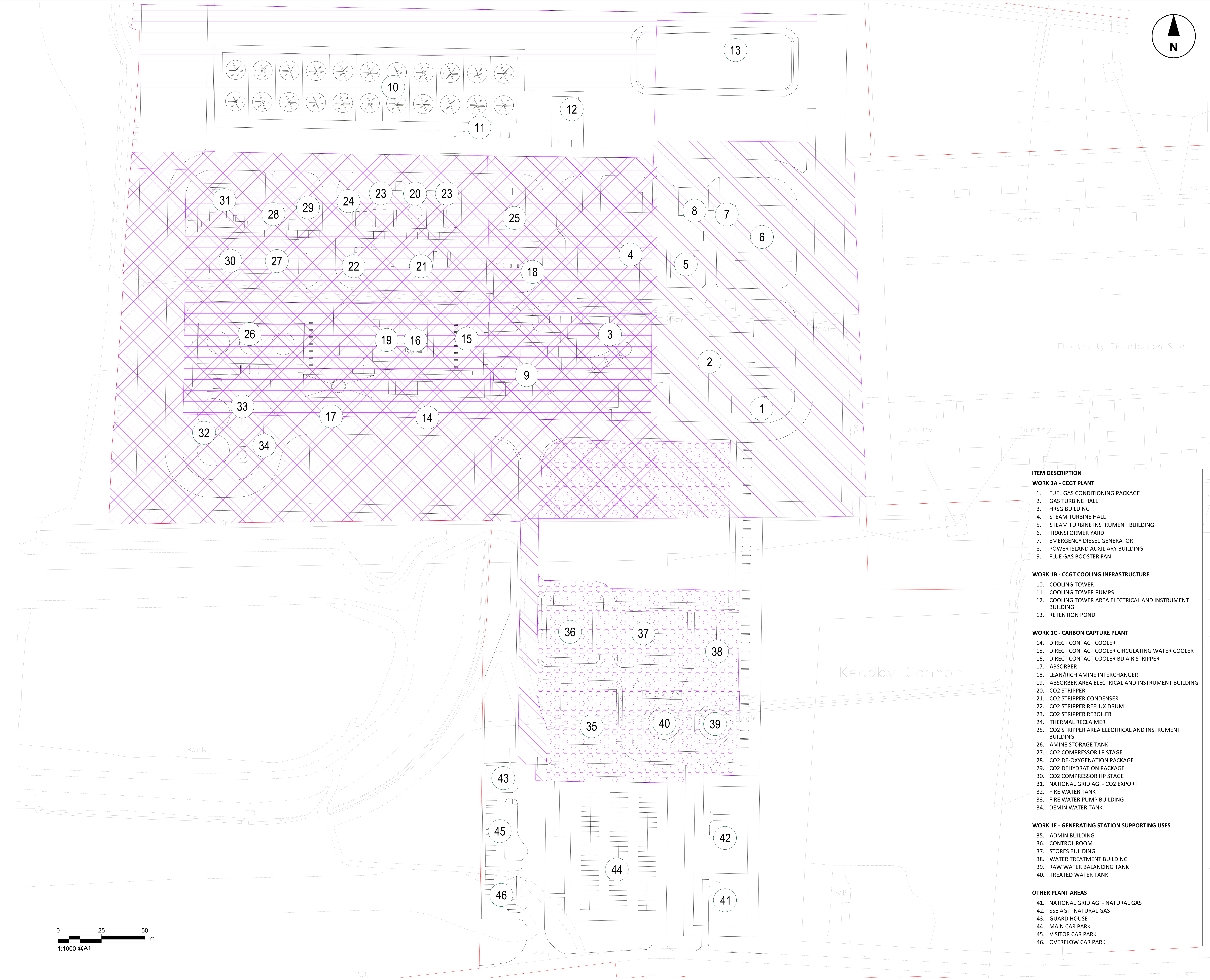
SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-002

Project Management Initials: Designer: Checked: Approved:

Last saved by: DAN.RAILEANU(2021-05-27) Last Plotted: 2021-05-27
Filename: C:\USERS\DAN.RAILEANU\AECOM DIRECTORY\KEADBY 3 DCO DELIVERABLES - GENERAL\WORKING\60625943-PE-DRG-002.DWG
AutoCAD Version: 22.0S (LMS TECH)

Last saved by: DAN.RAILEANU(2021-05-27) Last Plotted: 2021-05-27
Filename: C:\USERS\DAN.RAILEANU\AECOM DIRECTORY\KEADBY 3 DCO DELIVERABLES - GENERAL\WORKING\60625943-PE-DRG-003.DWG
AutoCAD Version: 22.0S (LMS TECH)



ITEM DESCRIPTION

WORK 1A - CCGT PLANT

1. FUEL GAS CONDITIONING PACKAGE
2. GAS TURBINE HALL
3. HRSG BUILDING
4. STEAM TURBINE HALL
5. STEAM TURBINE INSTRUMENT BUILDING
6. TRANSFORMER YARD
7. EMERGENCY DIESEL GENERATOR
8. POWER ISLAND AUXILIARY BUILDING
9. FLUE GAS BOOSTER FAN

WORK 1B - CCGT COOLING INFRASTRUCTURE

10. COOLING TOWER
11. COOLING TOWER PUMPS
12. COOLING TOWER AREA ELECTRICAL AND INSTRUMENT BUILDING
13. RETENTION POND

WORK 1C - CARBON CAPTURE PLANT

14. DIRECT CONTACT COOLER
15. DIRECT CONTACT COOLER CIRCULATING WATER COOLER
16. DIRECT CONTACT COOLER BD AIR STRIPPER
17. ABSORBER
18. LEAN/RICH AMINE INTERCHANGER
19. ABSORBER AREA ELECTRICAL AND INSTRUMENT BUILDING
20. CO2 STRIPPER
21. CO2 STRIPPER CONDENSER
22. CO2 STRIPPER REFLUX DRUM
23. CO2 STRIPPER REBOILER
24. THERMAL RECLAIMER
25. CO2 STRIPPER AREA ELECTRICAL AND INSTRUMENT BUILDING
26. AMINE STORAGE TANK
27. CO2 COMPRESSOR LP STAGE
28. CO2 DE-OXYGENATION PACKAGE
29. CO2 DEHYDRATION PACKAGE
30. CO2 COMPRESSOR HP STAGE
31. NATIONAL GRID AGI - CO2 EXPORT
32. FIRE WATER TANK
33. FIRE WATER PUMP BUILDING
34. DEMIN WATER TANK

WORK 1E - GENERATING STATION SUPPORTING USES

35. ADMIN BUILDING
36. CONTROL ROOM
37. STORES BUILDING
38. WATER TREATMENT BUILDING
39. RAW WATER BALANCING TANK
40. TREATED WATER TANK

OTHER PLANT AREAS

41. NATIONAL GRID AGI - NATURAL GAS
42. SSE AGI - NATURAL GAS
43. GUARD HOUSE
44. MAIN CAR PARK
45. VISITOR CAR PARK
46. OVERFLOW CAR PARK

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

THE ORDER LIMITS

Works Plan:

WORK NO. 1A CCGT PLANT

WORK NO. 1B CCGT COOLING INFRASTRUCTURE

WORK NO. 1C CARBON CAPTURE PLANT

WORK NO. 1E GENERATING STATION SUPPORTING USES

ISSUE/REVISION

I/R	DATE	DESCRIPTION
02	05/04/2022	DCO APPLICATION
01	01/06/2021	DCO APPLICATION

NOTES

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

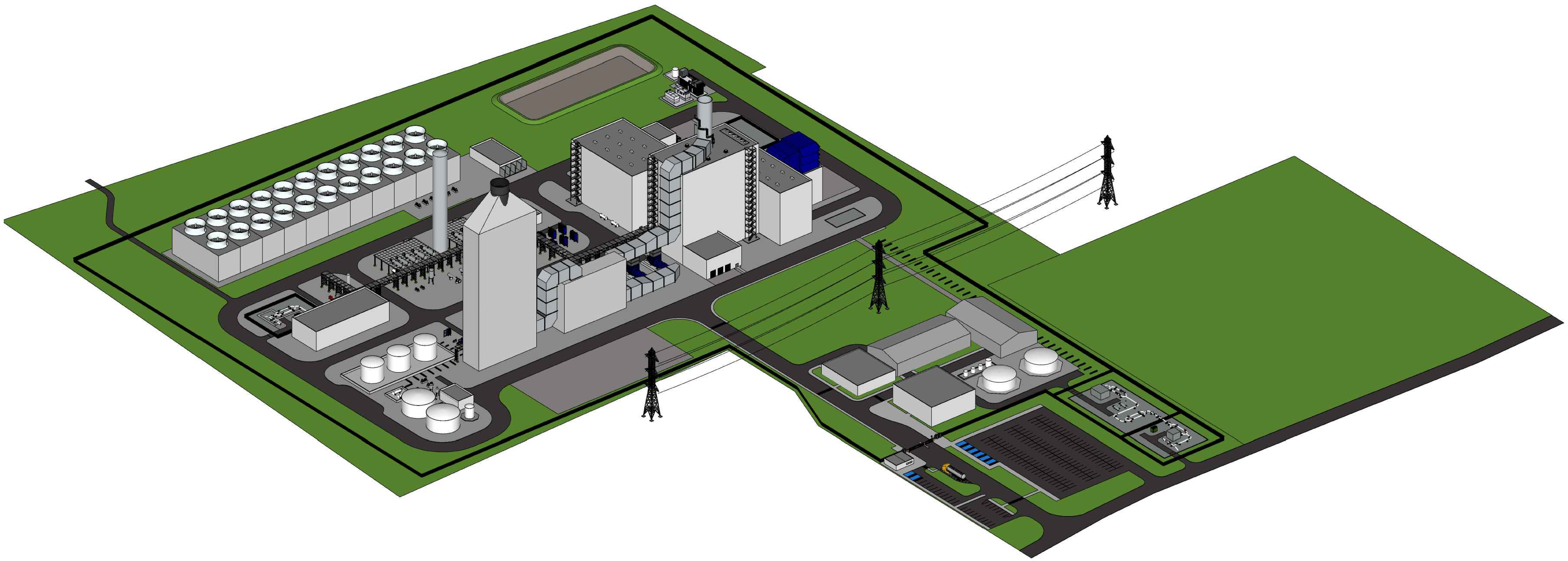
60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Single Large Absorber Sheet 3 of 10 - Layout View

SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-003



0 25 50 m
1:1000 @A1

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

ISSUE/REVISION

I/R	DATE	DESCRIPTION
02	05/04/2022	DCO APPLICATION
01	01/06/2021	DCO APPLICATION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

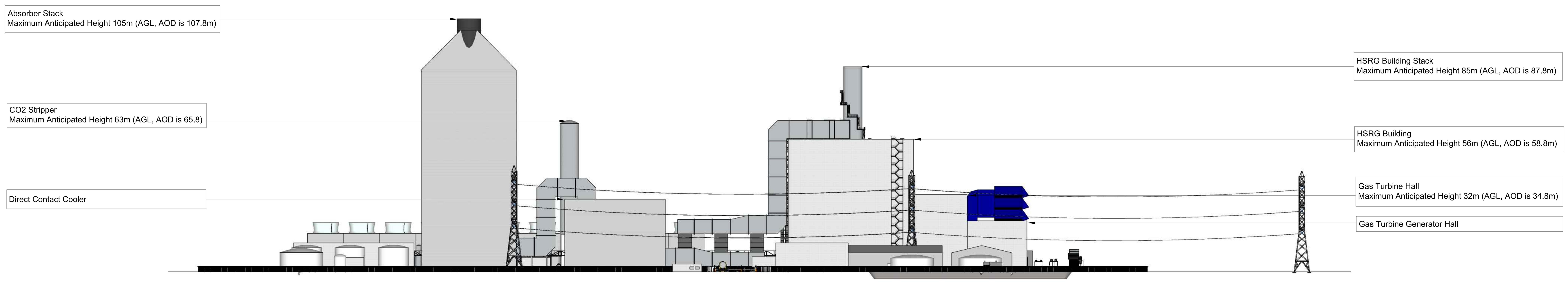
SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Single Large Absorber
Sheet 4 of 10 - 3D Aerial View

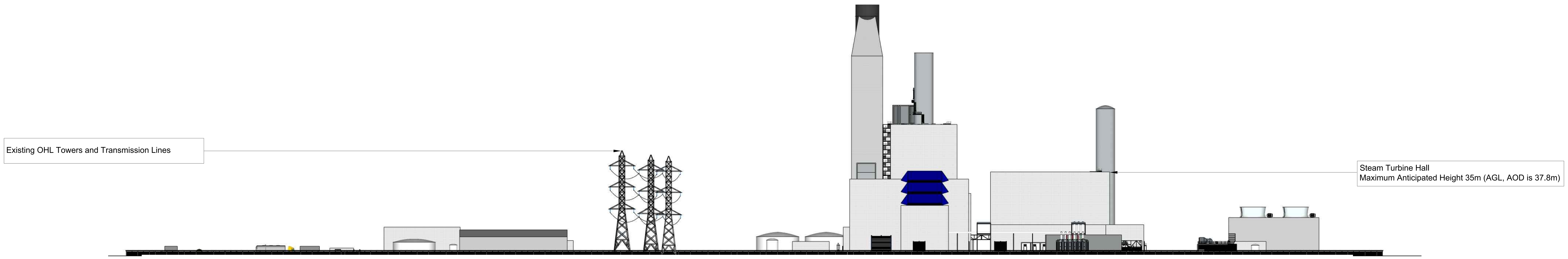
SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-004

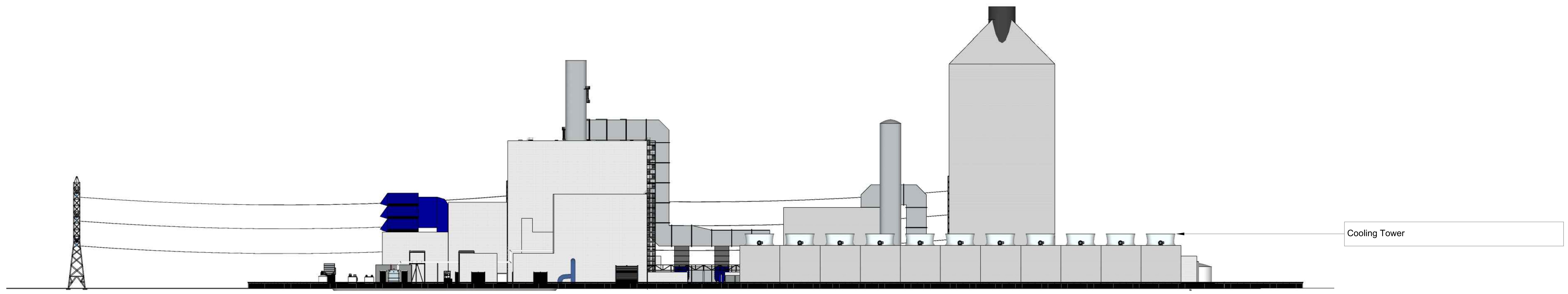
Project Management Initials: Designer: Checked: Approved:
Last saved by: JAMIE.CALVERT(2022-01-27) Last Plotted: 2022-01-27 AutoCAD Version: 23.1S (LMS TECH)
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-004.DWG



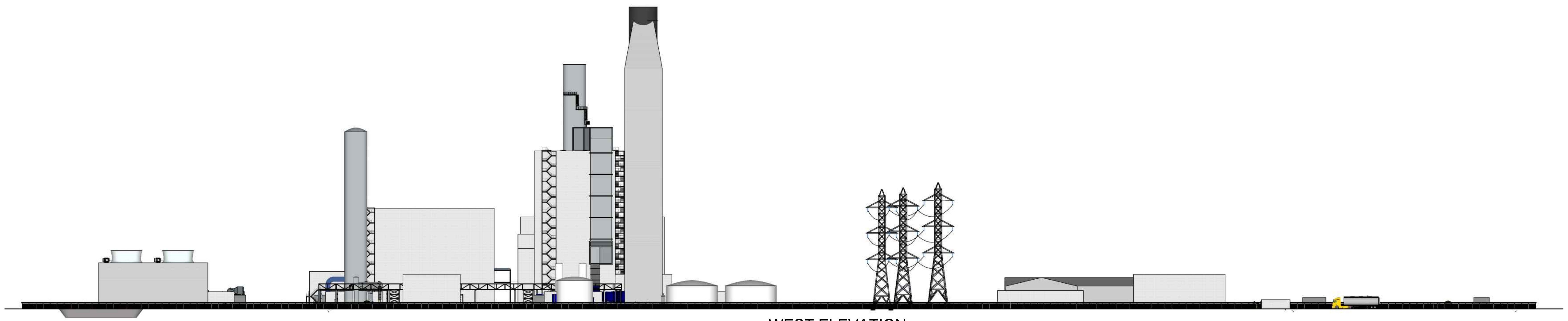
SOUTH ELEVATION



EAST ELEVATION



NORTH ELEVATION



WEST ELEVATION

0 25 50 m
1:1000 @A1

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

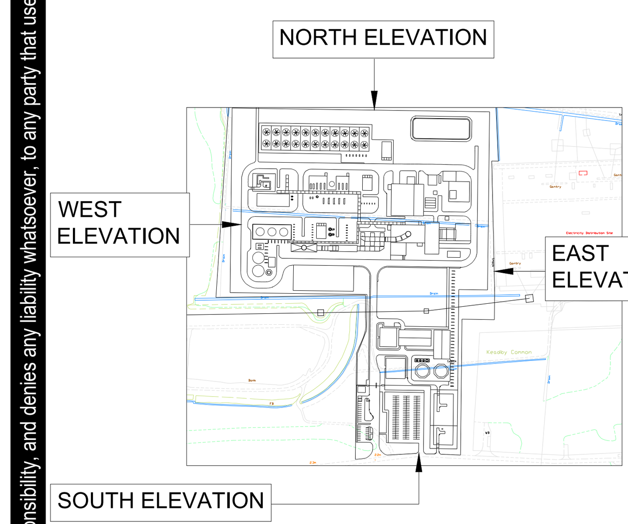
APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND



PLAN VIEW

ISSUE/REVISION

I/R	DATE	DESCRIPTION
02	05/04/2022	DCO APPLICATION
01	01/06/2021	DCO APPLICATION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Single Large Absorber Sheet 5 of 10 - Elevations View

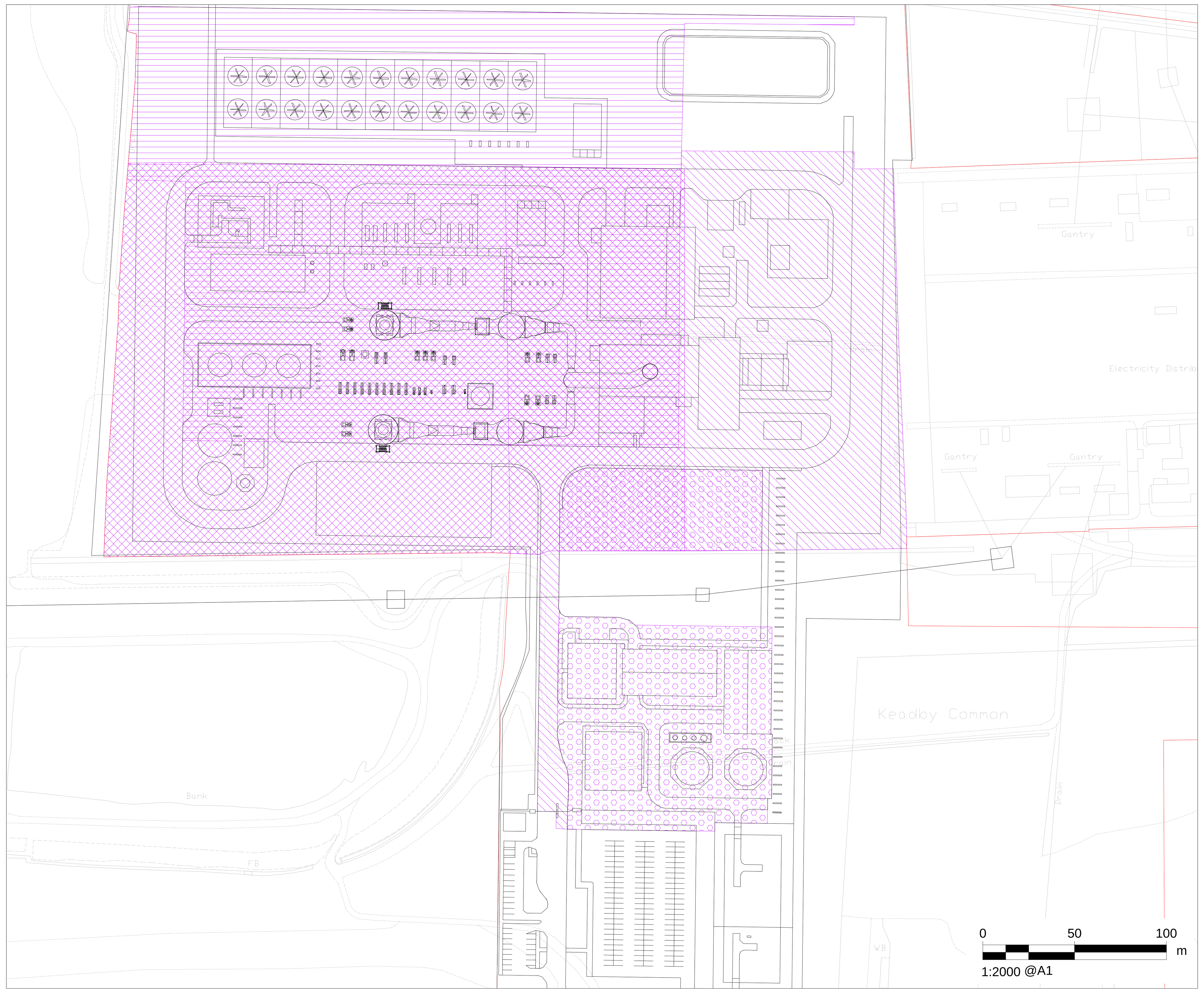
SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-005

Project Management Initials: Designer: Checked: Approved:

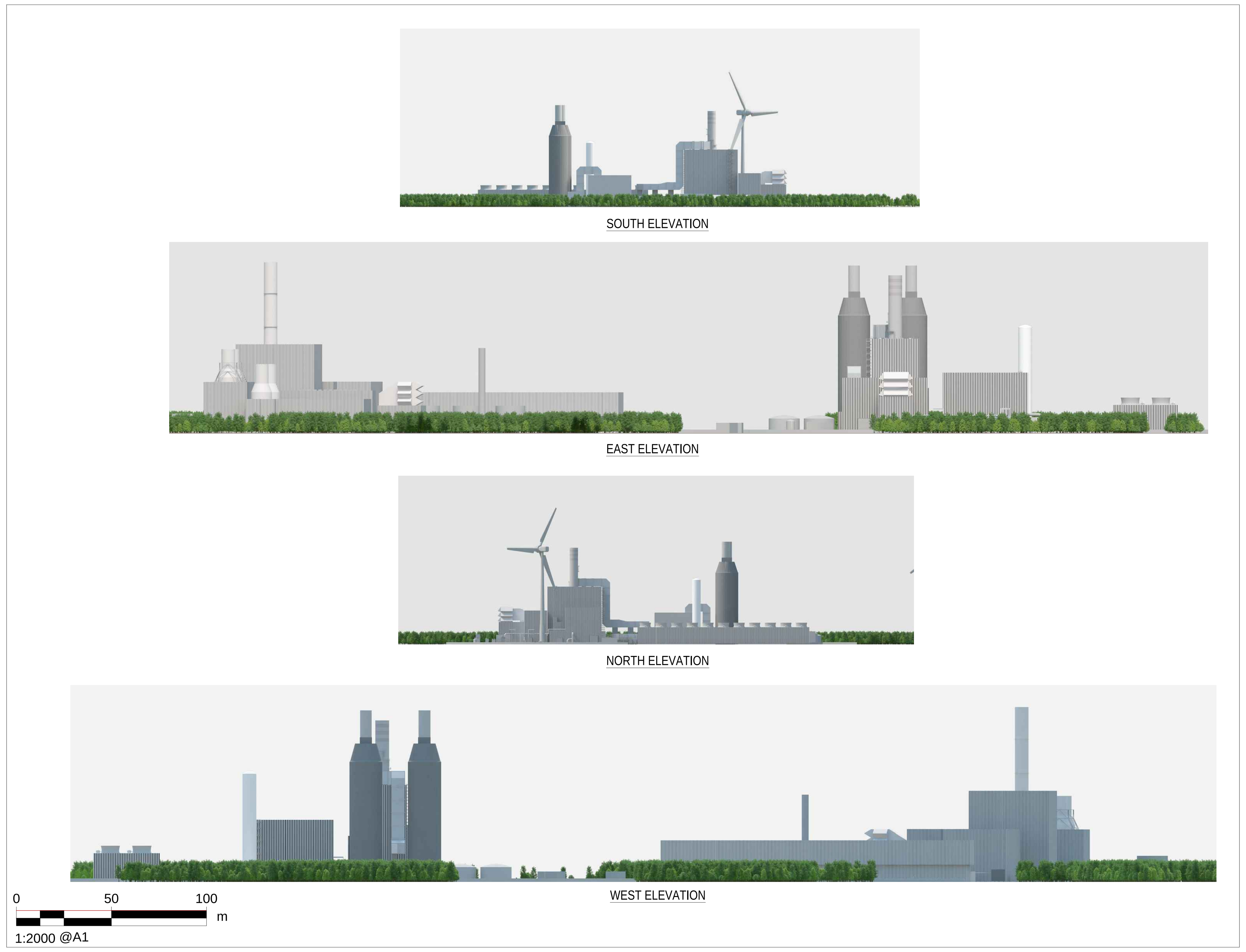
Last saved by: JAMIE.CALVERT(2022-01-27) Last Plotted: 2022-01-27
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-005.DWG
AutoCAD Version: 23.1S (LMS TECH)

SHEET 7 OF 10 - LAYOUT VIEW TWIN ABSORBER



SHEET 8 OF 10 - LAYOUT VIEW TWIN ABSORBER

SHEET 9 OF 10 - 3D AERIAL VIEW TWIN ABSORBER



SHEET 10 OF 10 - ELEVATIONS VIEW TWIN ABSORBER

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

- THE ORDER LIMITS

Works Plan:

- WORK NO. 1A CCGT PLANT
- WORK NO. 1B CCGT COOLING INFRASTRUCTURE
- WORK NO. 1C CARBON CAPTURE PLANT
- WORK NO. 1E GENERATING STATION SUPPORTING USES

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05/04/2022	DCO APPLICATION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Twin Absorber
Sheet 6 of 10 - Key Plan

SHEET NUMBER

Aplication Document Ref. 4.7
60625943-PE-DRG-111

#	Area
A	Natural Gas Receiving Area
B	Gas Turbine and Auxiliaries
C	HRSG and Auxiliaries
D	Steam Turbine and Auxiliaries
E	Power Island Electrical Equipment
F	Flue Gas Fans and Ducting
G	Flue Gas Cooling
H	Absorber
I	Stripping and Reclaiming
J	Storage and offsites
K	Compression and Dehydration
L	National Grid CO2 AGI
M	Cooling Towers
N	Gate house, security and parking
O	Admin, control room and stores buildings
P	Raw water treatment
Q	Attenuation pond

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

THE ORDER LIMITS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05/04/2022	DCO APPLICATION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Twin Absorber
Sheet 7 of 10 - Layout View

SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-112

Project Management Initials: Designer: Checked: Approved:

Last saved by: JAMIE.CALVERT(2022-04-04) Last Plotted: 2022-04-04 AutoCAD Version: 23.1S (LMS TECH)
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-112.DWG

ITEM DESCRIPTION

WORK 1A - CCGT PLANT

1. FUEL GAS CONDITIONING PACKAGE
2. GAS TURBINE HALL
3. HRSG BUILDING
4. STEAM TURBINE HALL
5. STEAM TURBINE INSTRUMENT BUILDING
6. TRANSFORMER YARD
7. EMERGENCY DIESEL GENERATOR
8. POWER ISLAND AUXILIARY BUILDING
9. FLUE GAS BOOSTER FAN

WORK 1B - CCGT COOLING INFRASTRUCTURE

10. COOLING TOWER
11. COOLING TOWER PUMPS
12. COOLING TOWER AREA ELECTRICAL AND INSTRUMENT BUILDING
13. RETENTION POND

WORK 1C - CARBON CAPTURE PLANT

14. DIRECT CONTACT COOLER
15. DIRECT CONTACT COOLER CIRCULATING WATER COOLER
16. DIRECT CONTACT COOLER BD AIR STRIPPER
17. ABSORBER
18. LEAN/RICH AMINE INTERCHANGER
19. ABSORBER AREA ELECTRICAL AND INSTRUMENT BUILDING
20. CO2 STRIPPER
21. CO2 STRIPPER CONDENSER
22. CO2 STRIPPER REFLUX DRUM
23. CO2 STRIPPER REBOILER
24. THERMAL RECLAIMER
25. CO2 STRIPPER AREA ELECTRICAL AND INSTRUMENT BUILDING
26. AMINE STORAGE TANK
27. CO2 COMPRESSOR LP STAGE
28. CO2 DE-OXYGENATION PACKAGE
29. CO2 DEHYDRATION PACKAGE
30. CO2 COMPRESSOR HP STAGE
31. NATIONAL GRID AGI - CO2 EXPORT
32. FIRE WATER TANK
33. FIRE WATER PUMP BUILDING
34. DEMIN WATER TANK

WORK 1E - GENERATING STATION SUPPORTING USES

35. ADMIN BUILDING
36. CONTROL ROOM
37. STORES BUILDING
38. WATER TREATMENT BUILDING
39. RAW WATER BALANCING TANK
40. TREATED WATER TANK

OTHER PLANT AREAS

41. NATIONAL GRID AGI - NATURAL GAS
42. SSE AGI - NATURAL GAS
43. GUARD HOUSE
44. MAIN CAR PARK
45. VISITOR CAR PARK
46. OVERFLOW CAR PARK

Project Management Initials: Designer: Checked: Approved:

Last saved by: JAMIE.CALVERT(2022-04-04) Last Plotted: 2022-04-04 AutoCAD Version: 23.1S (LMS TECH)
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-113.DWG

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

THE ORDER LIMITS

Works Plan:

WORK NO. 1A CCGT PLANT

WORK NO. 1B CCGT COOLING INFRASTRUCTURE

WORK NO. 1C CARBON CAPTURE PLANT

WORK NO. 1E GENERATING STATION SUPPORTING USES

ISSUE/REVISION

01	05/04/2022	DCO APPLICATION
I/R	DATE	DESCRIPTION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

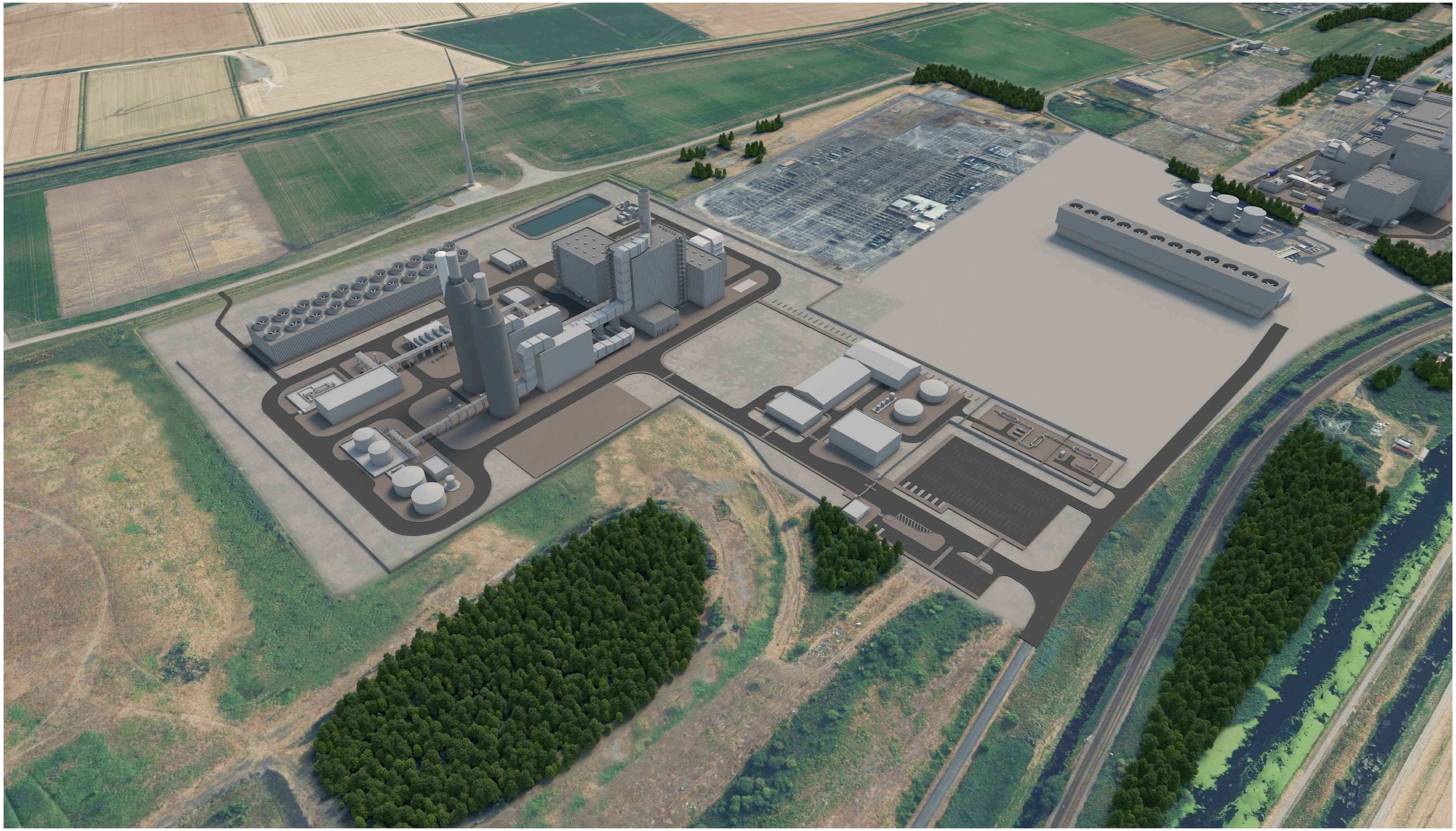
60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Twin Absorber
Sheet 8 of 10 - Layout View

SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-113



0 25 50 m
1:1000 @A1

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND

ISSUE/REVISION

01	05/04/2022	DCO APPLICATION
I/R	DATE	DESCRIPTION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Twin Absorber
Sheet 9 of 10 - 3D Aerial View

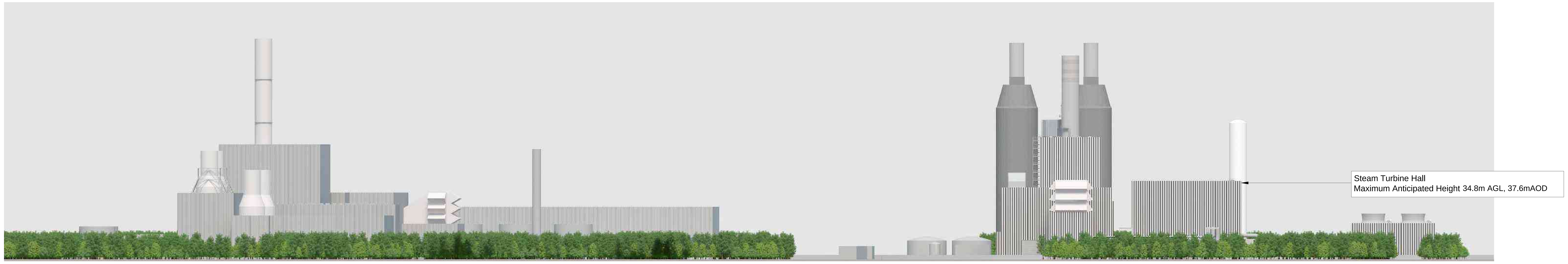
SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-114

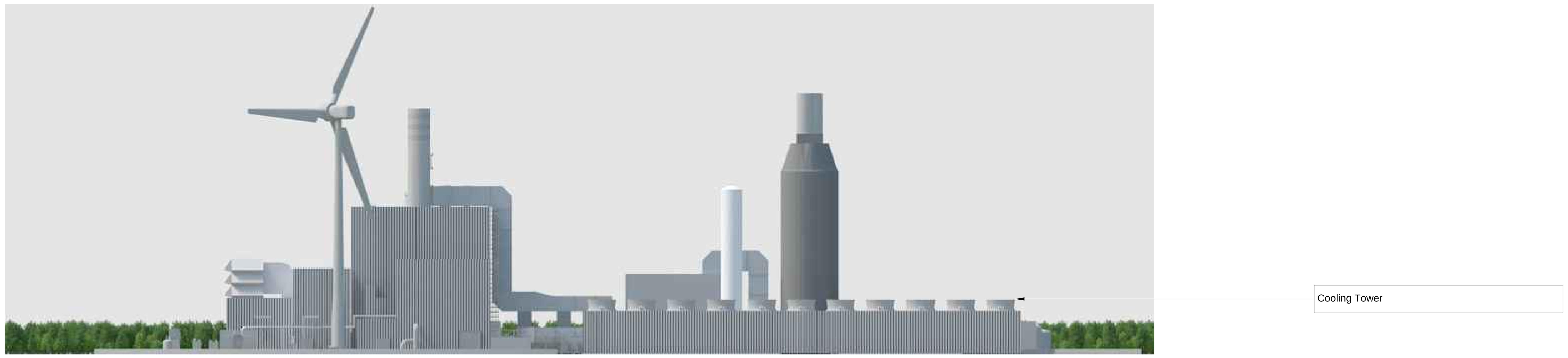
Project Management Initials: Designer: Checked: Approved:

Last saved by: JAMIE.CALVERT(2022-04-04) Last Plotted: 2022-04-04
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-114.DWG
AutoCAD Version: 23.1S (LMS TECH)

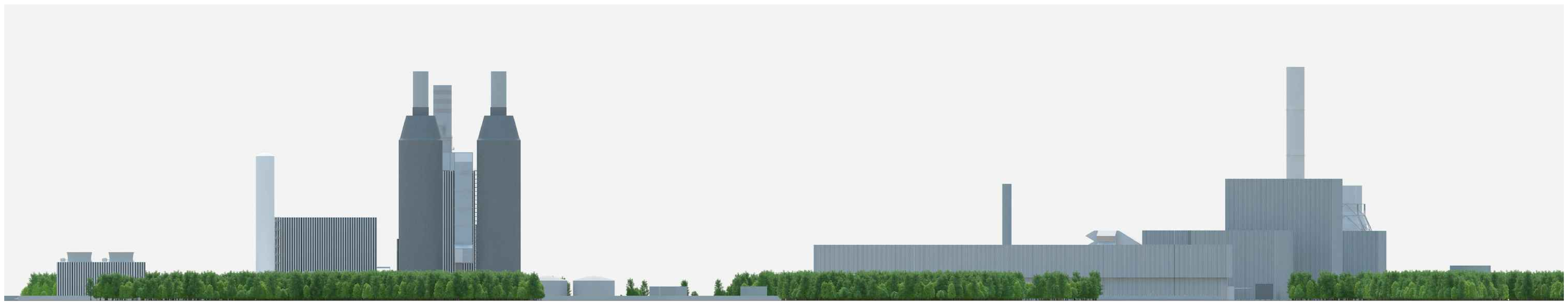
SOUTH ELEVATION



EAST ELEVATION



NORTH ELEVATION



WEST ELEVATION

0 25 50 m
1:1000 @A1

Project Management Initials: Designer: Checked: Approved:

Last saved by: JAMIE.CALVERT(2022-04-04) Last Plotted: 2022-04-04 AutoCAD Version: 23.1S (LMS TECH)
Filename: C:\USERS\JAMIE.CALVERT\DOCUMENTS\PROJECTS\SSE MEDWAY & KEADBY CCS THERMOFLOW\DCO DRAWINGS\60625943-PE-DRG-115.DWG

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

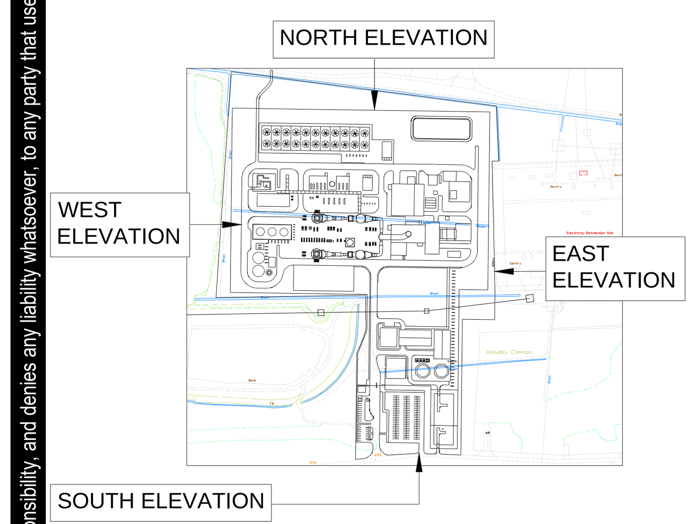
APPLICANT

Keadby Generation Limited

CONSULTANT

AECOM LIMITED
GROUND FLOOR
2 CITY WALK
LEEDS, LS11 9AR
T:+44-(0)113-301-8400
WWW.AECOM.COM

LEGEND



PLAN VIEW

ISSUE/REVISION

01	05/04/2022	DCO APPLICATION
I/R	DATE	DESCRIPTION

NOTES

The Keadby 3 Low Carbon Generating Station Order Regulation 5(2)(o) - Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

ISSUE PURPOSE

DCO APPLICATION

PROJECT NUMBER

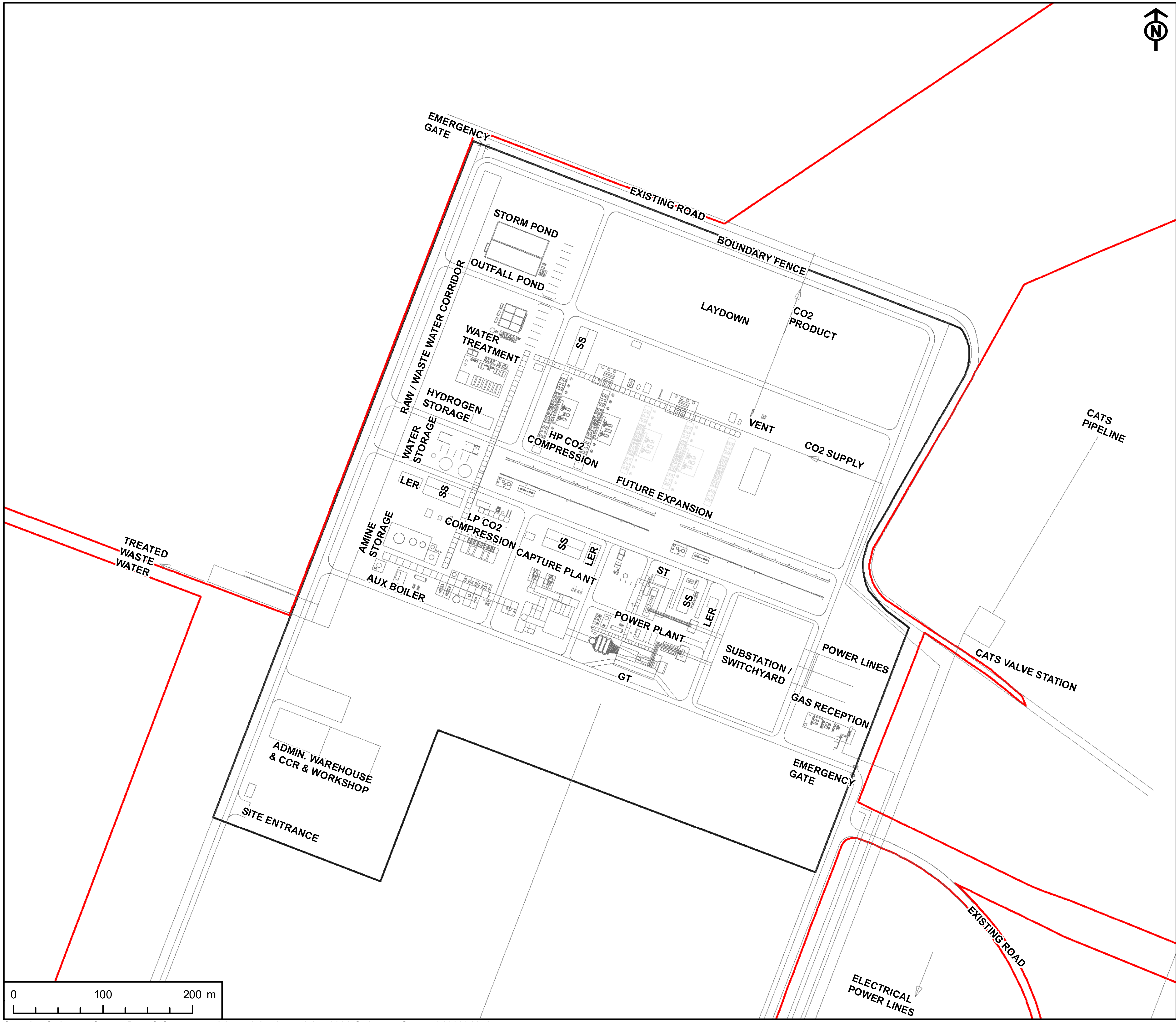
60625943

SHEET TITLE

Indicative Proposed Power and Carbon Capture Layout and Elevations/Section Plans Twin Absorber
Sheet 10 of 10 - Elevations View

SHEET NUMBER

Application Document Ref. 4.7
60625943-PE-DRG-115



Contains Ordnance Survey Data © Crown copyright and database rights 2022 Ordnance Survey 0100031673

Scale @ A3 1:4,000

Project Management Initials: RL Designer: LC Checked: AR Approved: IC

AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

Site Boundary

Power, Capture and Compressor Site

TITLE

FIGURE 4-1
INDICATIVE PCC SITE LAYOUT

REFERENCE

NZT_221025_ES_4-1_v5

SHEET NUMBER: 1 of 1

DATE: 25/10/2022

Riverside Energy Park

Illustrative Site Layout Plan

VOLUME NUMBER:

02

PLANNING INSPECTORATE REFERENCE NUMBER:

EN010093

DOCUMENT REFERENCE:

2.4

November 2018 | Revision 0 | APFP Regulation 5(2)(o)

Planning Act 2008 | Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

CORY
RIVERSIDE ENERGY

WEEDON architects
Harry's Yard
176-178 Newhall St
Birmingham B3 1SJ
T: 0121 454 4171
F: 0121 455 9152
www.weedonarchitects.co.uk

CORY RIVERSIDE ENERGY

RIVERSIDE ENERGY PARK

NORMAN ROAD BELVEDERE LONDON

DOC REF 2.4 ILLUSTRATIVE SITE LAYOUT PLAN

THE RIVERSIDE ENERGY PARK SITE LONDON

REGULATION 5(2)(o)

Date	13.11.18
A1 Scale	1:750
Drawn by	AG
Checked by	PC
Drawing Number	DOC REF 2.4

CORY

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX C: NZT RECOMMENDAT-ION REPORT EXTRACT - CA AND FLEXIBILITY

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

The Infrastructure Planning (Examination Procedure) Rules 2010 - Rule 8(1)(c)

The Planning Inspectorate
Yr Arolygiaeth Gynllunio

The Planning Act 2008

Net Zero Teesside Project

Examining Authority's Report
of Findings and Conclusions

and

Recommendation to the Secretary of State for
Business, Energy and Industrial Strategy

Examining Authority

Kevin Gleeson BA MCD MRTPI Panel Lead

Susan Hunt BA (Hons) MA MRTPI

Beth Davies BSc (Hons) MSc FGS CGeol

10 February 2023

currently no legal agreement that would secure this, and as such plots 292 and 293 must remain as proposed for TP. The area of land involved for Work No.9 has been appropriately reduced through the second change request. The same conclusion applies to land relating to the 'Red Main' access to RBT and other areas of STDC land where there may be an alternative, but which has not been secured voluntarily.

8.39.46. We are satisfied that the CA of rights easement corridor for utilities has been demonstrated, through the Applicants' responses to our questions and within the 'Justification for Pipeline Corridors Widths' document. As we have concluded for other APs, we understand the need for flexibility and that on completion of further technical work that such corridors are likely to substantially decrease in width. Article 31 of the dDCO would allow the Applicants to initially take TP of the whole width of corridors required for connections. Once detailed surveys have been carried out and the relevant apparatus installed the Applicants could then acquire new rights within a narrower strip in which permanent rights are required, within the wider construction corridor. This phased approach to occupation and acquisition allows the permanent rights corridor to be defined after construction, and to be only that which is necessary for the operation, maintenance, and protection of the apparatus.

8.39.47. We also recognise that the wide areas applied for would also allow for flexibility in the positioning of services in the event that another developer has similar requirements for the land, therefore we do not accept that the proposed width of the easement corridor would sterilise or blight future developments.

8.39.48. Overall, the land interests of STDC would be adequately protected through the provisions in Schedule 12 Part 20 of the recommended DCO. The Applicants have provided a reasoned explanation for the extent of proposed CA of land and rights. There is a justified need for the land for the land to be utilised for and in connection with the Proposed Development.

8.39.49. Whilst the Applicants acknowledge that some plots sought may not ultimately need to be the subject of the CA powers, they are not yet in a position to confirm that to be the case. The Applicants would not use these powers if they were not needed for the Proposed Development or if a narrower easement could be agreed between parties. We consider that to be a reasonable approach.

8.39.50. The concerns raised by STDC would not, in themselves, preclude the finding that there would be a compelling case in the public interest for the CA powers sought. We are satisfied that the proposed powers of CA in relation to STDC's plots would be necessary and are justified in the public interest.

8.40. Stockton-on-Tees Borough Council

8.40.1. STBC is a freehold landowner of a number of plots in the Billingham area, which comprise public highway land at Belasis Avenue, Nelson Avenue,

- Current and future management of the pipeline corridor.

8.51.4. We have taken account of the representations and objections made by landowners, business owners, Statutory Undertakers and other parties, and the Applicants' responses on the matters raised. There are only 17 landowners affected by CA, most of whom are also occupiers of land within the Order Limits, with some also having leaseholder status. Numerous other APs are not landowners or leaseholders but are occupiers with significant rights, principally in relation to the pipeline corridors and/or are Statutory Undertakers. The summary at Table 4 below specifies the status of each AP together with our understanding of the current status of negotiations. Taking in turn the common points as set out above, we comment as follows.

8.51.5. **Lack of design detail leading to uncertainty**: The 'First of a Kind' status of the project means that many details are unknown until full surveys and engineering designs are carried out. Whilst work on such matters was clearly ongoing throughout the Examination, as evidenced by the significant reduction in Order Limits through the change requests, there remain details that are likely to take longer to finalise and are dependent on several external factors. We accept the need for flexibility and are satisfied that the proposed parameters within the confines of the Rochdale Envelope provide sufficient certainty to understand the effects of the Proposed Development and in order to make recommendations to the SoS.

8.51.6. **Excessive land take**: This is related to the need for design flexibility as set out above. The Applicants have provided sufficient explanation in the 'Justification of Corridor Widths' document and other written submissions that the various widths around pipeline corridors and other infrastructure is required to deliver the Proposed Development. Aside from design details still being finalised, a range of other factors mean that routes of pipelines and other utilities need to remain flexible. These include unknown site conditions prior to full surveys, presence of other infrastructure, access requirements and the likelihood of other developments coming forward in the same area. In some cases widths have already been reduced, or changed to TP. The dDCO also includes provision for the land take to be reduced following the detailed design process.

8.51.7. **Excessive duration of rights**: Several APs raised this as an issue, stating that the CO_2 pipeline is likely to have a limited design life, so rights in perpetuity are unnecessary. The Applicants have adequately explained that the operational life of the Proposed Development is currently unknown, and may well operate beyond its design life, but as it would be a regulated asset the rights would be required for ongoing maintenance and access to enable its continued safe operation.

8.51.8. **Lack of consideration for reasonable alternatives**: This was a particular theme in representations from STDC (Tees Dock Road access), CNSL and NSMP (CATS and TGPP terminals). Should voluntary agreements be secured in the post-Examination period with the relevant

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX D: FLEXIBILITY LAYOUT DRAWINGS

DECARBONISATION

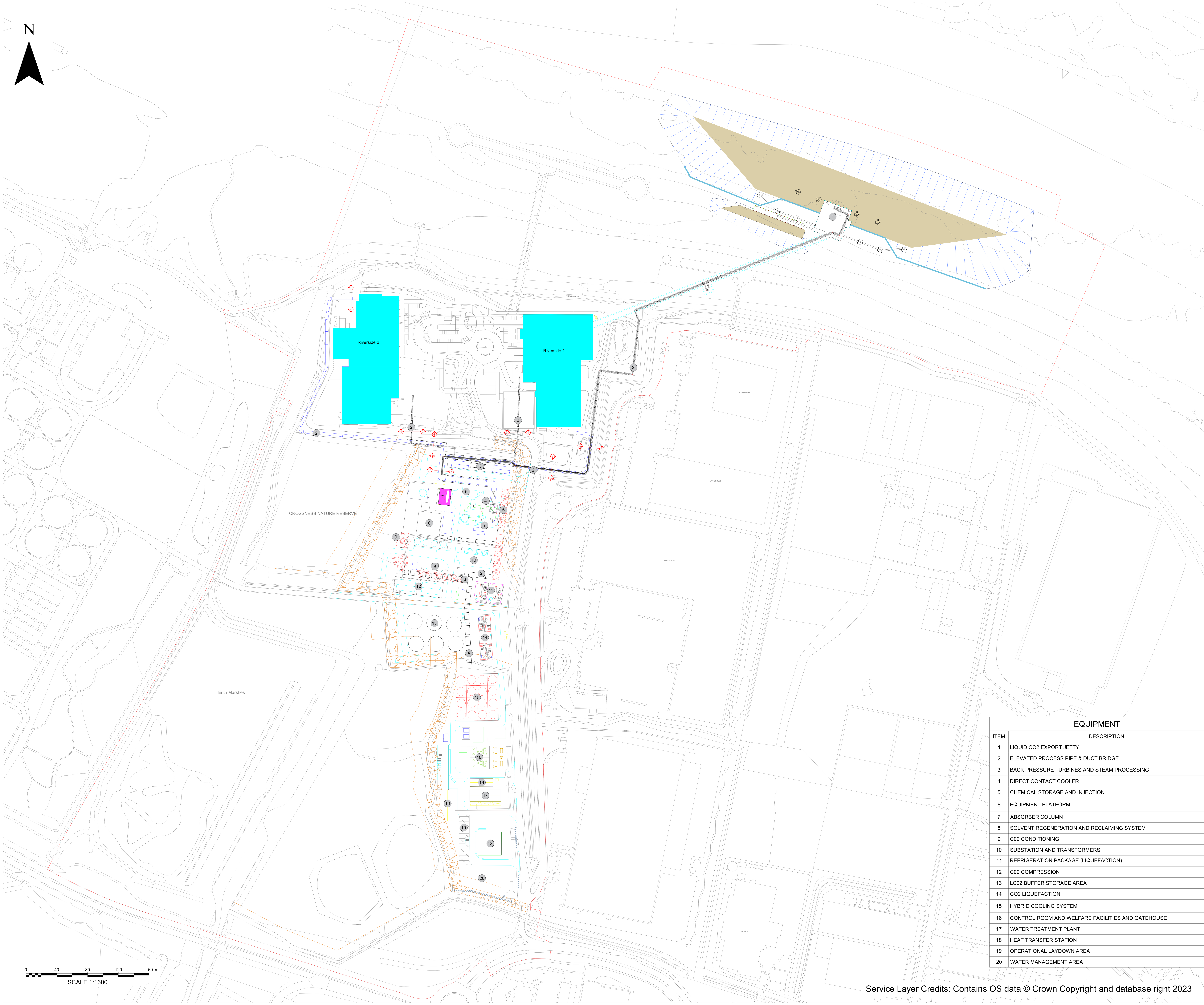
Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

The Infrastructure Planning (Examination Procedure) Rules 2010 - Rule 8(1)(c)



Service Layer Credits: Contains OS data © Crown Copyright and database right 2023

EQUIPMENT

ITEM	DESCRIPTION
1	LIQUID CO2 EXPORT JETTY
2	ELEVATED PROCESS PIPE & DUCT BRIDGE
3	BACK PRESSURE TURBINES AND STEAM PROCESSING
4	DIRECT CONTACT COOLER
5	CHEMICAL STORAGE AND INJECTION
6	EQUIPMENT PLATFORM
7	ABSORBER COLUMN
8	SOLVENT REGENERATION AND RECLAIMING SYSTEM
9	C02 CONDITIONING
10	SUBSTATION AND TRANSFORMERS
11	REFRIGERATION PACKAGE (LIQUEFACTION)
12	C02 COMPRESSION
13	LC02 BUFFER STORAGE AREA
14	CO2 LIQUEFACTION
15	HYBRID COOLING SYSTEM
16	CONTROL ROOM AND WELFARE FACILITIES AND GATEHOUSE
17	WATER TREATMENT PLANT
18	HEAT TRANSFER STATION
19	OPERATIONAL LAYDOWN AREA
20	WATER MANAGEMENT AREA

DO NOT SCALE

Scale: 1:10000

KEY:

- OUTLINE OF EXISTING PLANT
- ORDER LIMITS
- DREDGE POCKET
- DREDGE SLOPES
- INDICATIVE LOCATION OF RETAINING WALL TO ENABLE DREDGING

NOTES:

1. **THIS DRAWING IS FOR INFORMATION ONLY AND SHALL NOT BE USED FOR ANY OTHER PURPOSE**
2. **LOCATION OF PROPOSED INFRASTRUCTURE SHOWN INDICATIVELY**
3. **ALL LEVELS ARE IN METERS TO ORDINANCE DATUM (OD) UNLESS STATED OTHERWISE**
4. **THIS PLAN SHOWS ONLY ONE EXAMPLE WAY THAT THE PROPOSED SCHEME COULD BE LAID OUT WITHIN THE PARAMETERS AND LIMITS OF DEVIATION SET BY THE DEVELOPMENT CONSENT ORDER TO AID UNDERSTANDING OF THE PROPOSED SCHEME**
5. **LANDSCAPING AND BUFFER ZONES HIDDEN FOR CLARITY**

REVISION	DRAWN	CHECKED	APPROVED	DATE
0	AA	TA	TA	05/02/2025
FINAL				

DESCRIPTION

CORY

PROJECT TITLE:

CORY DECARBONISATION PROJECT

DRAWING TITLE:

INDICATIVE EQUIPMENT LAYOUT (SINGLE CARBON CAPTURE TRAIN OPTION)

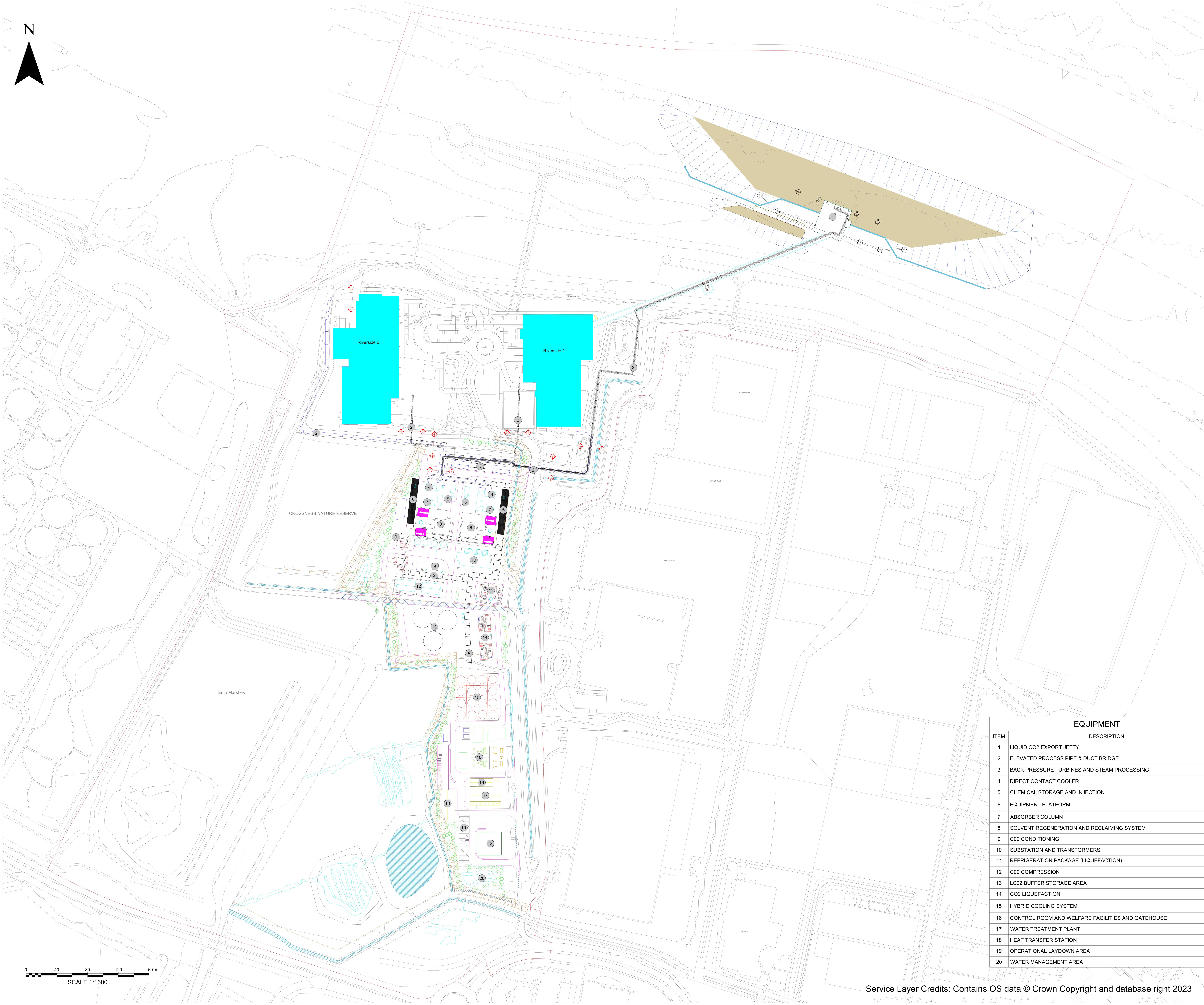
DRAWING STATUS: FOR CAH2

DRAWN:	CHECKED:	APPROVED:	AUTHORISED:
AA	TA	TA	AV

SCALE @ A0 SIZE:	DATE:	REVISION:
1:1600	FEB 2025	0

DRAWING NUMBER:

EN010128-01-XX-DG-PL-0006



EQUIPMENT	
ITEM	DESCRIPTION
1	LIQUID CO2 EXPORT JETTY
2	ELEVATED PROCESS PIPE & DUCT BRIDGE
3	BACK PRESSURE TURBINES AND STEAM PROCESSING
4	DIRECT CONTACT COOLER
5	CHEMICAL STORAGE AND INJECTION
6	EQUIPMENT PLATFORM
7	ABSORBER COLUMN
8	SOLVENT REGENERATION AND RECLAIMING SYSTEM
9	C02 CONDITIONING
10	SUBSTATION AND TRANSFORMERS
11	REFRIGERATION PACKAGE (LIQUEFACTION)
12	C02 COMPRESSION
13	LC02 BUFFER STORAGE AREA
14	C02 LIQUEFACTION
15	HYBRID COOLING SYSTEM
16	CONTROL ROOM AND WELFARE FACILITIES AND GATEHOUSE
17	WATER TREATMENT PLANT
18	HEAT TRANSFER STATION
19	OPERATIONAL LAYDOWN AREA
20	WATER MANAGEMENT AREA

DO NOT SCALE

Scale: 1:10000

KEY:
- OUTLINE OF EXISTING PLANT
- ORDER LIMITS
- DREDGE POCKET
- DREDGE SLOPES
- INDICATIVE LOCATION OF RETAINING WALL TO ENABLE DREDGING
- WATERCOURSE BUFFER
- ILLUSTRATIVE LANDSCAPE

NOTES:
1. THIS DRAWING IS FOR INFORMATION ONLY AND SHALL NOT BE USED FOR ANY OTHER PURPOSE
2. LOCATION OF PROPOSED INFRASTRUCTURE SHOWN INDICATIVELY
3. ALL LEVELS ARE IN METERS TO ORDINANCE DATUM (OD) UNLESS STATED OTHERWISE
4. THIS PLAN SHOWS ONLY ONE EXAMPLE WAY THAT THE PROPOSED SCHEME COULD BE LAID OUT WITHIN THE PARAMETERS AND LIMITS OF DEVIATION SET BY THE DEVELOPMENT CONSENT ORDER TO AID UNDERSTANDING OF THE PROPOSED SCHEME

0	AA	AC	TA	25/02/2025
FINAL				
REVISION	DRAWN	CHECKED	APPROVED	DATE
DESCRIPTION				

CORY

PROJECT TITLE:

CORY DECARBONISATION PROJECT

DRAWING TITLE:

INDICATIVE EQUIPMENT LAYOUT (THREE LCO2 STORAGE TANKS OPTION)

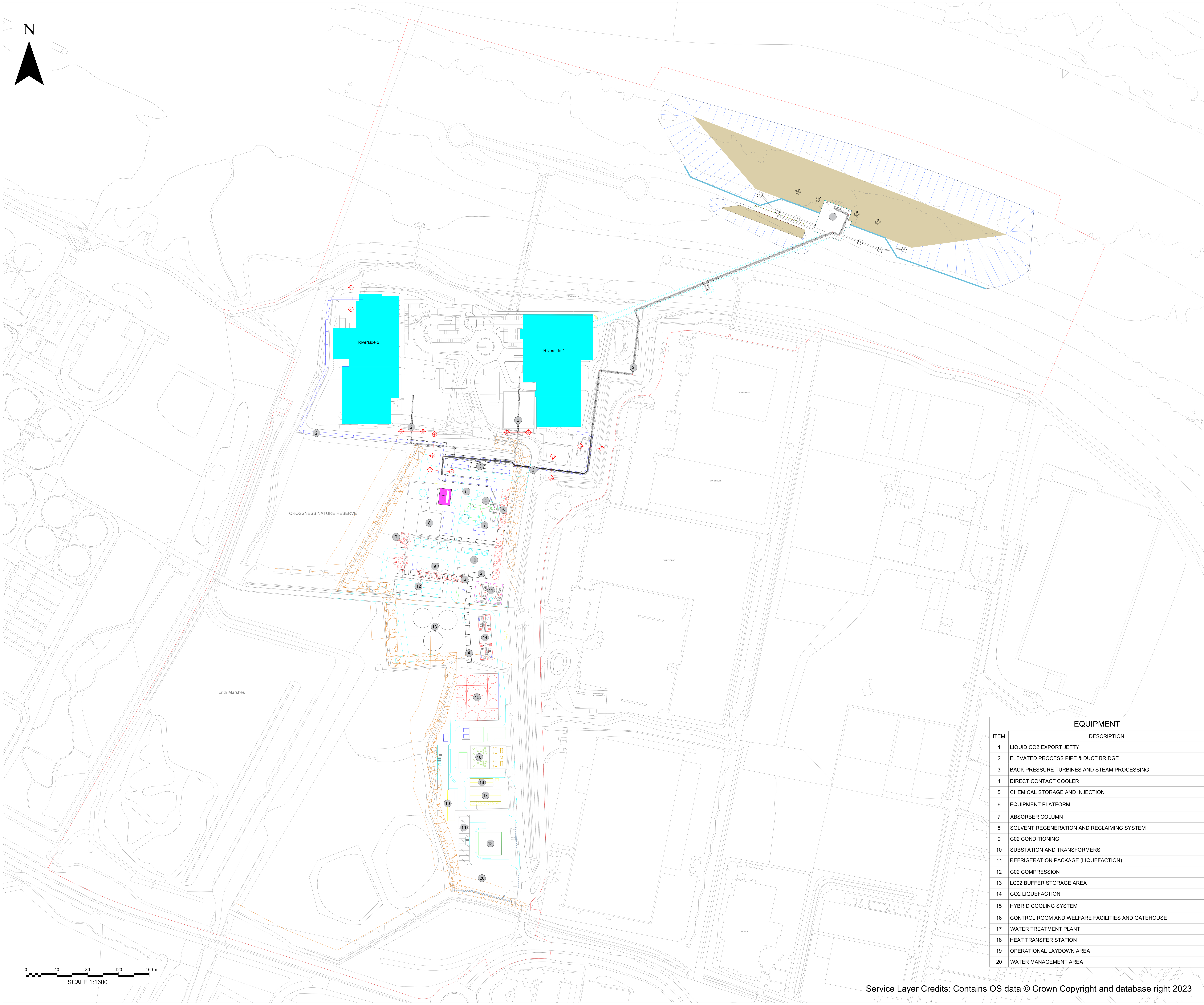
DRAWING STATUS: FOR CAH2

DRAWN:	CHECKED:	APPROVED:	AUTHORISED:
AA	AC	TA	TA

SCALE @ A0 SIZE:	DATE:	REVISION:
1:1600	Feb 2025	0

DRAWING NUMBER:

EN010128-01-XX-DG-PL-0007



EQUIPMENT

ITEM	DESCRIPTION
1	LIQUID CO2 EXPORT JETTY
2	ELEVATED PROCESS PIPE & DUCT BRIDGE
3	BACK PRESSURE TURBINES AND STEAM PROCESSING
4	DIRECT CONTACT COOLER
5	CHEMICAL STORAGE AND INJECTION
6	EQUIPMENT PLATFORM
7	ABSORBER COLUMN
8	SOLVENT REGENERATION AND RECLAIMING SYSTEM
9	C02 CONDITIONING
10	SUBSTATION AND TRANSFORMERS
11	REFRIGERATION PACKAGE (LIQUEFACTION)
12	C02 COMPRESSION
13	LCO2 BUFFER STORAGE AREA
14	CO2 LIQUEFACTION
15	HYBRID COOLING SYSTEM
16	CONTROL ROOM AND WELFARE FACILITIES AND GATEHOUSE
17	WATER TREATMENT PLANT
18	HEAT TRANSFER STATION
19	OPERATIONAL LAYDOWN AREA
20	WATER MANAGEMENT AREA

DO NOT SCALE

Scale: 1:10000

KEY:

- OUTLINE OF EXISTING PLANT
- ORDER LIMITS
- DREDGE POCKET
- DREDGE SLOPES
- INDICATIVE LOCATION OF RETAINING WALL TO ENABLE DREDGING

NOTES:

1. **THIS DRAWING IS FOR INFORMATION ONLY AND SHALL NOT BE USED FOR ANY OTHER PURPOSE**
2. **LOCATION OF PROPOSED INFRASTRUCTURE SHOWN INDICATIVELY**
3. **ALL LEVELS ARE IN METERS TO ORDINANCE DATUM (OD) UNLESS STATED OTHERWISE**
4. **THIS PLAN SHOWS ONLY ONE EXAMPLE WAY THAT THE PROPOSED SCHEME COULD BE LAID OUT WITHIN THE PARAMETERS AND LIMITS OF DEVIATION SET BY THE DEVELOPMENT CONSENT ORDER TO AID UNDERSTANDING OF THE PROPOSED SCHEME**
5. **LANDSCAPING AND BUFFER ZONES HIDDEN FOR CLARITY**

REVISION	DRAWN	CHECKED	APPROVED	DATE
0	AA	TA	TA	11/02/2025
FINAL				

DESCRIPTION

CORY

PROJECT TITLE:

CORY DECARBONISATION PROJECT

DRAWING TITLE:

INDICATIVE EQUIPMENT LAYOUT
(SINGLE CARBON CAPTURE TRAIN AND THREE LCO2 STORAGE TANKS OPTION)

DRAWING STATUS: FOR CAH2

DRAWN:	CHECKED:	APPROVED:	AUTHORISED:
AA	TA	TA	AV

SCALE @ A0 SIZE:	DATE:	REVISION:
1:1600	FEB 2025	0

DRAWING NUMBER:

EN010128-01-XX-DG-PL-0008

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX E: ELECTRICAL CONNECTIONS NOTE

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

TABLE OF CONTENTS

FIGURE

TABLE

ANNEXURES

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. As part of the Examination process into the Cory Decarbonisation Project ('the Proposed Scheme') Landsul Limited and Munster Joinery (UK) Limited ('LMJ') have engaged CRE Future Energies Ltd and Blake Clough Consulting Ltd ('Blake Clough') to review the Proposed Scheme and the Applicant's basis of electrical design indicative equipment layout in particular, on the basis of seeking to suggest that the amount of land proposed for electrical infrastructure within the indicative layout for the Proposed Scheme is excessive

1.1.2. Blake Clough is specifically contesting one element of the Applicant's basis of design which is the requirement for a 132kV electrical supply and associated step-down infrastructure. Blake Cough suggest that the electrical supply could be achieved using an 11kV supply from the existing Riverside 1 and under development Riverside 2 facilities, thereby reducing in part the amount of land needed for the Proposed Scheme.

1.1.3. Building on work previously done to explore if a 11kV supply was possible, this note provides a review of Blake Clough's justification for the use of an 11kV supply connection. For a number of reasons, WSP consider an 11kV supply is not feasible for the Proposed Scheme.

1.2. SCOPE

1.2.1. The purpose of this Technical Note is to provide an overview for the technical feasibility of various options for obtaining a potential 11kV connection for the supply of electricity to the Cory CCF, and in so doing respond to the suggestions put forward by Blake Clough.

2. SUMMARY OF CCF SUPPLY REQUIREMENTS

2.1.1. WSP understands that, the CCF will be an independent entity, separate from R1 and R2 facilities, with resilient 100% redundant power supply connections.

2.1.2. A high-level load assessment of the new CCF has estimated the load to be 44MW.

2.1.3. There is opportunity within the design to recover energy from the let-down of steam from the existing ERF through back-pressure turbine(s) that will in turn generate electricity and lower the internal demand of the CCF. However, an electrical supply that can provide the full 44MW electrical demand is required as it represents the worst-case demand that can be experienced when the back pressure turbine(s) are not operating due to planned or unplanned outages.

3. RIVERSIDE 1 & 2 ELECTRICAL CONFIGURATION

3.1. RIVERSIDE 1

3.1.1. Figure 1 shows a simplified single line representation of the existing Riverside 1 (R1) Energy-from-Waste (EfW) generator and connection to the associated 132/11kV step-up transformers. The output of the generator is connected directly from the output terminals of the machine via an underground ducted circuit consisting of 9 x 1core 630mm^2 copper cables per phase, totalling 27 cables. The generator cable circuit is routed underground and emerges into the transformer compound where it is terminated into Air Insulated Busduct (AIB). The AIB connection at this point tees off to connect into two Generator Circuit breakers (GCBs). The GCBs are in turn connected to the secondary windings of 2 three-winding step-up transformers using a short section of AIB located in the transformer compound area.

3.1.2. Auxiliary power for the EfW auxiliaries is obtained from a dedicated winding of each three-winding step-up transformer, rated at 12MVA per transformer.

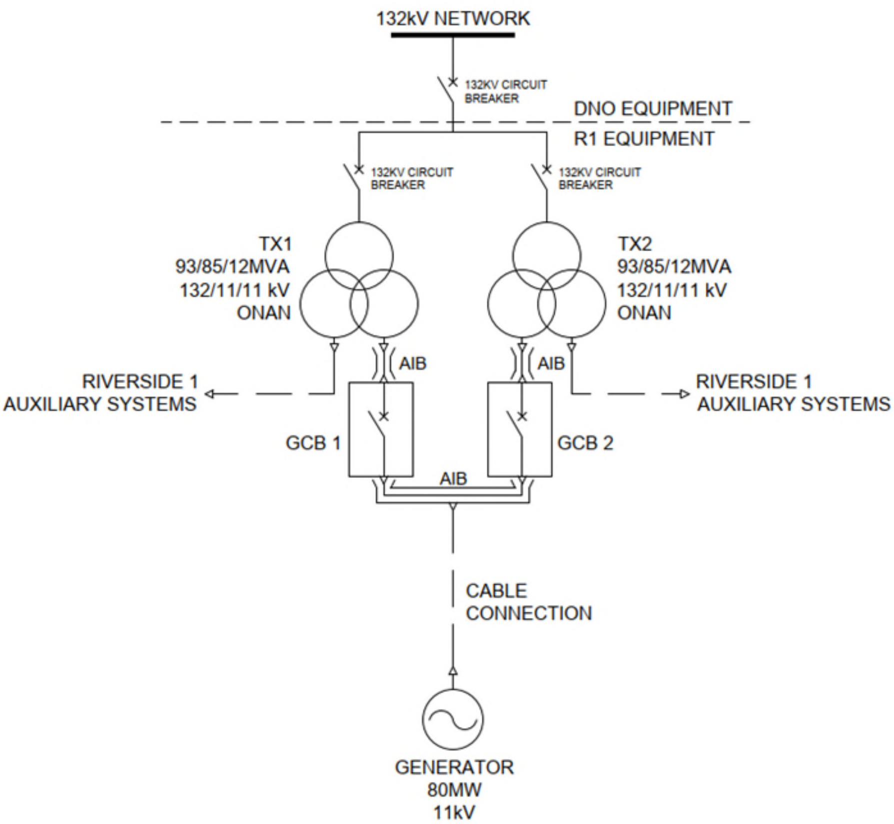


Figure 1 - Simplified SLD for Generator Export Connection - R1

3.2. RIVERSIDE 2

3.2.1. Figure 2 shows a simplified single line representation of the proposed Riverside 2 (R2) EfW generator and connection to the 132/11kV step-up transformer, based on available drawings. The output of the generator is made by a direct connection from the output terminals of the machine via an underground circuit consisting of Non-Segregated Phase Busduct (NSPB). The generator circuit is routed underground and emerges into the transformer compound where is it terminated into the GCB.

3.2.2. The output from the GCB is connected to the Plant's Generator Step-Up Transformer (GSUT) (plant no. 90BAT01) via Isolated Phase Busducts (IPBs). A tee-off from this connection (also accomplished via IPBs) supplies the Plant's Unit Auxiliary Transformer (UAT) (plant no. 9BBT01) which has a capacity of 18MVA and provides power to the EfW Plant auxiliaries. The IPB connections are made within the transformer compound area.

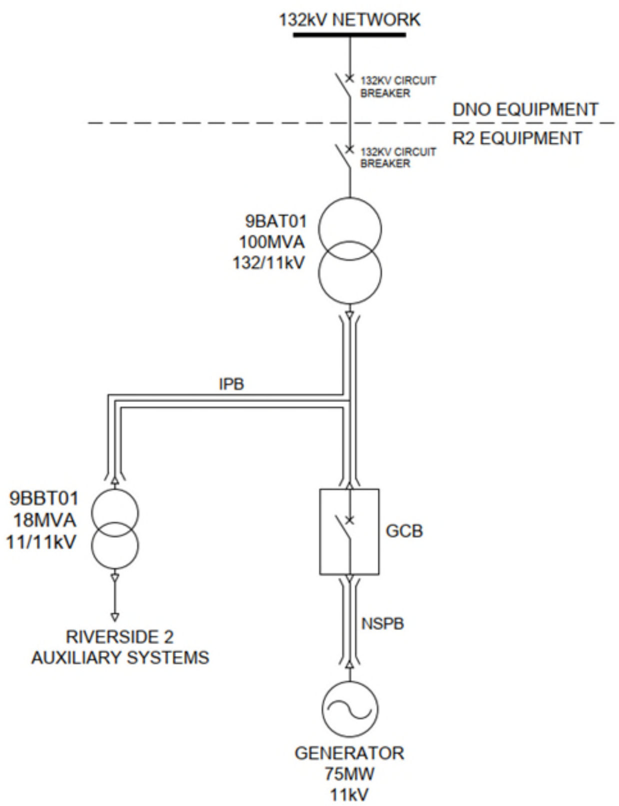


Figure 2 - Simplified SLD for Generator Export Connection - R2

4. CCF SUPPLY OPTIONS

4.1. CAPACITY OF EXISTING EFW 11KV AUXILIARY SYSTEMS

4.1.1. WSP has determined that the existing EfW auxiliary power systems at Riverside 1 and 2 do not have sufficient capacity to supply the CCF.

4.1.2. The Riverside 1 11kV auxiliary system is supplied via two 12MVA tertiary windings on the main step-up transformers (understood to operate as a 2 x 100% redundant pair) and hence do not have sufficient capacity to support 44MW of additional CCF demand.

4.1.3. The Riverside 2 11kV auxiliary system is supplied via an 18MVA two-winding UAT and hence does not have sufficient capacity to support 44MW of additional CCF demand.

4.1.4. Furthermore, the 11kV switchboards at both Riverside plants are not rated to carry the additional power required for the new CCF. The 11kV switchboards also cannot be extended or re-configured due to space constraints in the electrical switchgear rooms.

4.2. REPLACEMENT OR UPGRADE OF THE RIVERSIDE 1 AND RIVERSIDE 2 TRANSFORMERS

4.2.1. WSP does not consider the replacement of the three winding transformers (at Riverside 1) or UAT (Riverside 2) to provide power with larger capacity units to be a practical option. Reasons for this include:

- Exchanging the transformers for larger units would have a significant impact on the existing 11kV infrastructure at both Plants; for example, due to increased fault currents. This would require substantial re-configuration and replacement of the existing 11kV infrastructure;
- Both Plants would require major changes to the existing transformer compounds;
- Undertaking the required modifications would require the Plants being offline for a significant period of time; and
- Transformers of the required sizes are long-lead equipment items.

4.3. DIRECT 11KV SUPPLY FROM EFW GENERATOR MAIN CONNECTIONS

4.3.1. WSP has considered a number of options for obtaining supplies for the CCF from the main 11kV connections at the EfW plants. In this context, ‘main 11kV connections’ refers to the high-current connections between the generator and the associated main step-up transformer.

4.3.2. Unlike the EfW auxiliary 11kV systems, the generator main 11kV connections are less constrained in terms of available power. However, there are significant practical and physical constraints with making new connections to these existing systems.

RIVERSIDE 1

4.3.3. WSP has considered the feasibility of obtaining a direct supply from three points within the generator main 11kV connections of the Riverside 1 plant. In all cases it is WSP's position that it would not be practical to obtain a 100% redundant 11kV connection point for the following reasons:

4.3.4. **Option 1:** Tee-off connection between the Generator and the AIB connection (hypothetical SLD in Figure 3):

- Almost all of the connection between the generator and the AIB is underground and emerges in the transformer compound via a discrete cable riser into the AIB. WSP does not consider it practical to "break-in" to this circuit and create a new 11kV tee-off connection from which to supply the new CCF. This is due the physical constraints of the existing connection. Figure 4 shows the limitations of the space surrounding the transformer compound and Figure 5 shows the indoor location of the GCBs. WSP does not consider there to be suitable available space on site to include additional equipment to make a new 11kV connection. Breaking into the underground cable connection would also be very difficult due to the number of large cables (27) involved, which would all need to be diverted to a new intermediate switchgear assembly to provide a common point of isolation for the whole circuit.
- A new intermediate switchgear assembly would be required to provide protection and isolation for the CCF cable and to allow the generator to be disconnected from the rest of the R1 plant for synchronisation, and to prevent the generator running in motoring mode which could cause damage.
- The output of the generator is approximately 5,000A continuous. WSP's understanding is that commercially offered standard cubicle type switchgear, which would be typically used for applications of this type, does not include ratings of 5,000A. This would mean using a larger and more bespoke solution for the intermediate switchgear, which would exacerbate the issues around space requirements for additional equipment.
- The in-line type GCBs have been used between the generators and step-up transformer to account for near-to-generator fault phenomena These phenomena (such as delayed current zeros, transient recovery voltage, etc.) place increased demands on circuit breakers used near to large generators, which are likely to be beyond the capability of standard cubicle type switchgear, significantly increasing equipment footprints, costs and complexity.

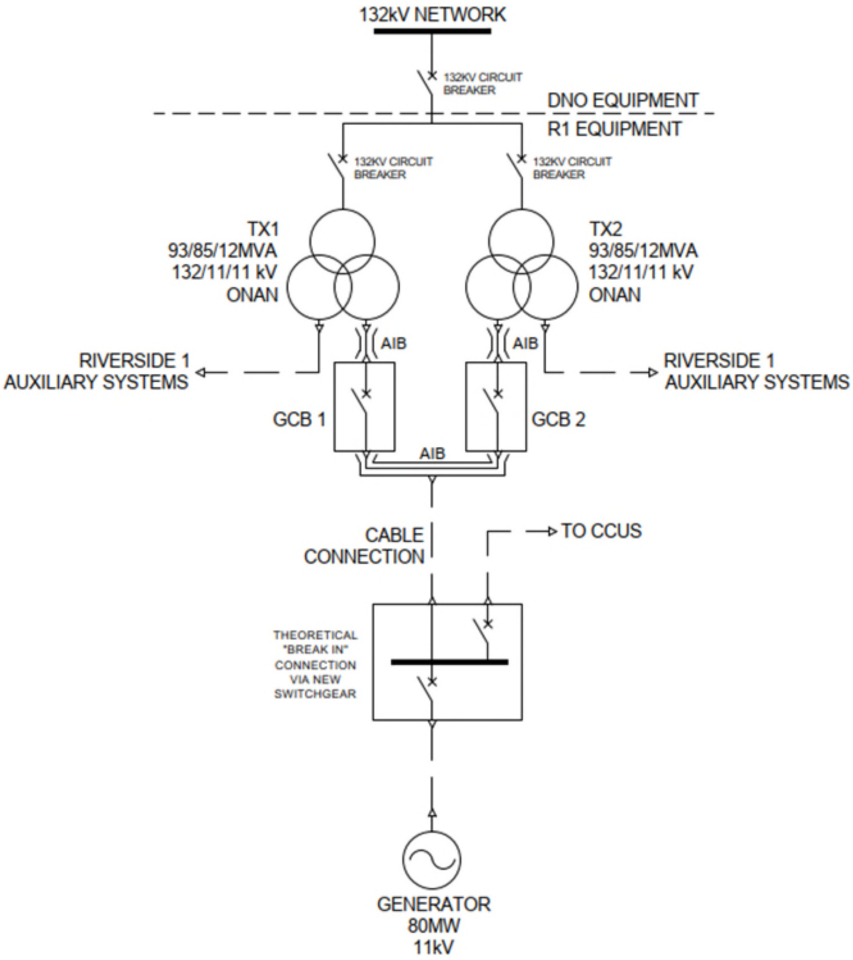


Figure 3 - SLD Showing a Theoretical 11kV "Break in" Connection – R1

Figure 4 - Aerial View of R1 Step-up Transformers (Approximate Location of Figure 5 Below Boxed in Yellow)

Figure 5 - View Inside R1 GCB Area

4.3.5. **Option 2:** Tee-off connection on the AIB between the generator and GCB (hypothetical SLD in Figure 6):

- WSP has estimated that to provide a 100% redundant connection to the new Carbon Capture Facility would require between 4-5 single core 630mm² Cu cables per phase. WSP considers this connection to be physically impractical to derive from the AIB due to the space constraints, highlighted in Figure 5. Any modification to the existing AIB would also result in a significant Plant outage.
- A new switchgear assembly would be required to provide protection and isolation for the CCF cable and to allow the generator to be disconnected from the rest of the R1 plant for synchronisation, and to prevent the generator running in motoring mode which could cause damage. Insufficient space is available to accommodate this switchgear, particularly if it needs to be rated for near-to-generator fault duty.

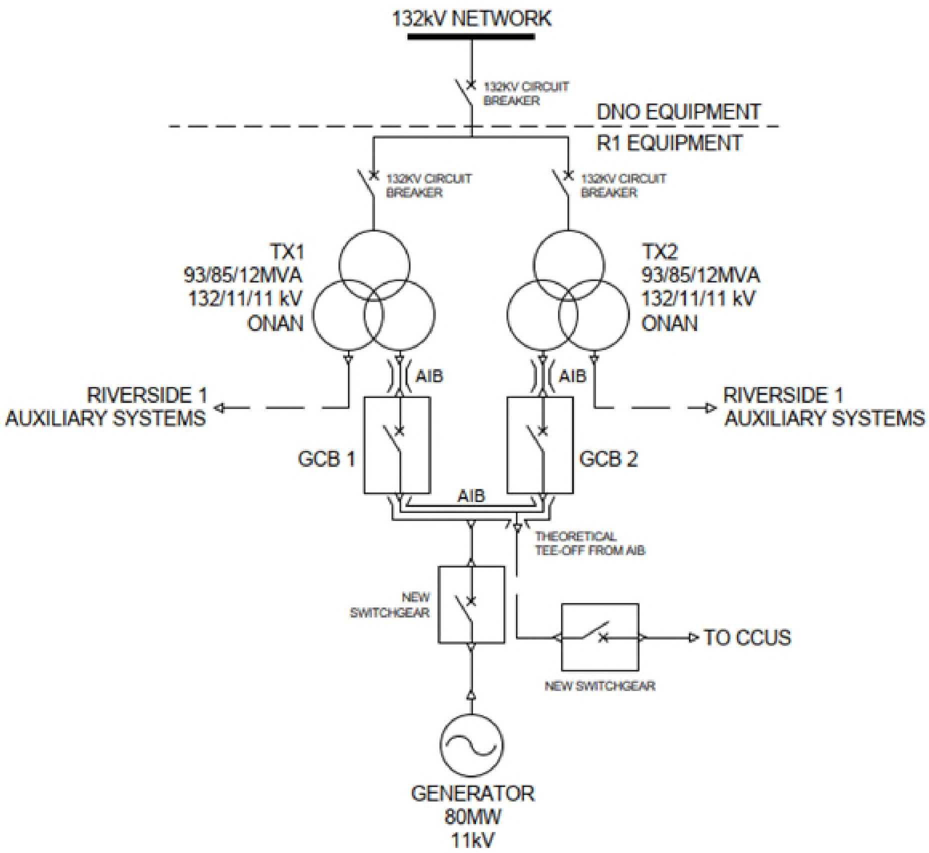


Figure 6 - SLD Showing a Direct Connection to the AIB on the Generator Side of the GCB – R1

4.3.6. **Option 3:** Tee-off connection on the AIB between the GCBs and the step-up transformers (hypothetical SLD in Figure 7):

- The AIB is located in the transformer compound, and WSP has estimated that to provide a 100% redundant connection to the new Carbon Capture Facility would require between 4-5 single core 630mm² Cu cables per phase. WSP considers this connection to be physically impractical due to the space constraints, highlighted previously in Figure 4 and Figure 5. Any modification to the existing AIB would also result in a significant Plant outage.
- A new switchgear assembly would be required to provide protection and isolation for the CCF cable. Insufficient space is available to accommodate this switchgear, particularly if it needs to be rated for near-to-generator fault duty.

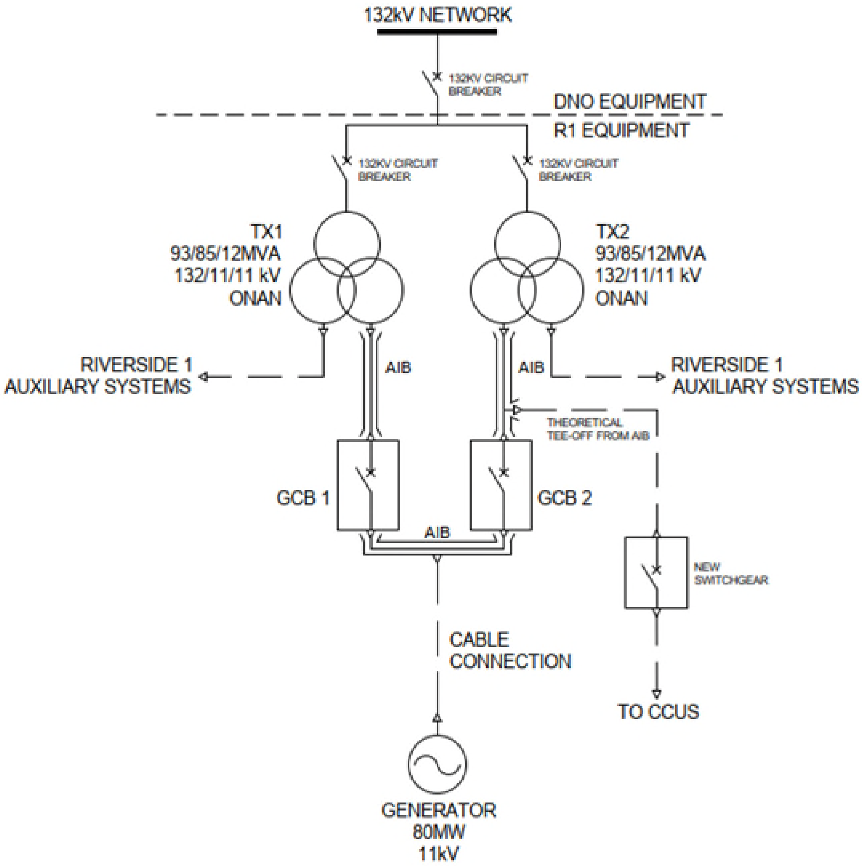


Figure 7 - SLD Showing a Direct Connection to the AIB on the Transformer Side of the GCB – R1

RIVERSIDE 2

4.3.7. WSP has considered the feasibility of obtaining a direct supply from two points within the generator main 11kV connections of Riverside 2 plant. In both cases it is WSP's position that it would not be practical to obtain a 100% redundant 11kV connection point for the following reasons:

4.3.8. **Option 1:** Tee-off connection on the NSPB between the generator and GCB (hypothetical SLD in Figure 8):

- Most of the circuit connection between the Generator and the GCB is underground in Non-Segregated Phase Busduct (NSPB) and emerges in the transformer compound. WSP does not consider it practical to "break-in" to this circuit and create a new 11kV connection level from which to supply the new Carbon Capture facility due the physical constraints of the connection, and the available space on site.

- New switchgear assemblies would be required to provide protection and isolation for the CCF cable and to allow the generator to be disconnected from the rest of the R2 plant for synchronisation, and to prevent the generator running in motoring mode which could cause damage. Insufficient space is available to accommodate this switchgear.
- Since the output of the generator is approximately 4,700A, WSP does not consider it an option to find standard commercially offered cubicle switchgear with the ratings required. The new switchgear would likely need to be of similar dimensions to the existing GCB.
- The in-line type GCBs have been used between the generators and step-up transformer to account for near-to-generator fault phenomena. These phenomena (such as delayed current zeros, transient recovery voltage, etc.) place increased demands on circuit breakers used near to large generators, which are likely to be beyond the capability of standard cubicle type switchgear, significantly increasing equipment footprints, costs and complexity will be significantly increased.

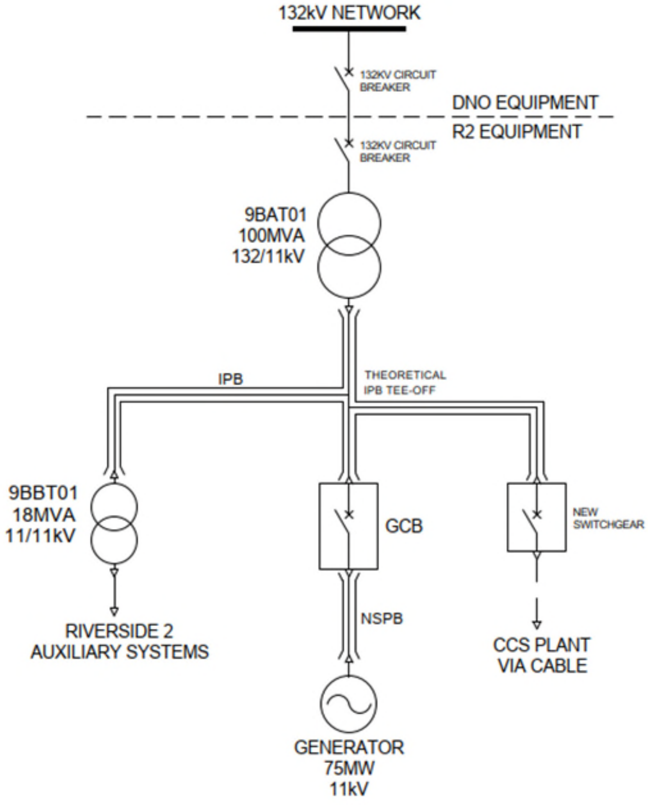


Figure 8 - SLD Showing a Tee-off Connection from the NSPB – R2

4.3.9. **Option 2:** Tee-off connection on the IPB between the GCB and the step-up transformer (hypothetical SLD in Figure 9)

- A 3D model of the under-development Riverside 2 site is shown in Figure 10, with detail of the transformer and GCB area shown in Figure 11. Due to the space constraints around the IPB above the GCB, it would be difficult to extend the IPB and install a new switchgear assembly to supply the CCF. Note, the space to the east of the GCB is the access road to UKPN's 132kV compound.

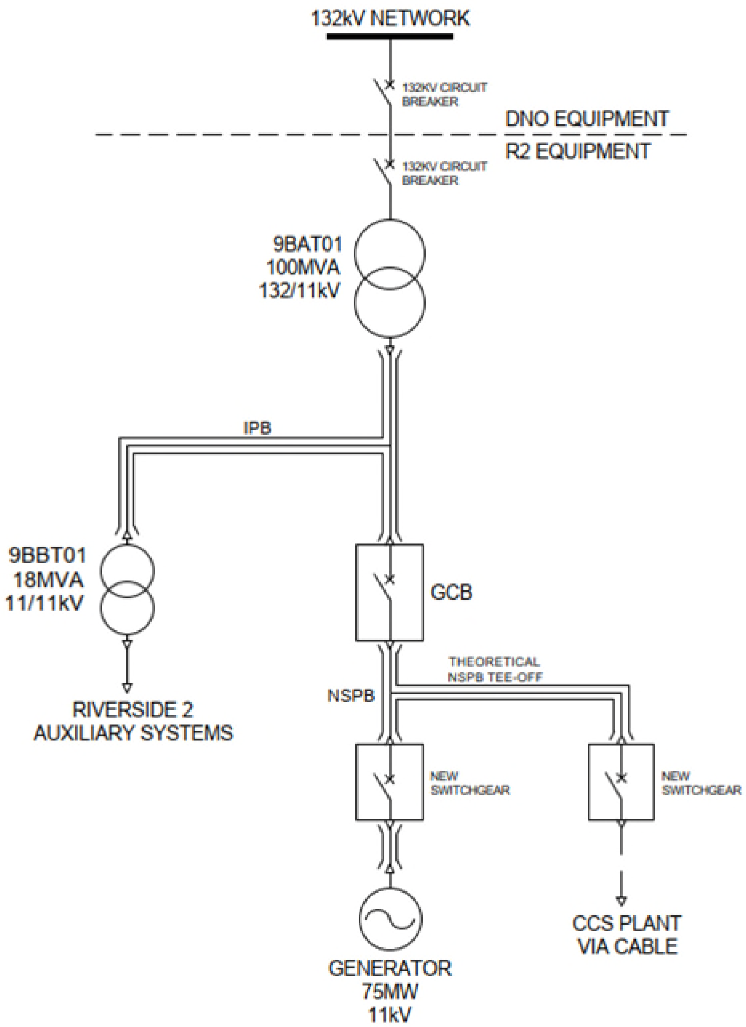


Figure 9 - SLD Showing a Tee-off Connection from the IPB – R2

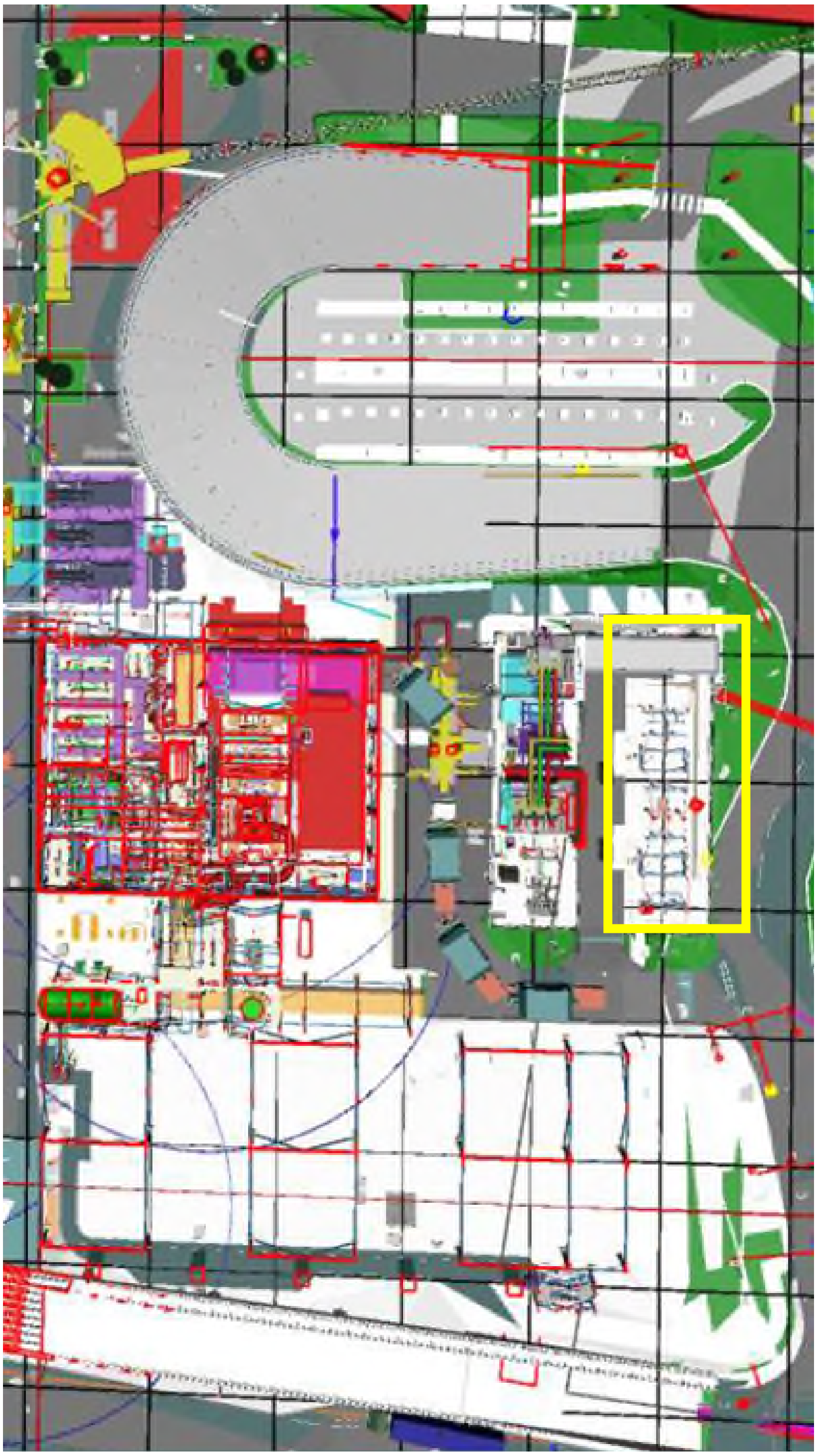


Figure 10 - Riverside 2 Site Layout - 3D Model (Transformer Area Boxed in Yellow)

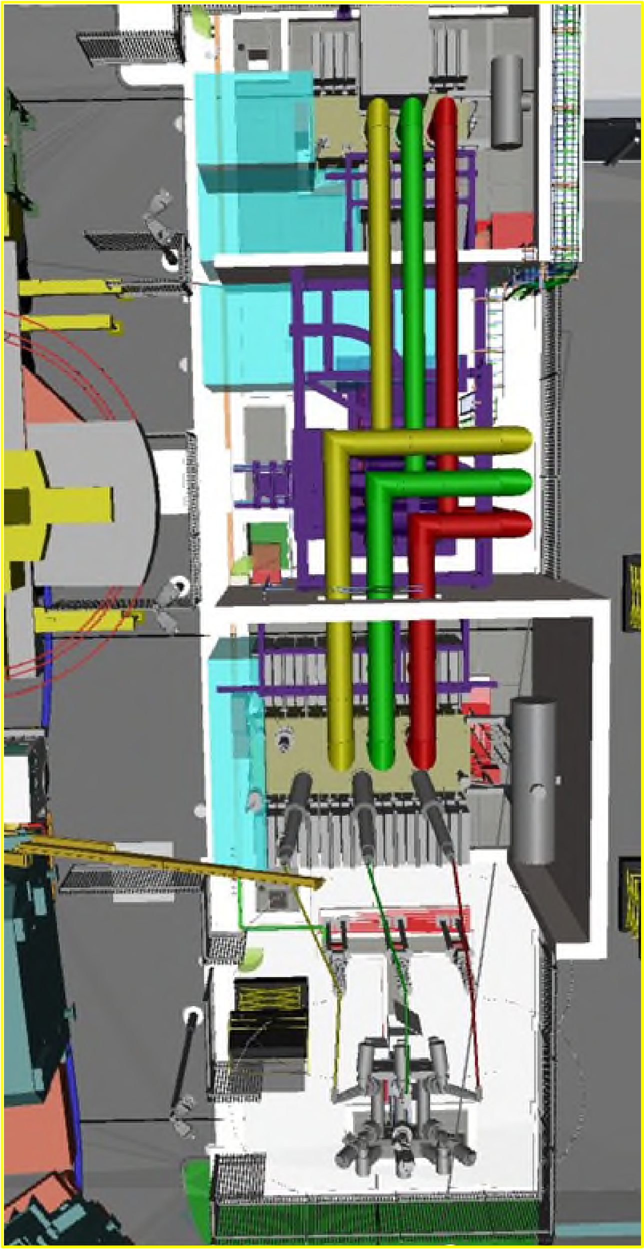


Figure 11 - 3D Model of Riverside 2 Electrical Supply Infrastructure

5. BLAKE CLOUGH ELECTRICAL ASSESSMENT – WSP COMMENTS

5.1.1. Blake Clough proposed a 50% capacity 11kV electrical supply utilising the existing infrastructure from Riverside 1 and Riverside 2 facilities. In addition to the reasons provided in earlier sections of this technical note, WSP have reviewed the Single Line Diagram and study produced by Blake Clough and have supplementary comments on the unsuitability of the 11kV supply design:

- While the 11kV supply cables are shown connected to a common bus with the Energy-from-Waste generators, no engineering detail has been provided as to how this connection would be accomplished. As has been discussed in detail in earlier section of this technical note, there are numerous technical reasons that make a connection to the EfW generator supply-side impractical or impossible.
- Blake Clough have assumed two runs of 630 mm^2 single-core Cu XLPE cables per circuit are sufficient to supply the 44MW CCF, however this is only sufficient if the supply is split evenly (50%) between the supply circuits. WSP also noted that the initial cable sizes proposed by Black Cough also did not account for any installation factors that would likely de-rate and increase the number of cables they original suggested. To provide a redundant supply, each circuit should be capable of carrying the full CCF current load in the event one supply circuit is unavailable and the sectionalising breaker is closed, which would require a minimum of four cables per phase for each circuit, which could prove difficult to terminate onto most commercial 11kV switchgear offerings.
- The existing Riverside 1 and Riverside 2 132/11kV step-up grid transformers have been incorrectly parameterised. They have assumed both are sized to 80MVA, 12% impedance, when the Riverside 1 step-up transformer is sized to 93MVA, 16% impedance, and the Riverside 2 step-up transformer is sized to 95MVA, 19% impedance.
- The power system model shows both back-pressure turbines in service, however the supply design should be capable of supplying the full CCF load with the BPTs out of service.
- The system loss calculations include losses from the existing step-up grid transformers at Riverside 1 and Riverside 2 for the 132/33kV supply case but excludes them from the 11kV supply case. Blake Clough's model assumes the transformer losses are avoided in the 11kV supply case by deriving the supply on the generator side, however this is misleading for the following reasons:
  - Any power produced by the EfW generators not consumed by the CCF facility would be exported to grid via the 132/11kV step-up transformers, resulting in system losses.

- In the event an EfW generator is isolated for maintenance, for example, some power may need to be imported from the 132kV grid connection which would result in transformer losses when the power is stepped down to 11kV.
- The 11kV supply design assumes the 11kV substation can be situated approximately 250m away from the existing supply points, at the north of the CCF site, with proposed dimensions of approximately 10m x 7m, as shown in Figure 12. WSP do not consider this sufficient space for all 11kV equipment, 11/0.4kV step-down transformers, LV distribution systems, communication infrastructure, etc. WSP has proposed an indicative 44 x 23 m footprint to accommodate the 11kV substation and all associated equipment.

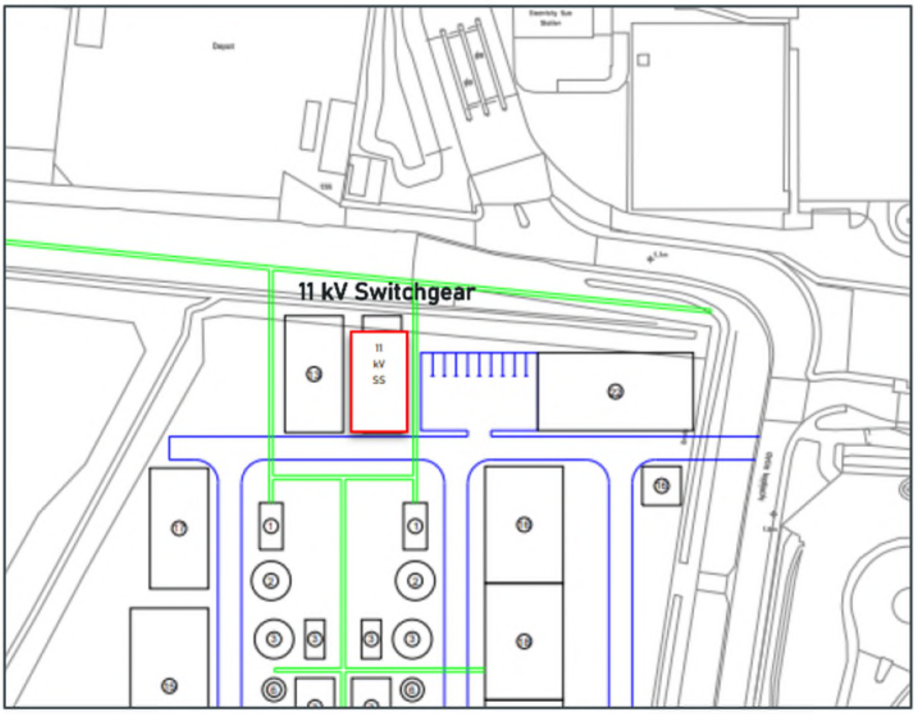


Figure 12 - Proposed location of 11kV substation

6. CONCLUSION

6.1.1. WSP has considered the possible connection options at 11kV for both Riverside 1 and Riverside 2 and have not found any technically feasible method of providing an 11kV electrical supply to the proposed CCF development from either site. The main issues associated with an 11kV connection are:

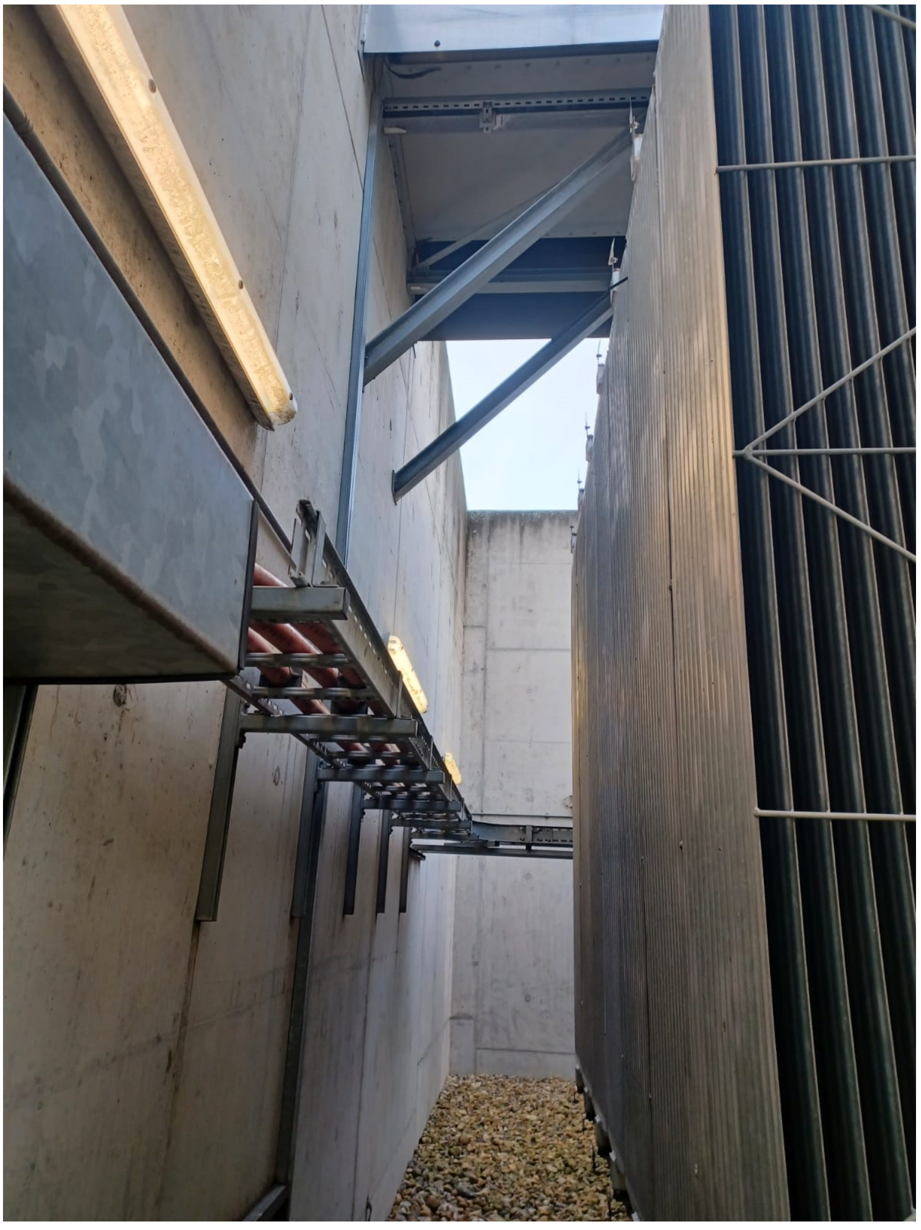
- The Energy-from-Waste 11kV auxiliary systems do not have the capacity to accommodate the additional demand from the proposed CCF development.
- Replacement of the Riverside 1 three-winding transformers and the Riverside 2 UAT would require long periods of plant outage and would not be able to supply partially renewable power to the grid during that extended period which would not be acceptable to the Applicant. Due to the limited space for expansion, replacement of higher capacity transformers would not be able to be accommodated in the existing transformer compounds. Additionally, increasing the transformer ratings by the required amount would likely significantly increase downstream fault currents and require large-scale modification/replacement of the existing 11kV auxiliary power systems.
- Difficulty in accessing underground main 11kV connections between generators and step-up transformers.
- Significant plant outages required to connect into existing 11kV main connections for the new development supply.
- Large number of cables required over a long distance to supply the required power to the CCF site.
- Insufficient space around existing and under-construction plant to extend 11kV supplies from the main 11kV connections. This includes lack of space for creating new tee-off or break-in connections, as well as lack of space for accommodating new switchgear assemblies. Additionally, depending on the option used, rating requirements for the new switchgear assemblies would be beyond the capabilities of standard cubicle type equipment, and multiple devices may be required to allow for isolation of the existing generators.

6.1.2. For these reasons, WSP maintains the proposed design submitted by the Applicant for a 132kV supply is the only feasible method of supplying the new CCF development from the existing Riverside 1 and under-construction Riverside 2 facilities.

Annex A

ANNEX A – RIVERSIDE 1 PHOTOS

TRANSFORMER COMPOUND



GENERATOR HALL


RUSH

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX F: MODIFIED ROUTE SHOWING VEHICLE TRACKING

DECARBONISATION

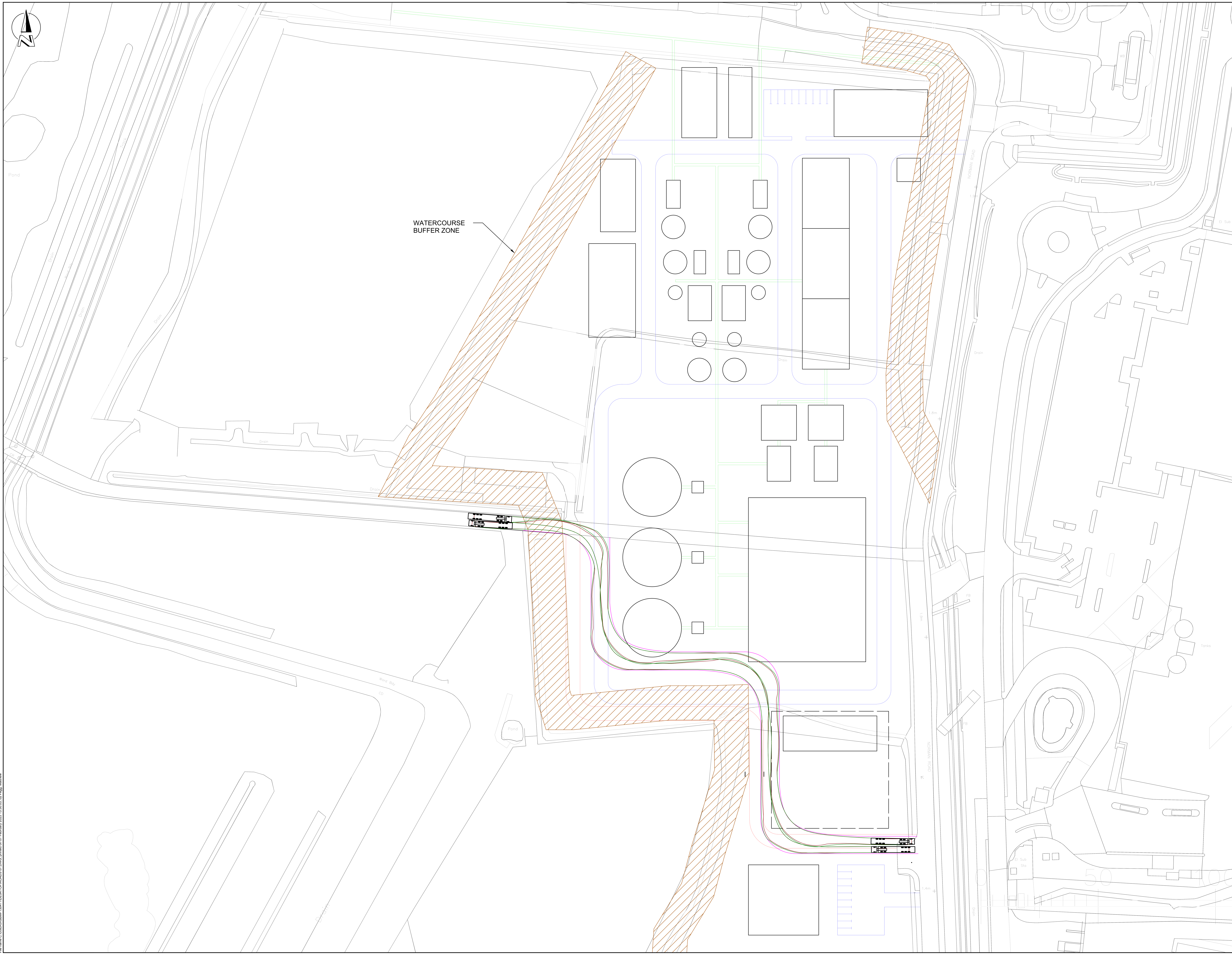
Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

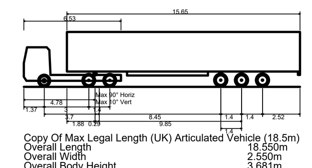
The Infrastructure Planning (Examination Procedure) Rules 2010 - Rule 8(1)(c)



Alternative Layout
Road Alignment

Autotrack Legend

Vehicle Wheel Track
Vehicle Body Outline



Copy Of Max Legal Length (UK) Articulated Vehicle (18.5m)

Overall Length	18.550m
Overall Width	2.550m
Overall Body Height	3.681m
Min Body Ground Clearance	0.411m
Max Track Width	2.500m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	6.530m

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	14/07/2023	JH	FIRST ISSUE	AC	AC

DRAWING STATUS: S0 - WORK IN PROGRESS

wsp
8 First Street, Manchester, M15 4GU, UK
T+ 44 (0) 161 200 5000
wsp.com

CLIENT: CORY

ARCHITECT: -

PROJECT: CORY DECARBONISATION PROJECT

TITLE: VEHICLE TRACKING

SCALE @ A0: 1:300	CHECKED: PA		APPROVED: PA
PROJECT No: 70090329	DESIGNED: JH	DRAWN: JH	DATE: JAN 2025

DRAWING No: XXXX
REV: P01

File name C:\USERS\GBMP130411\DESKTOP\ROADS 07.DWG, printed on 07 February 2025 13:30:03, by Pegg, Matthew

CORY

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX G: LANDSCAPING / WATERCOURSE BUFFERS NOTE

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

TABLE OF CONTENTS

Annexure

1. WATERCOURSE BUFFERS FOR THE CARBON CAPTURE FACILITY

1.1. INTRODUCTION

1.1.1. During CAH2, a request was made by the ExA to provide further detail on the nature of the ‘landscape buffer’ fringing the Carbon Capture Facility. Clarity is assumed to include:

- the nature of offsets associated with the retained ditch network;
- allowances for access to the ditch network by the Applicant, EA and LLFA; and
- planting widths associated with the landscape proposals.

1.1.2. The **Design Approach Document (DAD) (APP-044 to APP-046)** outlines the strategy for the landscape proposals and the existing retained ditch network and includes proposed Design Principles and Design Codes which are also reflected in the **Design Principles and Design Code (as updated alongside this submission)**. Relevant Design Principles and Design Codes are attached in an appendix to this note for ease of reference.

1.1.3. It is noted that the proposed layout is subject to ongoing design development and as noted in DP_ PL 1.9 the exact offsets to water courses will be established pursuant to Appendix 11-2 Flood Risk Assessment, responding to location specific constraints and giving consideration to achieving the full LaBARDS(s) (as updated alongside this submission), operational requirements and process safety for the CCF.

1.1.4. The Applicant is committed to reducing the loss of areas that may be located within fluvial flood extents by the inclusion of proposed offsets to watercourses from the edge of the Development Platform to the top of bank. The design process for the Proposed Scheme is illustrated in the **DAD (APP-044 to APP-046)** by way of summary diagram, Figure 2.1 (page 17) and in full diagram at Figure 2.2 (pages 18 and 19). The process reflects a systematic and structured approach to securing ‘good design’ that has been developed to demonstrate compliance with policy. Taking into account the factors discussed in this note has been a key part of this process.

1.1.5. The indicative layout of the Carbon Capture Facility and treatment of its boundaries has been informed by several often competing engineering and environmental considerations, balanced through ongoing and detailed stakeholder consultation and our agreed ‘good design’ framework. This includes but is not limited to; maintaining flood flow permeability through the Carbon Capture Facility (particularly to the north of the Thames Water access road), provision of new ditches as compensatory and enhanced habitats, for sustainable drainage systems, as visual mitigation and providing the necessary offsets for maintenance. The alternative scheme proposed by representatives of Landsul Limited and Munster Joinery cannot have been through and does not demonstrate, this considered process.

1.2. DITCH ACCESS

1.2.1. An allowance of 5m minimum is made to one side of watercourses to provide access for ditch maintenance, as agreed with the EA through ongoing consultations and in balancing with other technical requirements (acknowledging the 8m norm and achieving in excess of 8m to the majority of the CCF perimeter). In the case of the ditches to the west of the CCF (OW6, OW11 and OW16) access would be through a parallel offset in Norman Road Field and Western Paddock. For watercourses to the east of the CCF (MR4 and OW17), access is provided off the Norman Road or associated hardstanding/access road to Riverside 2. In the case of the North Dyke (eastern half of OW4) this is proposed to be removed and compensated for outside the fence line of the Carbon Capture Facility to support the alignment of the associated pipe network (within Norman Road Field).

1.2.2. The 5m minimum width is measured from the top of the ditch embankment which is measured from the assumed fence line. The development of the detailed design layout will be in accordance with the **Design Principles and Design Code (as updated alongside this submission)**.

1.2.3. Relevant design principles and design codes:

- Design Principle: DP_PL 1.9
- Design Code: DC_LNR 1.5

1.3. DITCH OFFSETS

1.3.1. The proposed layout is based on a minimum 5m offset, up to 8m or greater where practicable, from the top of the bank on existing retained watercourses for the provision of fluvial flood storage and compensation, balanced with many competing demands including the need to address other factors, such as; protection of habitats, watercourse access, visual mitigation/ planting, SUDS, tying into levels and site security. The agreed offset is the result of detailed and ongoing consultation with multiple stakeholders including the EA and LLFA.

1.3.2. The layout achieves a minimum of 5m with some exceptions where the illustrative facility configuration results in some localised intrusion, this is due to pressures associated with anticipated equipment and circulation requirements, and due to the irregular edges of the existing field boundaries. In these instances, it is anticipated that retaining walls will be used to reduce the intrusion in accordance with the Design Code, along with ongoing design development of both site levels and operational layout in accordance with the **Design Principles and Design Code (as updated alongside this submission)**. Planting is proposed within the 5m offset from the top of the ditch in the cases where it is not providing ditch access for maintenance.

1.3.3. In many locations the indicative scheme achieves in excess of the minimum offsets, in line with the Design Principles the Applicant's proposals prioritise delivering multiple beneficial outcomes from these wider area's nature reserve side of the development, including locating essential sustainable drainage, treatment and attenuation features, providing visual mitigation through planting and physical separation from the CLNR.

1.3.4. Relevant design principles and design codes:

- Design Principle: DP_PL 1.8 and DP_PL 1.9; and
- Design Code: DC _LNR 1.4, DC_LNR 1.5, and DC_CCF 1.11.

1.4. PLANTING BUFFERS

1.4.1. The proposed layout is based on a general planting allowance of approximately 10m as a principle, with localised narrowing and widening as relevant within the Site. A 10m width allows for ongoing management and continuity of screening/filtering in support of mitigation, planting also offers enhanced visual amenity, important green infrastructure / habitat linkages and well as shelter, enclosure and physical separation for the nature reserve and MOL from the industrial character to the east. In the case of localised widening, these areas also commonly accommodate SUDs or attenuation features that permit a minimum 10m planting belt to be retained. In the case of areas where the widths are below 10m, ongoing design development in relation to operational layout and levels will seek to maximise planting.

1.4.2. The development of the detailed design layout will be in accordance with the **Design Principles and Design Code (as updated alongside this submission)**.

1.4.3. A Compliance Statement will be submitted to support the discharge of the detailed design requirements within the DCO, which will report on implementation of the Design Principles and the Design Code (as updated alongside this submission).

1.4.4. Relevant design principles and design codes:

- Design Principle: DP_PL 1.5 and DP_PL 1.2; and
- Design Code: DC_CW 1.3, DC _CW 1.6, DC_CW 1.10, DC_CW 1.15, DC_NOR 1.6.

Annex A

ANNEX A: RELEVANT DESIGN PRINCIPLES AND DESIGN CODES

RELEVANT DESIGN PRINCIPLES

DP_PL 1.2 Provide well organised and well designed and managed boundaries to the operational areas. Control the visual appearance of the operational area in views from adjoining areas to deliver a coherent appearance. Provide planted boundaries appropriate to local character around the CCF site to support the natural character of the CLNR and an organised interface with Norman Road.

DP_PL 1.5 Recognise the Site and surrounding area's historic, cultural, and natural assets through conservation, retention, and enhancement where practicable.

DP_PL 1.8 Works to and in proximity of existing watercourses will be sensitively executed avoiding risk of damage and contamination to new and retained features and harm to wildlife. In line with policy and the BNG metric, all removed/adjusted watercourses will be compensated for with newly created equivalent habitat.

DP_PL 1.9 Allow for a minimum 5m offset, up to 8m or greater where practicable, from the top of bank on existing retained watercourses to allow for access and general maintenance of drainage assets, to protect habitats and for the delivery of flood compensation. The exact dimension for offset to be established during detailed design pursuant to Appendix 11-2: Flood Risk Assessment of the Environmental Statement (Volume 1), responding to location specific constraints and giving consideration to achieving the LaBARDS, operational requirements, and process safety for the CCF. To the east side of the CCF, ditch access would be secured via Norman Road without the need for an offset to the west of the existing ditch.

RELEVANT DESIGN CODES

DC_LNR 1.4 Vertical retaining walls should be positioned away from the CLNR boundary or with sufficient screening in front as a visual buffer. Landscaped gradients to be used where practicable instead of retaining walls.

DC_LNR 1.5 Watercourses must be accessible on one side as a minimum with a clear 5m width, up to 8m or greater where practicable, as offset for a working zone provided from top of bank.

DC_CCF 1.11 Development platform embankments should be a maximum of a 1:3 gradient where planting/tree planting is proposed.

DC_CW 1.3 The aesthetic of designed buildings, structures, landscape interventions, materiality, boundaries, signage/ wayfinding, and branding are to be carefully controlled and consistent across the development.

DC_CW 1.6 Drainage basins, ditches, and swales are to be designed to accommodate planting and standing water and to be an integrated element of the landscape design.

DC_CW 1.10 Create clear boundaries and security between public and private areas, service areas and access points. The materials, visual permeability, features, and security measures are to be considered and designed as an integral part of the CCF scheme design and not addressed as after-thoughts or add-ons.

DC_CW 1.15 Create a consistent approach to planting and landscape features along the length of the boundaries.

DC_NOR 1.6 Frontages onto Norman Road will have consistent and organised arrangement of planting and allow intermittent approach views towards Riverside 1 and Riverside 2, and into the CCF site.

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk

APPENDIX H: HEAT NOTE

DECARBONISATION

Cory Decarbonisation Project

PINS Reference: EN010128

February 2025

Revision A

TABLE OF CONTENTS

FIGURE

ANNEXURES

ANNEX A – HEAT RELEVANT POLICY AND STRATEGY

ANNEX B – GLA REPORT (DECEMBER 2024)

EXECUTIVE SUMMARY

Whilst the primary purpose of the Proposed Scheme is to decarbonise the energy from waste facilities at Riverside 1 and 2, the carbon capture process generates heat which is typically wasted.

The facilities at Riverside 1 and Riverside 2 each include their own Heat Transfer Stations ('HTS'), and as part of Cory's on-going commitment to harnessing opportunities in relation to heat and decarbonisation, the proposed Carbon Capture Facility also incorporates an HTS.

In their submissions, Landsul Limited and Munster Joinery (UK) Ltd ('MJL') have made assertions that the HTS proposed within the Proposed Scheme is either not required at all or not required within the built footprint of the Carbon Capture Facility.

The Applicant in this report dispels these assertions. Firstly, by outlining the extensive national and local policy which supports this technology and by highlighting the heat opportunities and relevant existing planning consents relevant to each of its facilities. Secondly, by confirming that there is in fact significant demand for heat within London (the Applicant having signed or currently negotiating MOU to supply heat networks with forecast demand of 907MW by the early 2030s). It clarifies the onsite supply and demand of Cory's facilities and interaction between Riverside 1 and 2 and the Proposed Scheme; describes the Riverside Heat Network and other existing and developing heat networks elsewhere in London and the opportunities currently being explored by Cory; and then demonstrates how delivery of this heat demand is technically and economically viable. Finally, the report turns back to address each of the MJL assertions, to demonstrate the reasons why the Carbon Capture Facility requires its own HTS, the significant levels of demand to be met, and why the HTS needs to be contiguous with the built footprint of the Carbon Capture Facility.

Section 2 of this report highlights the very clear policy imperative, both nationally and locally, to put waste heat to beneficial use. Successive governments and the Committee on Climate Change agree that the delivery of effective heat networks is a key element of ensuring energy security, affordability and sustainability and that district heating using low carbon sources is a key tenet of the energy sector's ability to continue making a meaningful contribution to achieving climate change priorities. This is clear from paragraph 4.8.16 of NPS EN-1, requiring that applicants for development consent provide appropriate evidence that CHP is included, or at least has been fully explored.

The expansion of the rollout of low-carbon heat networks in heat dense areas like cities and a shift towards low-carbon and waste heat supply sources by the mid-2020s is one of the four priorities set out in the Sixth Carbon Budget, and this priority is clearly reflected in both the London Plan and Bexley Local Plan, and in the publication of various reports particularly the GLA's December 2024 report promoting long range heat transmission from strategic heat sources, including the Riverside Campus. Whilst policy principally relates to new power plant and waste facilities, this does not make it irrelevant to the Proposed Scheme. This has been confirmed through the clear and active support from both the GLA and LBB for urgent delivery of the Riverside Heat Network and inclusion of the infrastructure to facilitate the export of heat from the Proposed Scheme, in recognition that the Riverside Campus can make an important and relevant contribution to the delivery of the national and local decarbonisation goals, particularly now London's net zero target has been brought forward to 2030.

Section 3 of this report addresses the assertion that there is no need for the heat generated by the Carbon Capture Facility to be harnessed, and consequently no requirement for an HTS within the Order limits. The report demonstrates that there is substantially greater heat demand across London than has been recognised by MJL to date (the Applicant having signed or currently negotiating MOU to supply heat networks with forecast demand of 907MW by the early 2030s). This should not be unexpected for a capital city of London's size and complexity with aspirations to be net zero by 2030.

Cory, working with Vattenfall, is developing a large heat network in its immediate surrounds, the Riverside Heat Network. This Network is under active development, with Cory and Vattenfall currently in commercial negotiations with Peabody Trust for the initial heat offtake.

This report explains how the Carbon Capture Facility will operate as a parasitic load on the Riverside EfW facilities, by using steam as part of the carbon capture process. Heat consumers require a confirmed and reliable supply of heat and so back up capacity is also required. Riverside 1 and 2 are suitably located to be either primary supply to demand and/or be back up capacity, however, as the Carbon Capture Facility will reduce the amount of waste heat available for the Riverside Heat Network (or any other demand) by around one third, the waste heat from the that Facility needs to be harnessed to replenish the supply from the Riverside EfW facilities. Heat recovery and HTS infrastructure is therefore required for the Carbon Capture Facility.

The Energy Act 2023 contains significant provisions aimed at expanding the heat networks in the UK to deliver the Climate Change Committee's target of 20% of the UK's heating being supplied by district heating by 2050. This 20% is to be concentrated in heat dense areas, such as London, and a key aspect of this legislation is the designation of 'heat network zones' in which there will be strong planning support for heat networks.

The Riverside Campus is identified by both the Mayor and the local authority as a key strategic heat resource, and Cory is also in active negotiations with five other existing and developing heat networks elsewhere in London to provide a strategic contribution to the decarbonisation of London's heat. This includes central London, where demand is very high and individual property solutions are challenging and there are few other major low-carbon sources to support the development of heat networks. Large waste heat supply also takes the strain off the electricity grid, which is a major constraint in wider decarbonisation plans.

Drawing from the information provided in the previous sections, Section four of this report finally returns to the assertions made by MJL, addressing each in turn to conclude that an HTS is required within the footprint of the Proposed Scheme, there is significant and demonstrated heat demand across London, and that the HTS proposed does need to be contiguous with the built footprint of the Carbon Capture Facility.

Addressing the first assertion, it confirms that it is appropriate, and provision has been made for a nominal, conservatively sized HTS, to be built within the footprint of the Carbon Capture Facility. It is needed to capture and transfer heat from the Carbon Capture Facility into whatever district heat network or heat demand is appropriate at the time of construction.

Addressing the second assertion, the report confirms there is substantial demand for heat across London, which is technically and economically viable from the Riverside Campus. The Riverside Campus is identified as a key strategic heat source in the GLA Report, through long range transmission to deliver the Mayor's decarbonisation objectives. This is echoed in the strategic approach being promoted across London Boroughs; in particular, LBB has sought assurances that the Proposed Scheme will not cause delay to the Riverside Heat Network. Even if there was no further demand (which there clearly and substantially is) as explained, an HTS within the Carbon Capture Facility would be required to maintain the original expected heat output from Riverside 1 and 2. Furthermore, the complaint that no assessment of heat demand has been provided is neither important nor relevant, as the Carbon Capture Facility is not an energy generation station. However, as waste heat will result from the operation of the Carbon Capture Facility, the Applicant is right to seek to use it and is robustly supported by both the GLA and LBB to do so.

In relation to the final assertion, although the HTS for the Carbon Capture Facility has been sized and located as relevant to the Carbon Capture Facility on a nominal supply of 100MW, it is also confirmed that there could be up to 300MW of heat available from the Facility, which would require a much larger HTS. Cory will ultimately have three sources of heat to manage in this location and requires flexibility to manage the inter-relationship between them in order to respond to demand and ensure the effective use of low- and high-grade heat. Physical proximity enables that integration to be achieved efficiently and effectively. Additionally, an optimised system should also enable connection both south, for a landward transmission, and northwards to the planned mobile heat jetty depending on future network requirements which will require the HTS to be positioned in this location. Whilst the HTS associated with the Carbon Capture Facility may be operated by Cory, it may also ultimately be operated by a third party. In this event, it is not unusual to have third party operator infrastructure of key utility interfaces within the boundary of an operating facility but separated from it, and indeed there are substantial benefits for assets to be co-located (as is the case for the UKPN electricity substations within Riverside 1 and 2). Regardless of optimised design and ultimate operator, it is appropriate and necessary to provide the HTS within the built footprint of the Carbon Capture Facility.

By conclusion, this report illustrates the very clear national and local policy imperative to make beneficial use of waste heat to support the decarbonisation of London's heat demand and contribute to the Mayor's 2030 net zero London ambitions. It demonstrates London's significant demand for heat and the importance of the Riverside Campus and Riverside Heat Network as a key strategic resource and explains the clear reasons why an HTS is required for the Carbon Capture Facility and why it must be contiguous with the built footprint of the Proposed Scheme. Ultimately, it concludes that it would be contrary to policy to remove this element from the Proposed Scheme and in any event, such deletion would not change the land requirements in such a manner as to no longer require the MJL land. Further, it demonstrates that there is a clear and appropriate framework for funding such delivery.

1. INTRODUCTION

1.1. PURPOSE AND ERRATA

PURPOSE

1.1.1. The purpose of this report is to present the important and relevant context to the delivery of heat from the Proposed Scheme in response to comments made jointly by Landsul Limited and Munster Joinery (UK) Ltd ('MJL') at Deadline 3 (REP3-045 and 046) (the 'MJL Response'), including its Annex A ('Dr Edgar's Report').

1.1.2. It also provides an update on potential funding mechanisms for heat.

ERRATA

1.1.3. The following sentence appears on page 6 of the Applicant's Follow Up Submission to Rule 17 Response (AS-083):

'Firstly, it is important to note that it is currently estimated that the Riverside EfW Facilities can provide around 490MW of heat.'

1.1.4. As confirmed at the Compulsory Acquisition Hearing held on 11 February 2025, this sentence contains a mistake in the amount of heat available from the Riverside EfW Facilities, which should be stated as 390MW.

1.2. OVERVIEW

Need for Heat Infrastructure within the Proposed Scheme

1.2.1. In their submissions (REP3-045 and 046) MJL makes three assertions that the heat transfer station (HTS) proposed within the Carbon Capture Facility is either not required at all or not required within the built footprint of the Carbon Capture Facility. In summary, these are:

1 That Riverside 1 and Riverside 2 are required by their own planning consents to include their own HTS requirements – as this requirement already exists it can't be used to justify an HTS site within the Carbon Capture Facility. It would only be appropriate to justify an HTS within the Carbon Capture Facility to capture heat from that Facility. (MJL Response paragraphs 7, 8 and 12; Dr Edgar's Report paragraph 4.10)

2 That the assessment of local demand completed by Fichtner for Riverside 1 can be entirely met via Riverside 1 and that any conceivable increase above that would be met by Riverside 2. Consequently, there is no further heat demand, no need to access heat from the Carbon Capture Facility, and so no need for an HTS. (MJL Response paragraphs 5 and 6; Dr Edgar's Report, paragraphs 4.6 to 4.9). Further, that a longer distance supply would not be technically viable. (Dr Edgar's Report, paragraphs 4.11 to 4.15)

3 That even if an HTS was to be included, it does not need to be contiguous with the built footprint of the Carbon Capture Facility. (Dr Edgar's Report, paragraph 3.4)

1.2.2. Taking these points in turn, the Applicant responds that:

1 Riverside 1 and 2 do provide for their own supply export; the HTS proposed for the Carbon Capture Facility relates to heat recovered from that facility.

2 The heat demand assessment relied on by MJL is not comprehensive. A subsequent and more developed study undertaken by Vattenfall indicates that local demand is twice the level stated in the 2019 Fitchner Report. Demand many times greater than this also exists towards central London. Heat supply towards central London is not only technically viable (and has been built in other cities), but:

a. it is being progressed commercially by Cory, who has Memorandums of Understanding in place or under negotiation for heat supply for more that 10x the heat demand identified in the 2019 Fichtner Report, with heat networks under development in central London, and

b. long range transmission from strategic heat sources is the basis for the GLA's latest report on high level strategy for heat decarbonisation in Greater London.

c. MJL also do not account for the fact that following the construction of the Carbon Capture Facility, materially less heat will be available from Riverside 1 and 2, because of the diversion of steam and power to the Carbon Capture Facility.

3 The HTS does need to be contiguous with the Carbon Capture Facility, for various operational reasons. The infrastructure indicated on the **Indicative Engineering Layout (AS-070)** is a nominal size relevant to its use for the Carbon Capture Facility only.

Consistency within the Proposed Scheme

1.2.3. The Applicant has been consistent in its responses recognising the substantial demand for heat and its intention to contribute to meeting that demand, not least **Appendix A** to its **Written Summary of Oral Submissions at Deadline 1 (REP1-026)**. This is a short report presenting the interaction of the Proposed Scheme with Riverside 1 and Riverside 2 in relation to heat. However, it is worthy of revisiting here in light of the confusion evident at paragraph 7 of the MJL Response.

1.2.4. Paragraphs 1.1.2 and 1.1.3 of **Appendix A to the Applicant's Written Summary of Oral Submissions at Deadline 1** give an overview of heat demand:

1.1.2 The Riverside Heat Network is in development and is currently capable of diverting up to 28.6 MWth of heat from Riverside 1, potentially benefitting up to 25,000 homes and businesses in the local area.

1.1.3 In addition to the potential heat benefits from the Proposed Scheme itself, opportunities have been identified to provide an additional 189 MWth of heat from Riverside 1 and 169 MWth of heat from Riverside 2 to the Riverside Heat Network or other district heat networks.

1.2.5. The overview is high level. However, it is also clear that other heat networks are being considered alongside the Riverside Heat Network. It is clear that further demand is being pursued.

1.2.6. Section 1.6 of Appendix A to the Applicant's Written Summary of Oral Submissions at Deadline 1 makes clear that the HTS provision within the built footprint of the Carbon Capture Facility is proposed for that Facility, and is not proposed for either Riverside 1 or Riverside 2. Indeed the text confirms that the *potential* for synergies with Riverside 1 or 2 would be considered at the detailed design stage; i.e. it has not been considered in the Proposed Scheme as submitted, and would anyway have minimal impact:

1.6.1 In summary, the Proposed Scheme has identified a heat opportunity within the carbon capture process itself and taken account of that potential in the basis of design. That opportunity could be brought forward either through connecting to the Riverside Heat Network or becoming part of its own heat network. Potential opportunities and synergies with Riverside 1/Riverside 2 and the Riverside Heat Network, as well as any other suitable heat networks, will be considered during FEED and at the detailed design stage.

1.6.2 Crucially, however, the key point is that the heat transfer station provided for as part of the DCO is proposed on the basis of the heat recovery opportunities from the Carbon Capture Facility, taking into account potential synergies with the heat networks associated with Riverside 1 and Riverside 2. The plant associated with integration with the Riverside 1/Riverside 2 heat networks has minimal impact on the overall size of the area taken within the Carbon Capture Facility.

1.2.7. The MJL Response relies upon a 2019 Fichtner report, prepared solely in relation to Riverside 1 despite the Applicant (on 10 January 2025, as explained in AS-077) providing headline responses on what it now understands heat demand to be and that it is significantly greater than that in that Fichtner report.

1.2.8. This report provides further detail to those headlines (particularly at section 3)

1.3. FUNDING

1.3.1. The Heat Transfer Station is intended to be funded separately from the wider CCS plant, which as described elsewhere is expected to have a dedicated government supported funding mechanism, specific to carbon capture. Heat export would generate separate revenues – including from direct heat sales – and the financing of the HTS would ultimately be based on those revenues.

1.3.2. Separate government support is also available for heat network projects, notably the Green Heat Network Fund (GHNF), which provides grant support up to 50% of eligible commercialisation and capital costs. Cory have been engaging with the GHNF scheme administrators for funding support under this programme.

1.4. STRUCTURE

1.4.1. To address the substantive points raised in the MJL Response (including Dr Edgar's Report) and to provide the full context to including provision for heat within the Proposed Scheme, this report is structured as follows:

- Section 2 sets out the wider context presenting the policy imperative for heat, local heat studies and the existing CHP consents delivering that policy;
- Section 3 presents an overview of heat demand and demonstrates its deliverability; and
- Section 4 demonstrates why a heat transfer station within the Carbon Capture Facility is necessary.

2. CONTEXT, LED BY THE POLICY IMPERATIVE

2.1. THE POLICY IMPERATIVE

2.1.1. Annex A to this report presents a full overview of the policy relevant and important to heat.

2.1.2. Successive governments and the Committee on Climate Change have been (and continue to be) aligned on the need to deliver effective heat networks as a key element of ensuring energy security, affordability and sustainability. District heating using low carbon sources is a key tenet of the energy sector's ability to continue making a meaningful contribution to achieving climate change priorities. At paragraph 4.8.16, NPS EN-1 makes clear that the '*Secretary of State should not give development consent unless satisfied that the applicant has provided appropriate evidence that CHP is included or that the opportunities for CHP have been fully explored.'*

2.1.3. In its Balanced Net Zero Pathway, the Sixth Carbon Budget has four priorities, *to be delivered over the coming decade or so*, for buildings, including:

'Expand the rollout of low-carbon heat networks in heat dense areas like cities, using anchor loads such as hospitals and schools. Prepare to shift away from using fossil fuel Combined Heat and Power (CHP) as a supply source towards low-carbon and waste heat by preference from the mid 2020s.' (page 109)

2.1.4. The NPPF, only recently updated in December 2024 (with a minor non-relevant typographical correction in February 2025), requires local planning authorities to expect that new development will:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable. (paragraph 166)

2.1.5. The London Plan's policy priority is to make the capital a zero carbon city by 2050. The use of waste heat from low carbon sources is a key element of the Mayor's intentions to decarbonise homes and businesses across the city. '*The Mayor will work with boroughs, energy companies and major developers to promote the* ***timely and effective development of London's energy system*** *(energy production, distribution, storage, supply and consumption)*.' (paragraph 9.3.1, emphasis original to the London Plan)

2.1.6. Paragraph 9.3.2 continues:

'London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the Mayor's zero-carbon target by 2050 requires changes to the way we use and supply energy so that power and heat for our buildings and transport is generated from local clean, low-carbon and renewable sources. London will need to shift from its reliance on using natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources. Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply and will help London become more self-sufficient and resilient in relation to its energy needs.'

2.1.7. Policy DP31 of the Local Plan makes this policy intention local to Bexley, making clear at sub paragraph 3 that proposals '*for major developments that produce heat and/or energy should consider how they can contribute to the supply heat in a designated heat network priority area or demonstrate that this is not technically feasible or economically viable.'*

2.1.8. Whilst policy SP14(c) of the Bexley Local Plan states:

'The Council will actively pursue the delivery of sustainable development by:… investigating opportunities for the funding and development of decentralised energy networks in the borough; and, supporting the provision of infrastructure, including safeguarding routes and land for such use, where necessary;'

2.1.9. London Borough of Bexley ('LBB') has been seeking to achieve a district heat network for at least the past 10 years, publishing two reports over that time:

- The Bexley Energy Masterplan, October 2015, which focussed on the area surrounding Riverside 1. The masterplan concluded that the primary opportunity for a heat network would be for Riverside 1 to supply heat to the Peabody Thamesmead housing estate and the Belvedere Growth Area, in addition to proposed growth and employment land developments on the route west along Yarnton Way.
- The Thamesmead & Belvedere, Heat Network Feasibility Study: Work Package 2, published in May 2019, which concluded that the level of heat demand and annual consumption determined for all loads modelled for connection to an initial 'Core Scheme' network, comprising the Belvedere, Thamesmead and Abbey Wood redevelopment areas (plus limited adjacent existing buildings/sites) can be met via heat offtake from Riverside 1.
  - However, it also identified that:

  '6. If a more aggressive build-out scenarios were considered for the Core Scheme and additional sites further afield in Bexley and particularly Greenwich, where build-out is closely linked to potential new transport links, further improvement would be seen to the network commercial case. It is also likely that a further

heat source(s) beyond the existing Cory plant would be required to meet any significant increases to total heat demands.'

2.1.10. Policy is predominantly written for new power plant and waste facilities. The Proposed Scheme is neither of these, but this does not mean the policy is irrelevant to it. First, the Carbon Capture Facility is supporting infrastructure to two strategic waste facilities that together will provide some 50% of all residual waste management capacity in London.

2.1.11. Second, it has an important and relevant contribution to make in delivering the decarbonisation goals set out in national, regional and local policy. Not least the London Plan makes clear that it expects low carbon heat to be available and for major development to use it.

2.1.12. Since adoption of the London Plan, the Mayor has committed to bring forward London's net zero target from 2050 to 2030. In January 2020, the GLA published document titled '*London Net Zero 2030 – An Updated Pathway'* and set out the preferred pathway to net zero – the Accelerated Green pathway; delivery of which requires:

- nearly 40 per cent reduction in the total heat demand of our buildings, requiring over 2 million homes and a quarter of a million non-domestic buildings to become properly insulated
- 2.2 million heat pumps in use in London by 2030
- **460,000 buildings connected to district heating networks by 2030**
- a 27 per cent reduction in car vehicle kilometres travelled by 2030
- fossil fuel car and van sales ended by 2030 and enforced in line with Government's existing commitments.

2.1.13. *'These ambitions are challenging. The previous trajectory in the 1.5°C Plan said that **by the mid-2020s, 160,000 homes would need to be retrofitted each year**, 900,000 heat pumps would need to be installed by 2030 and a 12 per cent reduction in car vehicle km travelled be achieved by 2030.*' (page 9, emphasis added)

2.1.14. *London Net Zero 2030 – An Updated Pathway* identifies the funding sources available and actions necessary to deliver heat networks, including further work to consider zones for heat networks, the work on which is reported below (as the GLA Report).

LOCAL IMPERATIVE

2.1.15. Beyond their development plan policy, both the GLA and LBB have made clear their active support (beyond policy intention) for the Riverside Heat Network in written submissions, and that they are keen to be assured that the Proposed Scheme will not delay its delivery:

- *The Mayor would like to see faster progress by Cory and its partners in connecting to a local heat network as a contribution to net zero.* (GLA, Written Representation, section 2, REP1-072)
- *Notwithstanding the above, the Council is concerned that the proposed development would delay the aspiration of the planned Riverside District Heat Network to which both Riverside 1 and the currently being constructed Riverside 2 are the heat source. Whilst the Council accepts that the Carbon Capture Facility would not prevent the District Heat Network from coming forward, it could delay any potential implementation due to the Carbon Capture Facility being constructed.* (LBB, Deadline 3 Response, page 6, REP3-038)
- *It is agreed that Bexley Local Plan Policies DP31 and SP14(c) and London Plan Policy SI3 are relevant to both this topic and the Land Use and Consideration of Alternatives. It is agreed that the Proposed Scheme appropriately makes provision for heat transfer within the Order limits.*

  …

  In light of these policies as well as Policy SI3 of the London Plan, LBB supports the inclusion of infrastructure to facilitate the export of heat.

  (SoCG with LBB, Rev C, (AS-080))

2.1.16. Further, both authorities have led development of heat networks through a series of studies, undertaken with stakeholders including the Applicant, as summarised below.

2.2. EXISTING CHP CONSENTS

INTRODUCTION

2.2.1. To date Cory has been progressing heat opportunities as relevant to each facility and its planning commitments – set out below

2.2.2. R1 and R2 do have capacity for their own HTS, as required under their planning permissions. The HTS for the Carbon Capture Facility would relate to heat from the Carbon Capture Facility.

2.2.3. In short, there are currently three consenting regimes relevant to the export of heat from the Riverside Campus:

- Riverside 1 – deemed planning consent under section 36 Electricity Act 1989:
  - Condition 31, Feasibility Review; and
  - Condition 31, Provision of necessary plant and pipework.

- Riverside 2 – development consent order under Planning Act 2008:
  - Work No. 1A, 3 and 6A;
  - Requirement 2, to ensure sufficient space for heat export system; and
  - Requirement 24, CHP Review and working group.
- District heat network, phased development under Town and Country Planning Act 1990.

2.2.4. The key spatial elements of these three consenting regimes are shown in Figure 2-1-, with the key below.

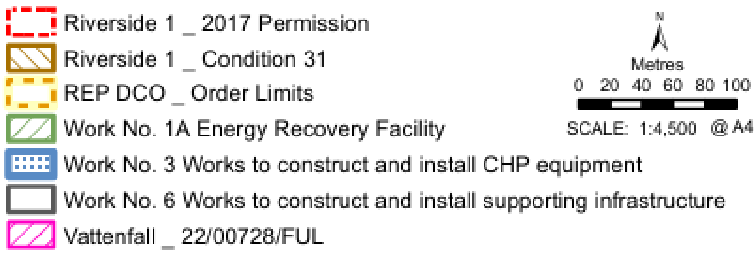
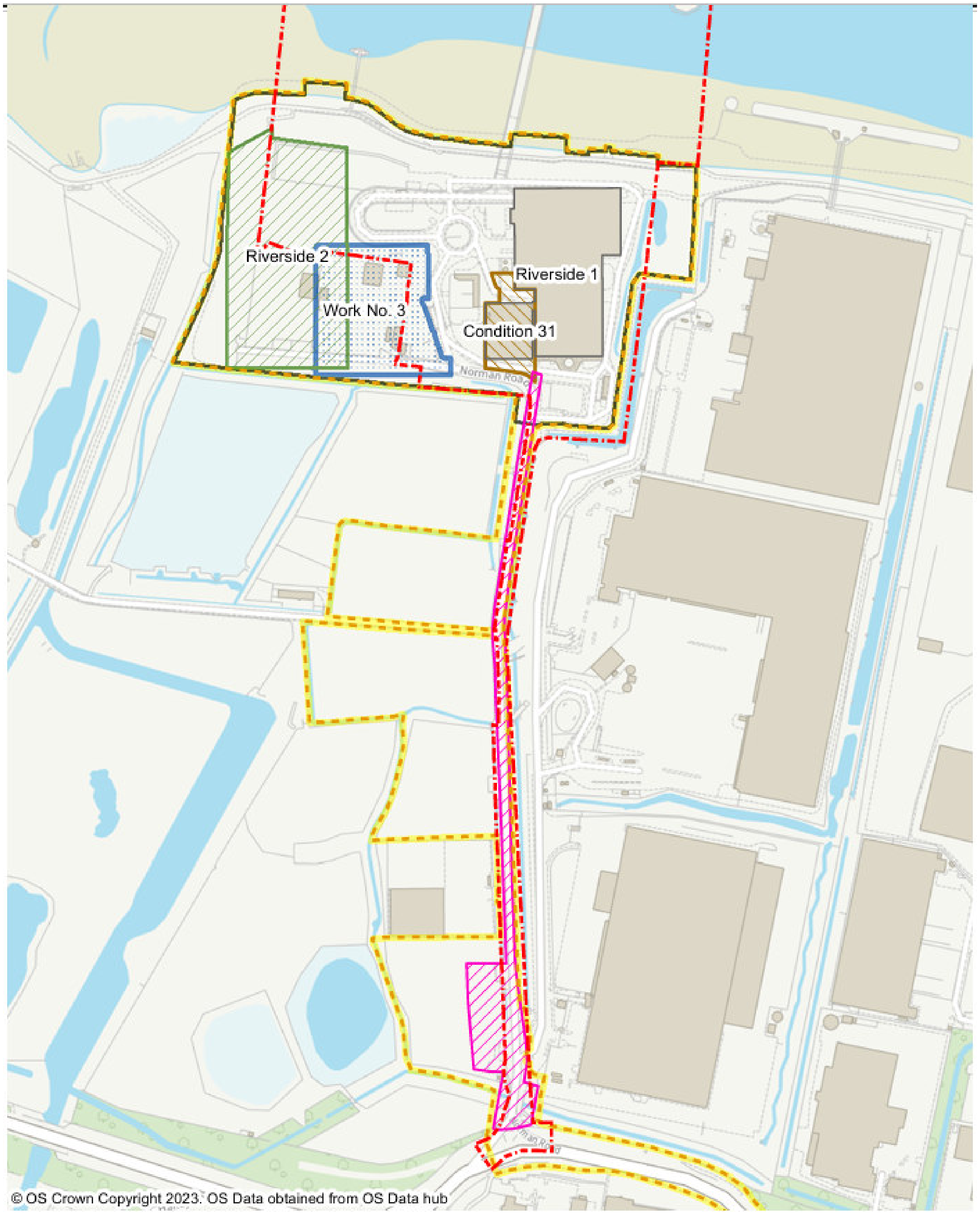


Figure 2-1 -Heat Consents at Riverside Campus



RIVERSIDE 1

(MJL Response, Paragraph 9)

2.2.5. The Secretary of State for the Department of Trade and Industry granted consent for Riverside 1 (then referred to as RRRF) on 15 June 2006, under section 36 of the Electricity Act 1989 (Original s.36 Consent) accompanied by a Direction under section 90(2) of the TCPA 1990 (Original Permission).

2.2.6. Both the Original s.36 Consent and Original Permission underwent various amendments in 2007, 2015 and 2016, with the contemporaneous permissions, relevant to heat, being:

- the 2015 s.36 Variation; and
- the 2017 Permission (deemed planning permission reference 16/02167/FUL, approved 4 October 2017).

2.2.7. It is noted that the Riverside Energy Park Generating Station Order 2020 made some minor modifications to both the 2015 s.36 Variation and the 2017 Permission in order to provide for the co-existence of both Riverside 1 and 2. No modification was made of any relevance to heat.

2.2.8. The 2017 Permission is subject to 37 conditions, with condition 31 being relevant to CHP. Condition 31 of the 2017 Permission required that:

'Within 1 year from date on which this permission was deemed granted, the Company must prepare a Combined Heat and Power (CHP) feasibility review assessing potential commercial opportunities for use of heat from the development, which must be submitted in writing to the Council for its approval. The review must provide for ongoing monitoring and full exploration of potential commercial opportunities to use heat from the development as part of a Good Quality CHP scheme (as defined in CHPQA Standard issue 3), and for the provision of subsequent reviews of such opportunities as necessary. Where viable opportunities for the use of heat in such a scheme are identified, a scheme for the provision of the necessary plant and pipework to the boundary of the site shall be submitted in writing to the Council for its approval. Any plant and pipework installed to the boundary of site to enable the use of heat shall be installed in accordance with the agreed details.'

2.2.9. A CHP Feasibility Review was submitted in July 2021 (reference 16/02167/FUL02) and approved on 27 January 2022.

2.2.10. On 18 November 2021 (reference 16/02167/FUL02) an application was submitted to present a scheme for the provision of the necessary plant and pipework to the boundary of the site. This application was also approved on 27 January 2022, with a note confirming that: the condition is partly discharged and that details relating to a scheme for the provision of the necessary plant and pipework to the boundary of the site is still required to be submitted to the Council.

2.2.11. On 15 April 2021, an application was made section 36C of the Electricity Act 1989, to:

- amend the power generation description of RRRF in paragraph 2 of the 2015 s.36 Variation to change the energy generation limit from 'up to 72MW' to 'up to '80.5MW'; and
- request that the Secretary of State then gives a direction under section 90(2) of the TCPA 1990 varying the conditions attached to the 2017 Permission, to increase the maximum waste throughput from 785,000 tpa to 850,000 tpa; and
- amend the s.36 Variation and to incorporate into the new deemed planning permission the amendments authorised by the Secretary of State in the REP DCO regarding the ash storage area for Riverside 1 and use of the jetty by both Riverside 1 and 2.

2.2.12. This application was approved on 17 December 2021 (the 2021 s.36 Consent and 2021 Permission). Conditions 30 and 31 maintain the focus on supplying heat from the facility, requiring the following:

30. A facility shall be provided and maintained within the development to enable steam pass-outs and/or hot water pass-outs and reserve space for the provision of water pressurisation, heating and pumping systems for off-site users of process or space heating.

31. Within 1 year from date on which this permission was deemed granted, the Company must prepare a Combined Heat and Power (CHP) feasibility review assessing potential commercial opportunities for use of heat from the development, which must be submitted in writing to the Council for its approval. The review must provide for ongoing monitoring and full exploration of potential commercial opportunities to use heat from the development as part of a Good Quality CHP scheme (as defined in CHPQA Standard issue 3), and for the provision of subsequent reviews of such opportunities as necessary. Where viable opportunities for the use of heat in such a scheme are identified, a scheme for the provision of the necessary plant and pipework to the boundary of the site shall be submitted in writing to the Council for its approval. Any plant and pipework installed to the boundary of site to enable the use of heat shall be installed in accordance with the agreed details.

RIVERSIDE 2

(MJL Response, Paragraph 11)

2.2.13. The Riverside Energy Park Order 2020 was made by the Secretary of State on 9th April 2020. This has been amended by the Riverside Energy Park (Correction) Order 2021 which came into force on 10 March 2021 and the Riverside Energy Park (Amendment) Order 2023, which came into force on 17 February 2023. Together, it is hereafter referred to as the Order.

2.2.14. The work numbers relevant to CHP are:

- Work No. 1A – An energy recovery facility with a capacity to process up to 805,920 tonnes of waste per calendar year including – (v) a steam turbine incorporating at least 30 megawatts of net off-take for district heating and electrical generator (if not constructed and installed as part of Work No.2).
- Work No. 3 – Works to construct and install combined heat and power equipment including heat exchangers, pipework (including flow/return pipework, valving, pumps, pressurisation and water treatment systems).
- Work No. 6A – Works to construct and install supporting infrastructure, including – pipework (including flow/return pipework), cables, telecommunications, other services and associated infrastructure.

2.2.15. In addition, there are two requirements relevant to CHP: Requirement 2 and 24.

2.2.16. Requirement 2(2) of the Order, requires

No part of Work No. 1A and Work No. 3 may commence until a plan has been submitted to and approved by the relevant planning authority demonstrating that within Work No. 1A and Work No. 3 there is sufficient space to support a heat export system capable of providing at least 30 megawatts heat off–take for district heating Set out CHP delivery requirement.

2.2.17. The relevant plans under Requirement 2 were approved on 26 January 2022 (LBB reference 19/00998/ALA14).

2.2.18. Requirement 24 is a lengthy condition requiring (in short) that:

- 1. Riverside 2 must be constructed to produce CHP and that prior to the date of final commissioning, a CHP Review must be submitted to LBB for its approval.
- 2. Consent must be gained from LBB on the terms of reference for a CHP Working Group.
- 3. Work No. 1A shall not start commissioning until a CHP Working Group has been established.
- 4. The CHP Review must be completed by a competent CHP consultant selected from an approved list as agreed by the CHP Working Group.
- 5. The technically and commercially viable actions that are identified in the CHP Review must be implemented within the timeframe set out.
- 6. A revised CHP Review is due every 3 years that the facility is operational.
- 7. Sub paragraphs 4 and 5 apply to the CHP Review revisions.
- 8. If export of heat is achieved, the CHP Review is required every 5 years.

2.2.19. The Terms of Reference for the CHP Working Group (Requirement 2(2)) was approved on 30 October 2024 (LBB reference 19/00998/ALA23).

2.2.20. The rest of Requirement 2 is yet to be discharged, with the Managing Director for Heat currently seeking to set up a meeting of the CHP Working Group, not least to agree the list of consultants to be asked to prepare a CHP Review (Requirement 2(4)) such that the CHP Review can be undertaken and submitted to LBB for its approval (Requirement 2(1)).

DISTRICT HEAT NETWORK

(MJL Response, Paragraph 10)

2.2.21. On 22 March 2022, a hybrid application was made by Vattenfall, reference 22/00728/FUL, for:

'… a phased development comprising (Phase 1) full planning permission for the installation of a district heat network pipeline in Norman Road connecting to Riverside Resource Recovery Facility; and (Phase 2) outline planning permission (all matters reserved) for the provision of a bridge carrying a district heat network pipeline over the ditch to the south of Norman Road with a pedestrian walkway structure above the bridge, decked area and associated alterations and improvements around the existing pedestrian gate at the south west of Norman Road and associated works.'

2.2.22. This application was approved on 08 July 2022. The Phase 1 element of the scheme is subject to compliance conditions only; there are no pre-commencement details to discharge.

2.3. CONCLUSION

2.3.1. There is a clear policy imperative, both nationally and locally, to put waste heat to beneficial use, decarbonising the energy sector and ensuring supply remains reliable and affordable. Policy is clear that all opportunities should be taken to use waste heat effectively in homes and businesses.

2.3.2. Both the GLA and LBB have progressed studies for heat networks. The, very recent, GLA Report (see from paragraph **Error! Reference source not found.**) confirms its support for strategic heat sources (expressly including the Riverside Campus) and long range transmission as the route forward for achieving its decarbonisation objectives.

2.3.3. In light of the important and relevant policy context, both the GLA and LBB have expressed their support for it within the Proposed Scheme and '*supports the inclusion of infrastructure to facilitate the export of heat'* from the Proposed Scheme (SocG with LBB, Rev C, (AS-080)).

2.3.4. The Applicant is already complying with this policy context at Riverside 1 and Riverside 2; both facilities are CHP Ready and have identified areas for their own heat transfer stations. They have been progressed on the company's knowledge at the time and have been focussed on the Riverside Heat Network. However, as explained in section 3 of this report, that is just one element of the total heat demand across London.

2.3.5. Vattenfall, an energy delivery company that has been in the UK for 15 years, has gained the consent necessary to commence delivery of the Riverside Heat Network.

2.3.6. The Proposed Scheme would not comply with policy imperatives if it did not provide for heat transfer. If a HTS is not built into the Proposed Scheme, as required by policy, the opportunity to provide it efficiently and effectively is lost.

3. HEAT DEMAND AND DELIVERABILITY

3.1. INTRODUCTION

3.1.1. The Applicant confirms that there is significant demand for heat; and a level of demand much larger than can be supplied by the Riverside Campus.

3.1.2. This confirmation should not be unexpected for a capital city the size and complexity of London that has intentions to be net zero by 2030.

3.1.3. The Applicant is actively working on heat supply so as to provide a strategic contribution to the decarbonisation of London's heat. This activity is being led by its new Managing Director for Heat, with responsibility to put the waste heat from Riverside to beneficial use. In Cory's senior management structure there are just two other managing directors, one for Riverside and for Marine Logistics and Operations, demonstrating the significant level of commitment the company gives to this role.

3.1.4. This section of the report addresses heat demand, first clarifying on site demands, then describing the Riverside Heat Network and finally considering other demands that are located more distant from the site.

3.1.5. Within this report heat demand is expressed as both megawatts (MW) and terrawatt hours (TWh); both are relevant, they just do different things.

- MW is the measure of power, or the rate of heat export. It is similar to 'speed' in a speed/time/distance analogy. It used to described peak or instantaneous load/demand.
- TWh is the total heat or total energy supplied. It is similar to 'distance travelled' in a speed/time/distance analogy. It is used to describe the total demand over a period of time (in this report, one year) recognising potential fluctuations.

HEAT SUPPLY

3.1.6. Prior to considering demand, it is relevant to first consider supply. Waste heat can be supplied as either high or low grade, with high grade preferred in district heat networks. The waste heat from the Riverside energy from waste facilities is both, as would be the waste heat from the Carbon Capture Facility:

- Riverside 1 ~220MW
- Riverside 2 ~170MW; and
- Carbon Capture Facility ~100MW to 300MW

3.1.7. Consequently, the Riverside EfW facilities are able to provide around 390MW.

3.1.8. The Carbon Capture Facility heat cannot be simply added on, as it will use some of that heat and reduce it by about one third. Overall, the Riverside Campus, including the Carbon Capture Facility, would be able to provide some 360MW to 560MW.

3.2. ON SITE DEMAND

BACK UP PLANT

3.2.1. Heat consumers require a confirmed and reliable supply of heat. They need to know that supply will be available as required to meet demand.

3.2.2. Consequently, it is not enough simply to provide a heat source; there needs also to be back up capacity.

3.2.3. Riverside 1 and 2 are suitably located to be either primary supply to demand and/or back up plant to each other. However, both are needed to enable this level of reliability to be provided.

CARBON CAPTURE FACILITY

3.2.4. The Carbon Capture Facility is proposed to use steam from Riverside 1 and/or Riverside 2. This energy use will, consequently, reduce the amount of waste heat available for the Riverside Heat Network, or any other demand.

3.2.5. If waste heat from the Carbon Capture Facility is not recovered, Cory will lose around one third of its heat supply potential, due to the amount being used for the Proposed Scheme. The waste heat from the Carbon Capture Facility is necessary to replenish supply from the Riverside EfW facilities.

3.3. RIVERSIDE HEAT NETWORK

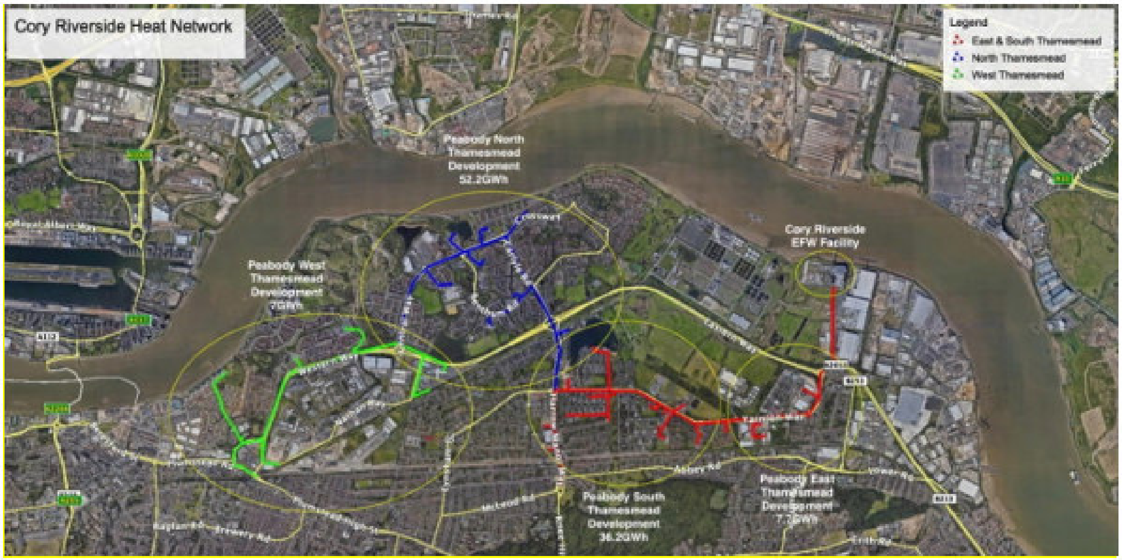
3.3.1. Working with Vattenfall and the London Borough of Bexley, Cory is developing one of the largest heat networks in the UK. The Riverside Heat Network presents a watershed moment in London's decarbonisation journey by transforming how a large part of the city is supplied with heat. The two energy from waste facilities at Riverside have already been identified to provide heat suitable for tens of thousands of homes in the London Borough of Bexley and the Royal Borough of Greenwich. Heat from the Carbon Capture Facility would either supplement that Heat Network (replacing the heat drawn down for its own operation) and/or would be used for other heat demand.

3.3.2. -The Riverside Heat Network is under active development. Not least, Cory, with Vattenfall, is currently in commercial negotiations with Peabody Trust regarding the Riverside Heat Network.

3.3.3. In April 2021, the project gained a £12.1 million award from the Government's £320 million Heat Networks Investment Project (HNIP). The funding comprises a £1.6 million commercialisation grant and a £10.5 million construction loan, delivered by Triple Point Heat Networks Investment Management.

3.3.4. Figure 3-1 shows the development areas defined within the HNIP application.

Figure 3-1- Riverside Heat Network, Development Areas in HNIP Application



Source: Vattenfall website

3.3.5. -Application 23/02922/FULM (validated in December 2023) is a major development proposal for the redevelopment of former gas storage site located on Yarnton Way to provide 392 residential units and commercial floorspace, together with associated car parking and cycle storage, landscaping etc. Paragraph 6.5 of the Energy Statement submitted as part of that application explains that, '*following correspondence with Vattenfall who are developing the Cory Riverside Heat Network, it has been decided to implement a strategy to connect to this network subject to detailed commercial negotiations*.'

3.3.6. Figure 5 of the Energy Statement (reproduced in Figure 3-2 shows the site of the proposed development immediately adjacent to the route of the heat network as shown on the London Heat Map. The development site is located less than 750m (following the public highway) from the bottom of Norman Road.

Figure 3-2 -Reproduction, Figure 5 of Energy Statement for development at Yarnton Way

Figure 5: Site on London Heat Map (2023)

3.3.7. On 8 July 2022, Vattenfall gained consent for a hybrid application (reference 22/00728/FUL) for a phased development comprising (Phase 1) full planning permission for the installation of a district heat network pipeline in Norman Road connecting to Riverside Resource Recovery Facility; and (Phase 2) outline planning permission (all matters reserved) for the provision of a bridge carrying a district heat network pipeline over the ditch to the south of Norman Road with a pedestrian walkway structure above the bridge, decked area and associated alterations and improvements around the existing pedestrian gate at the south west of Norman Road and associated works.

3.3.8. Phase 1 (the works necessary to lay the pipeline within Norman Road) is subject to compliance conditions only; it is ready to be implemented. It is noteworthy that the GLA and LBB have been pushing for the Riverside Heat Network to be realised and seeking assurance that the Carbon Capture Facility won't further delay its implementation (see paragraph 2.1.15). Progress has not been expedited largely due to capacity issues on Norman Road with Riverside 1 in operation, Riverside 2 in construction and four other strategic occupiers (including regional distribution centres) being primary users of this space constrained public highway. During operation, the traffic associated with Riverside 2 will be much reduced to that during construction, and site access will be more flexible than during Riverside 2's construction, such that there would be capacity on the highway and access to the site to install the pipework and the Proposed Scheme need not further delay delivery.

3.4. OTHER HEAT DEMAND

3.4.1. In addition to the Riverside Heat Network, Cory is also actively engaging with five other existing and developing heat networks elsewhere in London, so as to provide a strategic contribution to the decarbonisation of London's heat. This includes central London, where demand is very high, individual property heat decarbonisation solutions are challenging, and there are few other major low carbon heat sources to support heat networks.

3.4.2. As context, the Energy Act 2023 contains significant provisions aimed at expanding heat networks in the UK, to deliver the Climate Change Committee's target of 20% of UK heating being supplied by district heating by 2050. This 20% is concentrated in heat dense areas, such as London. A key aspect of the legislation is the designation of "heat network zones" in which there will be strong planning support for heat networks. There will also be wide powers for appointed developers, for instance the power in some cases to mandate that buildings connect to heat networks.

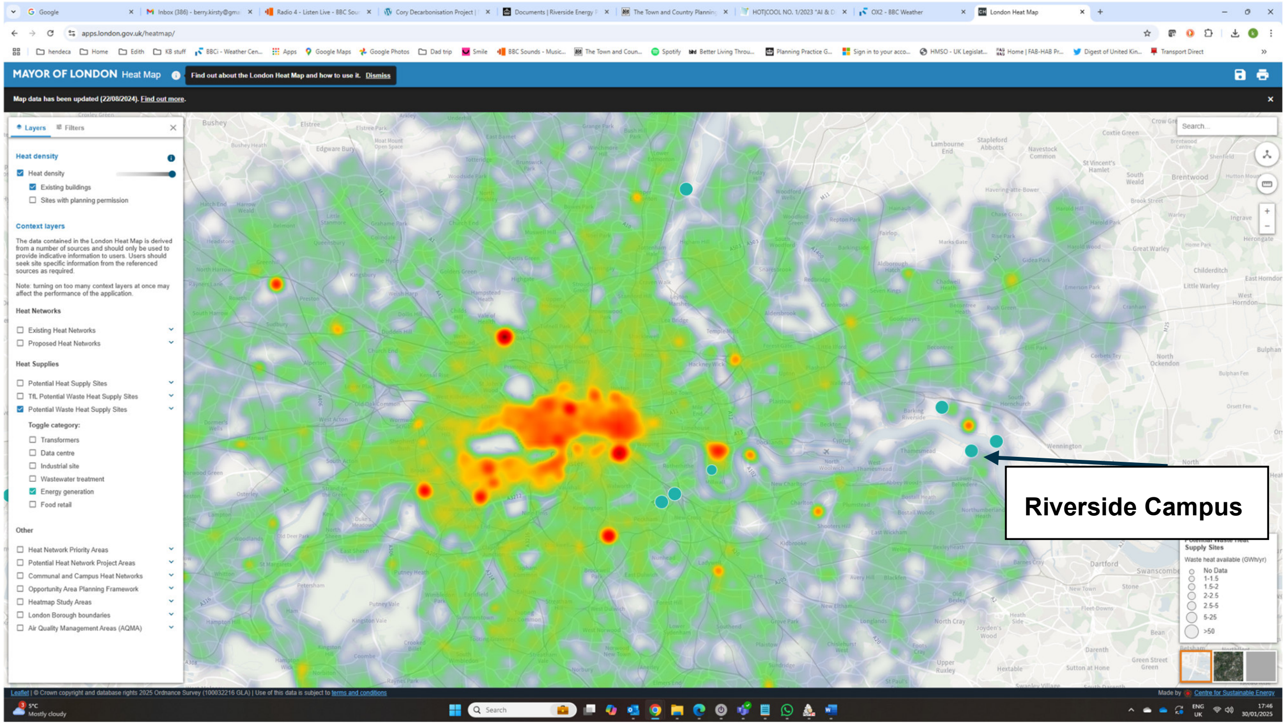
3.4.3. Two heat network zones have already been designated in London:

- South Westminster Area Network (https://www.swanheat.co.uk/) which was brought to life by DESNZ and Westminster City Council who have partnered with '*a joint venture between Hemiko and Vital Energi, two of the leading heat networks developers in the UK, who were appointed in October 2024*. *… The heat network will supply low carbon heating, sourced from within the local area. The heat will need to come from innovative sources such as the London Underground, the Thames, and the sewer network. It might even be brought down the river on barges*.' Construction of SWAN is due to start in 2026.
- Old Oak and Park Royal Development Corporation (https://www.london.gov.uk/who-we-are/city-halls-partners/old-oak-and-park-royal-development-corporation-opdc) was established by the Mayor of London to secure the regeneration of the Old Oak Opportunity area, spanning land in three London boroughs – Ealing, Brent and Hammersmith & Fulham. In October 2024 it was selected as one the government's first heat network zones, expected to deliver 95GWh of heat across five phases between 2026 and 2040. The project was awarded £36m from the government's Green Energy Heat Network Fund in November 2023. In September 2024, the Corporation announced the acquisition of the site for the heat network's energy centre in Park Royal.

3.4.4. Several more are scheduled to be designated in the foreseeable future, including the City of London and the City of Westminster – both administrations are due to be almost entirely zoned as heat networks in the near future.

3.4.5. Looking to deliver on London Plan objectives, the GLA hosts the London Heat Map; a tool designed to identify areas of high heat demand, explore opportunities for new and expanding district heat networks and to draw potential heat networks and assess their financial feasibility. (https://apps.london.gov.uk/heatmap/) The Heat Map was recently updated (August 2024) and shows substantial demand across central London. Figure 3-3 is a screen grab of -the London Heat Map.

Figure 3-3 -Screen grab of London Heat Map (taken 30 January 2025)



3.4.6. The Applicant is actively engaging with heat consumers, whose forecast demand by the early 2030s is over 1.2TWh per year (or around 907MW peak demand). Total addressable demand in London is significantly greater than this – but even this demonstrates the commercial and technical attractiveness of heat supply at scale from the Riverside Campus to central London.

3.4.7. Using advanced heat recovery techniques (including recovering heat from the Carbon Capture Facility) the Applicant can make a major contribution to core decarbonisation objectives.

3.5. HEAT IS DELIVERABLE

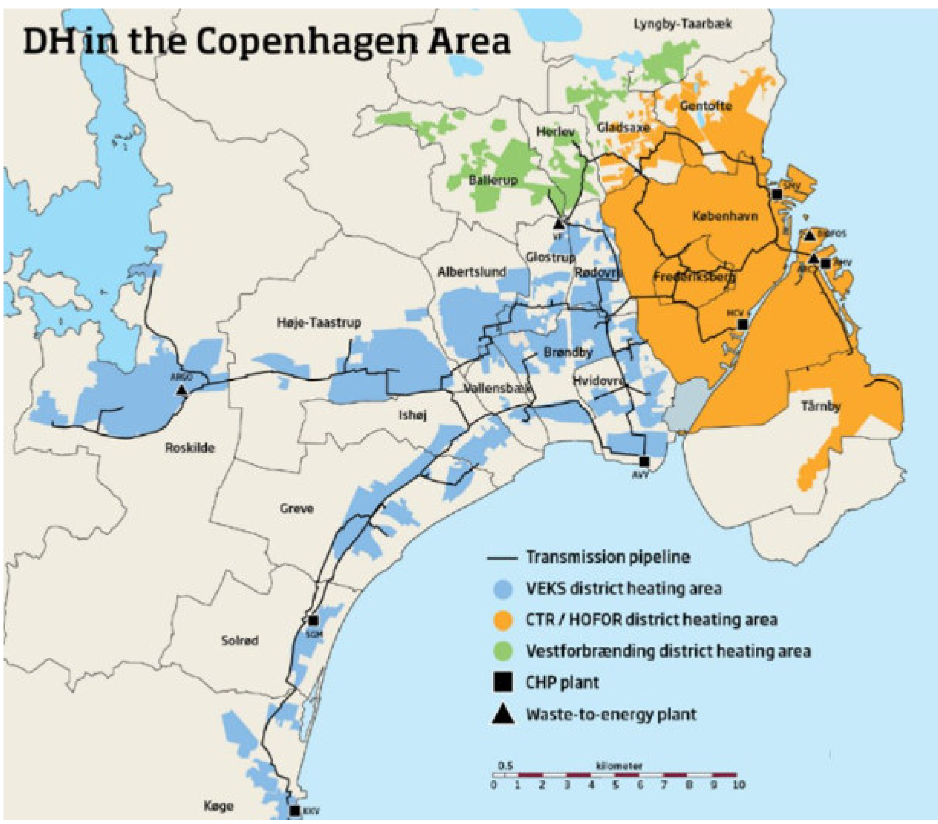
3.5.1. The Applicant confirms that its heat is technically deliverable to service this demand and is pursuing two options for long range heat transmission.

3.5.2. First, the use of thermal stores integrated on barges, to move heat along the River Thames (termed 'Mobile Heat'). Mobile Heat would make use of the Applicant's marine logistics assets and expertise, as well as available heat. The initial studies undertaken by Cory for Mobile Heat have also received funding support via the Heat Network Development Unit in the Department for Energy Security and Net Zero.

3.5.3. Second, the construction of a long range transmission main from the Riverside Campus operating as a strategic heat source.

3.5.4. This is a solution already used in cities with well-developed district heating infrastructure, such as Copenhagen, which has several such mains extending over 50km from the city centre. Figure 3-4-shows the transmission network in Greater Copenhagen.

Figure 3-4 -Transmission Network in Greater Copenhagen



Source: The transmission network in Greater Copenhagen, Hot/Cool International magazine on district heating and cooling (Figure 1) https://hotcool.dbdh.dk/view/144755169/

3.5.5. Very recently (in December 2024) the GLA published its report '*London Energy Accelerator. Waste Heat Strategic Areas Summary'* (the 'GLA Report', provided at Annex B).

3.5.6. Chapter 12 of the study concludes '*there is a significant quantity of waste heat available from a relatively few large waste heat sources across London and they provide a good opportunity to develop out a number of strategic multi-borough district heat networks*.' The GLA Report identifies the Riverside Campus as one of those strategic heat sources.

3.5.7. To realise this opportunity requires a partnership approach and a '*departure from the current development model which is largely happening at an individual borough level and led, in most cases, by the relevant London Borough. This is often constraining the ambition and size of London's district heat networks and with the introduction of heat network zoning in 2025, there is real opportunity for London Government – the GLA, London Councils and London Boroughs - to coordinate and develop these strategic opportunities*.' (GLA Report, chapter 12)

3.5.8. Consequently, through its December 2024 report the GLA is promoting an approach of strategic heat sources (including the Riverside Campus) supplying long range transmission of heat as key to realising its decarbonisation ambitions. Figure 12-1 of the GLA Report (reproduced as Figure 3-5, over the page) shows the studied Strategic Area Networks and the extent of the opportunity to roll out heat networks across London.

3.5.9. The distance from the Riverside Campus to central London is c.25km (half that of the distance covered in Copenhagen) with a greater heat density than Copenhagen. It is eminently achievable and the GLA Report demonstrates that the GLA intends for it to happen.

3.5.10. Cory has commissioned a feasibility study and basis of design for a tunnelled heat main, connecting the Riverside Campus to the identified heat loads in central London. Because the heat main would be tunnelled, the River Thames would not present a major engineering obstacle, and the proposed route would supply distribution heat networks north and south of the river.

3.5.11. Via both delivery options (Mobile Heat or transmission network) heat supply towards central London is technically and commercially viable based on the current level of techno-economic appraisal.

3.5.12. Cory has already signed or is negotiating MOUs with prospective heat networks (including to networks not considered by the GLA Report) with total forecast annual demand of over 1.2TWh by 2035.

Figure 3-5 Reproduction, Figure 12-1 Map showing all Strategic Area Networks

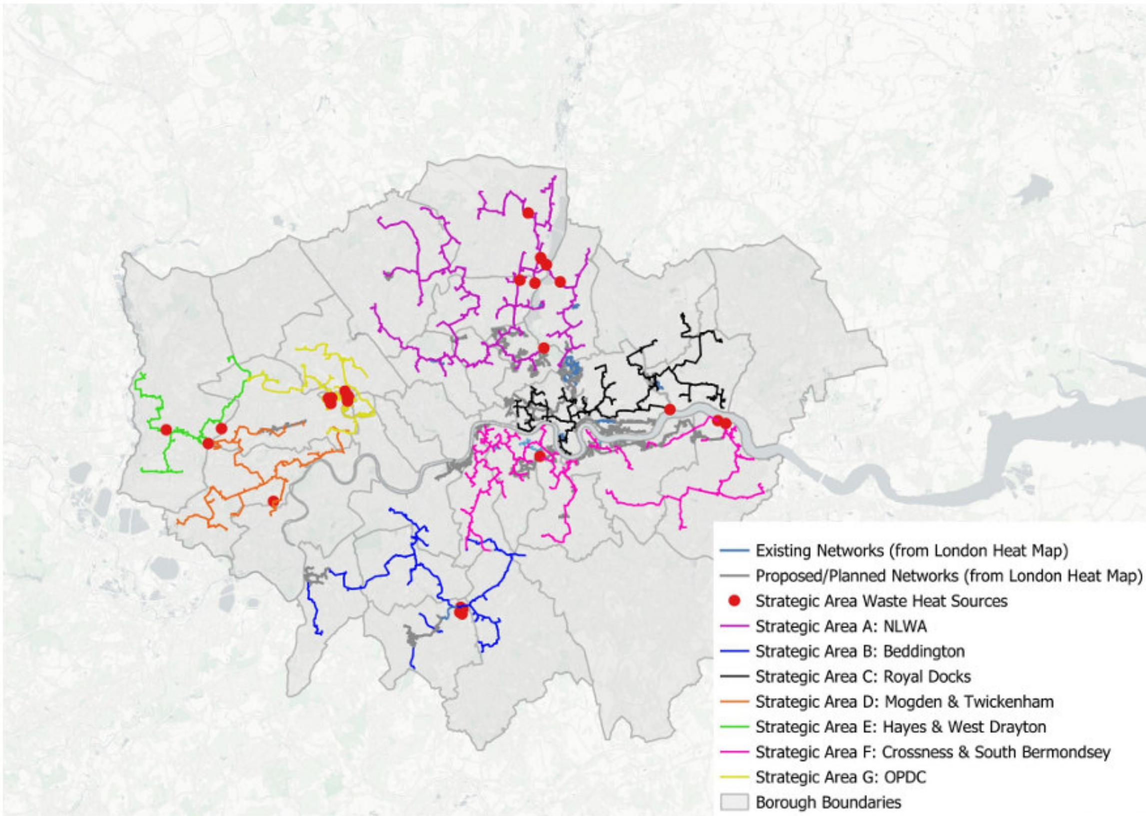


Figure 12-1 Map showing all Strategic Area Networks

3.6. CONCLUSION

3.6.1. There is additional waste heat available from the Riverside Campus than is currently recognised by MJL (up to 560MW, see paragraph 3.1.7). However, there is also substantially greater demand for heat across London than MJL recognises (some 907MW, see paragraph 3.4.6), which should not be unexpected for a capital city of its size and complexity, and with aspirations to be net zero by 2030.

3.6.2. The Carbon Capture Facility will operate as a parasitic load on the Riverside EfW facilities; it will reduce their heat output by approximately one third. Ensuring the deliverability of local demand, not least the Riverside Heat Network, requires that loss to be made up, which can be achieved through using waste heat from the Carbon Capture Facility.

3.6.3. The Riverside Campus is identified by both the Mayor of London and the local authority as a key strategic heat source and very recent work by the GLA and Burro Happold confirms that long range transmission of heat is deliverable and desirable in order to achieve its decarbonisations objectives.

3.6.4. This is validated by early market signals. Cory is in commercial discussions to supply heat to heat networks along the Thames corridor towards central London, in addition to the local Riverside Heat Network being progressed with Vattenfall. The total forecast demand for these networks aggregates to more the 1,200 GWh per year by the early 2030s. Cory is actively engaging with heat consumers, not least through its newly installed Managing Director for Heat, whose role is to ensure Cory's heat is available to support London's decarbonisation.

3.6.5. The heat demand (as currently understood) is larger than the available heat available from Riverside but using advanced heat recovery techniques (including recovering the heat from the Carbon Capture Facility) the Applicant can make an important and relevant contribution to meeting that demand.

4. NEED FOR A HEAT TRANSFER STATION WITH THE CARBON CAPTURE FACILITY

4.1. INTRODUCTION

4.1.1. Contrary to the position set out in the MJL Response, an HTS is necessary within the built footprint of the Carbon Capture Facility. Section 1 of this report summarised the three reasons that MJL say an HTS within the built footprint of the Carbon Capture Facility is not required. They are:

1 That Riverside 1 and Riverside 2 are required by their own planning consents to include their own HTS requirements – as this requirement already exists it can't be used to justify an HTS site within the Carbon Capture Facility. It would only be appropriate to justify an HTS within the Carbon Capture Facility to capture heat from that Facility. (MJL Response, paragraphs 7, 8; and 12; Dr Edgar's Report paragraph 4.10)

2 That the assessment of local demand completed by Fichtner for Riverside 1 (the 2019 Fichtner Report) can be entirely met via Riverside 1 and that any conceivable increase above that would be met by Riverside 2. Consequently, there is no further heat demand, no need to access heat from the Carbon Capture Facility, and so no need for an HTS. (MJL Response, paragraphs 5 and 6; Dr Edgar's Report, paragraphs 4.6 to 4.9) Further, that a longer distance supply would not be technically viable. (Dr Edgar's Report, paragraphs 4.11 to 4.15)

3 In any case, even if an HTS was to be included, it does not need to be contiguous with the built footprint of the Carbon Capture Facility. (Dr Edgar's Report, paragraph 3.4)

4.1.2. Each is addressed below, with the conclusion recognising the policy imperative, and Cory's ongoing work to deliver against that policy imperative and the significant levels of demand.

4.2. AN HTS FOR THE CARBON CAPTURE FACILITY IS APPROPRIATE

4.2.1. First, (addressing MJL Response, paragraphs 7 and 8; and Dr Edgar's Report, paragraph 4.10) the Applicant would confirm the position in relation to the HTS provision currently set out within the Proposed Scheme.

4.2.2. Simply, provision has been made, at a nominal size, for an HTS within the built footprint of the Carbon Capture Facility. It is proposed to transfer the waste heat from the Carbon Capture Facility into whatever district heat network or heat demand is appropriate at the time of its construction.

4.2.3. At paragraph 8, the MJL Response is correct to identify that both Riverside 1 and 2 include provision for the transfer of heat from those facilities. The Applicant consequently confirms that the HTS within the built footprint of the Carbon Capture Facility has not been designed or sized to also provide heat transfer capacity for Riverside 1 or Riverside 2.

4.2.4. The HTS presented in the **Indicative Equipment Layout (AS-070)** is nominally sized (with a footprint of 30m x 30m) based upon the assumption only the high grade heat (~100MW) would be exported to a heat network, and that this heat would be of a suitable temperature for export without requiring any pre-treatment. Discussion with heat delivery partners indicates that the Riverside Heat Network would require a higher temperature than the Carbon Capture Facility high grade heat. Consequently, it would need heat pumps to be incorporated into the HTS, which would enlarge the building size.

4.2.5. Further, discussion with heat partners indicates that the low grade heat, principally recovered from the cooling system of the Carbon Capture Facility, could also be beneficial, leading the Carbon Capture Facility being capable of providing ~300MW total waste heat output (both low and high grade). A high level consideration of the building required to export all of this waste heat, indicates a footprint area of 80m x 60m, considerably larger than the footprint presented on the **Indicative Equipment Layout (AS-070)**. Whilst it is unlikely that all the waste heat would be captured and exported, it is clear that greater potential exists than has been considered to date.

4.2.6. Both these factors demonstrate that a conservative footprint for the HTS has been presented within the Proposed Scheme, it is a small representation of what is likely to be required. Both factors also demonstrate the need for flexibility through detailed design and for all of the Carbon Capture Facility site area to enable an optimal project to be delivered.

4.2.7. As discussed in section 4.4 of this report, the potential to optimise a strategic approach to waste heat across the Riverside Campus (including the Carbon Capture Facility) is recognised and is worthy of further consideration at detailed design. However, that approach has driven neither the indicative size/design nor location of the HTS shown within the built footprint of the Carbon Capture Facility on the **Indicative Equipment Layout (AS-070)**.

4.2.8. Further, and as has been demonstrated in the **Applicant's Response to Relevant Representations** and its **Appendix E (AS-044)** and in the **Written Summary of the Applicant's Oral Submissions at ISH 1 REP1-025)** and its **Appendix C (REP1-026)**, the Riverside Campus does not have space to take waste heat from the Carbon Capture Facility to either of the HTS intended for the EfW facilities, especially when considering the necessary pipework as well as the footprint of the HTS.

4.2.9. Consequently, it is appropriate to include an HTS within the built footprint of the Carbon Capture Facility on the **Indicative Equipment Layout (AS-070)**.

4.3. SUBSTANTIAL HEAT DEMAND IS EVIDENT AND IS DELIVERABLE

4.3.1. The MJL Response (at paragraphs 5 and 6) and Dr Edgar's Report (at paragraphs 4.6 to 4.9) are wrong to assert that there is insufficient heat demand to support that to be gained from the Carbon Capture Facility. As set out in section 3 above (which provides additional information to the headlines provided to MJL on 10 January 2025) there is substantial demand for heat across London, which is technically accessible from the Riverside Campus.

4.3.2. Instead, MJL's Deadline 3 submission relies only on the work published in 2019 that was prepared solely for the purposes of, and so focussed only on, Riverside 1; a document that is now over five years old. It fails to consider either the headline information provided to MJL (which at least Dr Edgar is cognisant of, as he references it at his paragraph 4.12) or other relevant, up to date, and in the public domain, information, such as the GLA Report (December 2024).

4.3.3. The GLA Report identifies key strategic heat sources (including the Riverside Campus) alongside the use of long range heat transmission to deliver the Mayor's decarbonisation objectives. The delivery of heat networks is not being left to individual heat sources/projects/developers; a strategic approach across London Boroughs is being promoted to make bigger projects happen. The Riverside Heat Network is one of those networks, to which LBB has sought assurance that the Proposed Scheme is not going to cause delay.

4.3.4. In addition, there is also substantial demand within central London, information on which was outlined in the Applicant's 10 January email. Dr Edgar's response (at his paragraphs 4.11 to 4.15) is that these plans are merely 'aspirational'. In reality, they are plans that are being progressed by a dedicated Managing Director within Cory, using both Mobile Heat and long range transmission, a technique that is well established elsewhere (the example of Copenhagen is given in section 3 of this report).

4.3.5. In any event, MJL fail to consider the impact of the Carbon Capture Facility on the heat output from Riverside 1 (or 2). It will use about a third of the heat that the 2019 Fichtner Report considered available to third parties. In the very least, even if there was no further demand, which there clearly and substantially is, the heat from the Carbon Capture Facility would mean that the original expected heat output from Riverside 1 (or 2) could be maintained.

4.3.6. The complaint (made at paragraph 12 of the MJL Response and paragraph 4.5 of Dr Edgar's Report) that no assessment of heat demand has been provided, is neither important nor relevant. The Carbon Capture Facility is not an energy generating station; generating energy is not its function. However, waste heat will be a result of its operation and the Applicant is right to seek to use it. The Applicant has been proactive in ensuring the policy imperative for heat can be delivered.

4.3.7. MJL Response paragraph 12 says:

'The need for a HTS within the proposed scheme should therefore be assessed on whether there is demand for the heat produced by the proposed scheme, which there is not.'

4.3.8. There is a demonstrable and substantial demand for heat (some 907MW) to underpin the need for an HTS in the built footprint of the Carbon Capture Facility. Experience from cities elsewhere, the GLA's clear intentions, and that Cory has deployed a senior role to deliver it and is actively in commercial discussions, demonstrates that the export of (potentially up to 560MW) waste heat to contribute to meeting this demand is both technically and financially viable.

4.3.9. Having demonstrated there is demand for the heat, the Applicant has confirmed the need for the HTS within the built footprint of the Carbon Capture Facility.

4.4. THE HTS SHOULD BE CONTIGUOUS WITH THE CARBON CAPTURE FACILITY

4.4.1. The HTS shown on the **Indicative Engineering Layout (AS-070)** has been sized and located as relevant to the Carbon Capture Facility, on a nominal heat supply of 100MW. It does not take any account of heat from Riverside 1 or Riverside 2 or additional heat that may be recovered from the Carbon Capture Facility through optimisation.

4.4.2. However, in making its optimal contribution to the decarbonisation of London, Cory would have three sources of heat to manage and would require flexibility to manage the inter-relationship between them.

4.4.3. Cory would be seeking a holistic approach across the Riverside Campus, optimising the heat captured from the carbon capture process by integrating it with heat supply capability from Riverside 1 and Riverside 2, so that these can be mutually reinforcing as a combined, strategic point of supply – the operator needs to be able to direct heat to different end points at different times, it needs flexibility to respond to the demand made and to ensure effective use of both low and high grade heat. Physical proximity enables that integration to be achieved efficiently and effectively.

4.4.4. The optimised system should also enable connection south for landward transmission pipeline, as well as north to the planned mobile heat jetty (being a westward extension of the Middleton Jetty).

4.4.5. While the HTS associated with the Carbon Capture Facility may be operated by a third party, it may be operated by Cory. This is a key point of flexibility in the Company's commercial design. If operated by Cory, there may be efficiencies to be gained in terms of landtake. However, as discussed above (paragraphs 4.2.4 & 4.2.5) the HTS may need to be larger than currently indicated to enable optimisation of heat export from the Site.

4.4.6. In any event, it is not unusual to have a third party operator infrastructure of key utility interfaces within the boundary of an operating facility but separated from it. This is exactly the situation at the Riverside Campus which has two electricity substations, one each for Riverside 1 and Riverside 2; these are UKPN assets and UKPN needs safe and ready access to them for maintenance. The substations are located within the built footprint of the Riverside EfW facilities and consequently within the secured boundary, however, they are separately fenced within the Campus, and necessarily so.

4.4.7. Whilst Norman Road is identified as Work No. 3 Utilities Connections and Site Access Works it is not without its limitations. Cory constructed the road as part of Riverside 1; it required substantial piling to ensure an appropriate structure for a public highway on marshland and it already accommodates utilities servicing both Riverside 1 and Riverside 2. There is adequate space for necessary utilities connections (it is appropriately identified as Work No. 3); however, space is constrained and there is not room for extraneous pipework resulting from sub-optimal design (a non-contiguous site would require additional pipework).

4.4.8. The HTS needs to be contiguous with the built footprint of the Carbon Capture Facility. There are substantial benefits, similar to UKPN, for these assets to be co-located and not providing an HTS within the built footprint of the Carbon Capture Facility risks it not happening, an outcome that would be contrary to policy.

4.5. CONCLUSION

4.5.1. At paragraph 4.8.16, NPS EN-1 makes clear that the '*Secretary of State should not give development consent unless satisfied that the applicant has provided appropriate evidence that CHP is included or that the opportunities for CHP have been fully explored.'*

4.5.2. There is a policy driven need to provide an HTS within the built footprint of the Carbon Capture Facility.

4.5.3. Whilst recognising this policy is drafted for energy generation stations rather than carbon capture facilities, it is an approach that is replicated within national and local planning policy. As a key element of achieving decarbonisation objectives, the policy imperative requires that opportunities for heat are progressed. This approach has been implemented in the Proposed Scheme.

4.5.4. The **Indicative Equipment Layout (AS-070)** includes nominal provision for an HTS to enable the export of waste heat from the Carbon Capture Facility. This piece of infrastructure has been presented at a nominal size appropriate to the Carbon Capture Facility, contrary to the MJL Response, it has been neither sized nor located with reference to the potential for heat supply from either Riverside 1 or 2.

4.5.5. Indeed, it is readily demonstrated that a conservative footprint for the HTS has been presented within the Proposed Scheme and that being able to respond to market requirements and optimise heat output from the Carbon Capture Facility demonstrates the need for flexibility through detailed design. All of the Carbon Capture Facility site area is required to enable an optimal project to be delivered.

4.5.6. Further, there is a substantial demand for that waste heat; not only to make up heat losses that will occur as a result of the Proposed Scheme, but also to enable a full contribution to be made, from this identified strategic heat source, to meeting heat demand across London, some 907MW. Contributing to that demand, enabling the export of heat from the Riverside Campus is not 'aspirational'; it is a number of very real projects being led by a senior role within the Cory group.

4.5.7. Optimising heat supply requires certainty that an appropriately sized, safe and accessible HTS is provided within the built footprint of the Carbon Capture Facility.

4.5.8. It is appropriate, and necessary to provide the HTS within the built footprint of the Carbon Capture Facility. It would be contrary to policy to remove this element from the Proposed Scheme and, as discussed in other submissions such deletion would not change the land requirements in such a manner to no longer require the MJL land in any event.

Annexures

ANNEX A – HEAT RELEVANT POLICY AND STRATEGY

INTRODUCTION

This annex has been prepared to present the policy and strategy that is important and relevant to the provision of heat. It covers the following documents:

- Overarching National Policy Statement for Energy, November 2023;
- Sixth Carbon Budget, The UK's path to Net Zero, December 2020;
- National Planning Policy Framework, December 2024;
- London Plan, March 2021;
- Thamesmead and Abbey Wood Opportunity Area Planning Framework, December 2020;
- London Environment Strategy, May 2018; and
- Bexley Local Plan, April 2023.

NATIONAL EXPECTATIONS

NPS EN-1

Section 3.4

3.4.27. Heat networks are a crucial technology for decarbonising the UK's heating, particularly in dense urban areas. They are uniquely able to unlock otherwise inaccessible sources of larger scale renewable and recovered heat such as waste heat and heat from waterways and mines. By using recovered heat from industry, geothermal energy and power generation, and accessing sources of ambient heat, heat networks can reduce overall production requirements for gas, as well as offering a way of storing and balancing energy needs overall. In parts of the UK, heat networks will represent a lower cost route to decarbonisation than alternatives such as repurposing the gas network for low carbon hydrogen.

Section 4.8

4.8.15 Given the importance which government attaches to CHP, if an application does not demonstrate that CHP has been adequately considered the Examining Authority should seek further information from the applicant.

4.8.16 The Secretary of State should not give development consent unless satisfied that the applicant has provided appropriate evidence that CHP is included or that the opportunities for CHP have been fully explored.

SIXTH CARBON BUDGET

Executive Summary

How the Sixth Carbon Budget supports global climate action (page 17):

Our recommended Sixth Carbon Budget and UK NDC reflect the goals and requirements of the Paris Agreement, recognising the UK's responsibility as a richer developed nation and its respective capabilities:

…

The actions required to meet the budget and NDC (including full decarbonisation of the power sector, full switchover to electric vehicle sales and **installation of low-carbon heating**, and roll-out of carbon capture and storage) would go beyond those required from the world on average (Table 1), in line with the UK's responsibility as a richer nation with larger historical emissions. The timing of these actions would align to that required from other climate leaders. (emphasis added)

…

4. Recommendations for action (page 29)

We identify priorities for every sector of the economy, building on our detailed recommendations in our June Progress Report.

…

Buildings (17%). Government must produce a robust and ambitious Heat and Buildings strategy which sets the direction for the next decade, with clear signals on the phase-out of fossil heating, rebalancing of policy costs between electricity and gas, commitments to funding and delivery plans which include regional and local actors. Our Balanced Pathway is underpinned by clear timetables for standards to make all buildings energy efficient and ultimately low-carbon. **The other priorities are rapidly to scale up supply chains for heat pumps and heat networks and to develop the option of hydrogen for heat.** Proper enforcement of standards, including avoiding overheating risks, and an effective approach to skills are essential.

(emphasis added)

Chapter 3, Sector Pathways to Net Zero

2. Buildings (page 109)

Our Balanced Net Zero Pathway reflects four priorities over the coming decade or so:

- Deliver on the Government's energy efficiency plans to upgrade all buildings to EPC C over the next 10-15 years.
- Scale up the market for heat pumps as a critical technology for decarbonising space heating, while maintaining quality.

- **Expand the rollout of low-carbon heat networks in heat dense areas like cities, using anchor loads such as hospitals and schools. Prepare to shift away from using fossil fuel Combined Heat and Power (CHP) as a supply source towards low-carbon and waste heat by preference from the mid 2020s.**
- Prepare for a potential role for hydrogen in heat through a set of trials building on the current innovation programme.

(emphasis added)

Low-carbon heating in the Balanced Net Zero Pathway (page 115 and 116)

Our Balanced Net Zero Pathway implies that by 2030, low-carbon heat installations in homes could represent up to around 80% of sales.* Of these low-carbon heat installations, 75% are heat pumps (including hydrogen hybrids), 19% are low-carbon heat networks, and 5% are other flexible electric heating with space heat storage or solar thermal.

…

- Low-carbon heat networks are built through 2020-2050, with scaling up through to 2028, from which point around 0.5% of total heating demand is converted per year. By 2050, around a fifth of heat is distributed through heat networks.

  By 2030 37% of public and commercial heat demand is met by low-carbon sources. Of this low-carbon heat demand 65% is met by heat pumps, 32% district heating and 3% biomass. By 2050 all heat demand is met by low-carbon sources of which 52% is heat pumps, 42% is district heat, 5% is hydrogen boilers and around 1% is new direct electric heating.

C. Impacts of the scenarios: costs, benefits and co-impacts on society (page 122)

This is a major investment programme which, if managed well, can have strong economic benefits. In particular, the investment can act as a stimulus and create skilled employment throughout the UK, with the Construction Industry Training Board (CITB) estimating over 200,000 new jobs in this scenario (Figure 3.2.g). There is strong reason to believe these jobs would be additional to the current workforce. Energy efficiency retrofits are expected to provide new jobs and have already been recognised as an important part of the green recovery. Low-carbon heat installations, while replacing fossil fuel installations, are expected to drive additional jobs due to the additional labour required for more complex installations and household conversion.*

NPPF

Planning for climate change (pages 48 and 49)

164. New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and b) help to reduce greenhouse gas emissions, such as

through its location, orientation and design. Any local requirements for the sustainability of buildings in plans should reflect the Government's policy for national technical standards.

165. To help increase the use and supply of renewable and low carbon energy and heat, plans should: a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts); 61 In line with the objectives and provisions of the Climate Change Act 2008. 48 b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co- locating potential heat customers and suppliers.

166. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

167. Local planning authorities should also give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.

168. When determining planning applications for all forms of renewable and low carbon energy developments and their associated infrastructure, local planning authorities should: a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and give significant weight to the benefits associated with renewable and low carbon energy generation and the proposal's contribution to a net zero future; b) recognise that small-scale and community-led projects provide a valuable contribution to cutting greenhouse gas emissions; c) in the case of applications for the repowering and life-extension of existing renewable sites, give significant weight to the benefits of utilising an established site.

169. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

LONDON-WIDE EXPECTATIONS

LONDON PLAN

Polic.y SI 2 – Minimising greenhouse gas emissions

A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1 be lean: use less energy and manage demand during operation

2 be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly

3 be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site

4 be seen: monitor, verify and report on energy performance.

Supporting text at paragraph 9.2.3:

Boroughs should ensure that all developments maximise opportunities for **on-site electricity and heat production** from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.

Policy SI 3 - Energy infrastructure

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B. Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:

1 major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)

2 heat loads from existing buildings that can be connected to future phases of a heat network

3 major heat supply plant including opportunities to utilise heat from energy from waste plants

4 secondary heat sources, including both environmental and waste heat

5 opportunities for low and ambient temperature heat networks

6 possible land for energy centres and/or energy storage

7 possible heating and cooling network routes

8 opportunities for futureproofing utility infrastructure networks to minimise the impact from road works

9 infrastructure and land requirements for electricity and gas supplies

10 implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector

11 opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

C. Development Plans should:

1 identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure

2 identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

D Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1 the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks

b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)

c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)

d) use ultra-low NOx gas boilers

2 CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality

3 where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

E Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent

Supporting text at paragraphs 9.3.1 to 9.3.5

9.3.1 The Mayor will work with boroughs, energy companies and major developers to promote the **timely and effective development of London's energy system** (energy production, distribution, storage, supply and consumption). (emphasis within the London Plan)

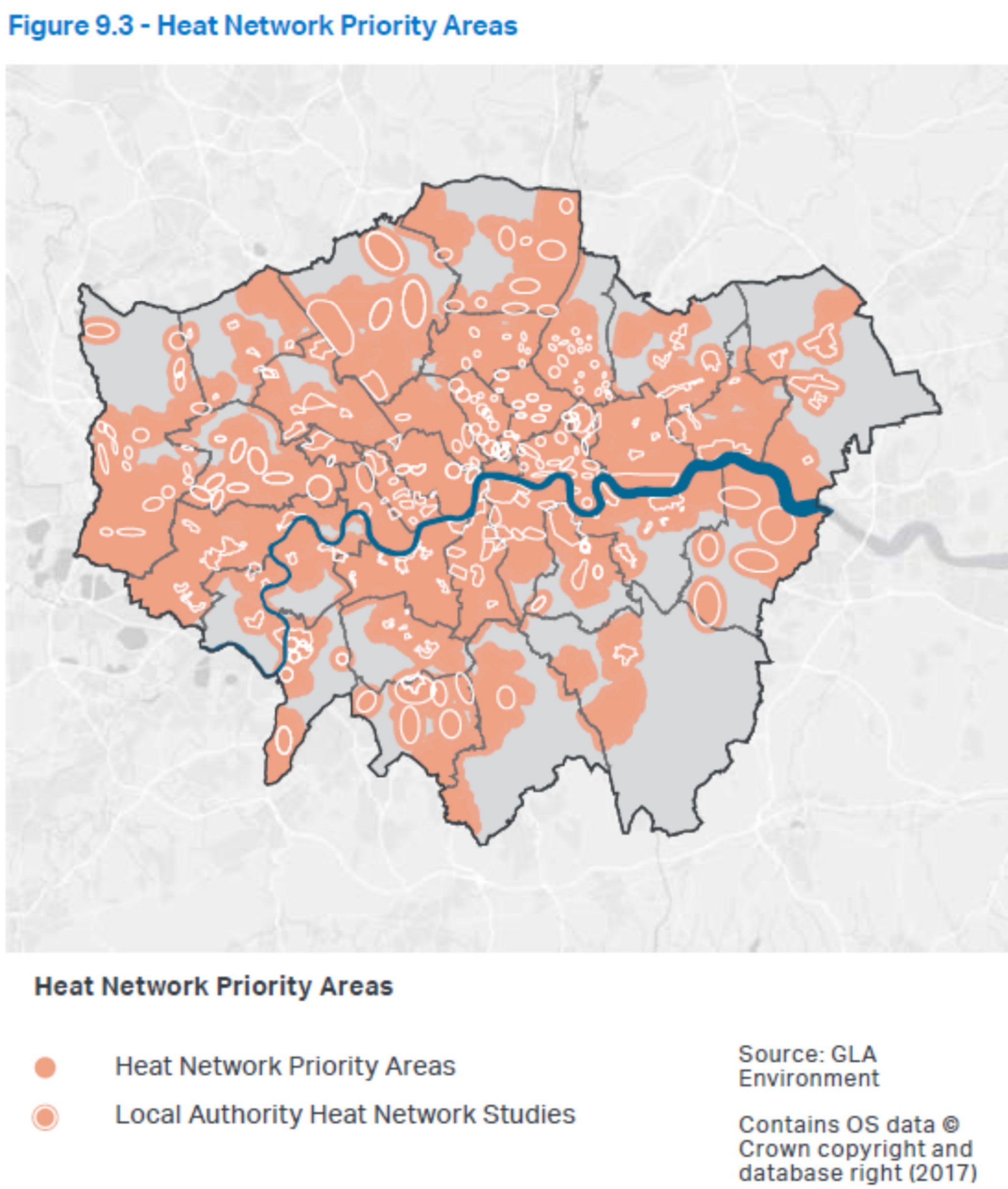
9.3.2 London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the **Mayor's zero-carbon target by 2050** requires changes to the way we use and supply energy so that power and heat for our buildings and transport is generated from local clean, low-carbon and renewable sources. London will need to shift from its reliance on using natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources. Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply and will help London become more self-sufficient and resilient in relation to its energy needs.

9.3.3 Many of London's existing **heat networks** have grown around combined heat and power (CHP) systems. However, the carbon savings from gas engine CHP are now declining as a result of national grid electricity decarbonising, and there is increasing evidence of adverse air quality impacts. Heat networks are still considered to be an effective and low-carbon means of supplying heat in London, and offer opportunities to transition to zero-carbon heat sources faster than individual building approaches. Where there remains a strategic case for low-emission CHP systems to support area-wide heat networks, these will continue to be considered on a case-by-case basis. Existing networks will need to establish decarbonisation plans. These should include the identification of low- and zero-carbon heat sources that may be utilised in the future, in order to be zero-carbon by 2050. The Mayor will consider how boroughs and network operators can be supported to achieve this.

9.3.4 Developments should connect to existing heat networks wherever feasible. New and existing networks should incorporate good practice design and specification standards comparable to those set out in the CIBSE/ADE Code of Practice CP1 for the UK or equivalent. They should also register with the Heat Trust or an equivalent scheme. This will support the development of good quality networks whilst helping network operators prepare for regulation and ensuring that customers are offered a reliable, cost-competitive service. Stimulating the delivery of new district heating infrastructure enables the opportunities that district heating can provide for London's energy system to be maximised. The Mayor has identified Heat Network Priority Areas, which can be found on the London Heat Map website.158 These identify where in London the heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers. Data relating to new and expanded networks will be regularly captured and made publicly available. Major development proposals outside **Heat Network Priority Areas** should select a low-carbon heating system that is appropriate to the heat demand of the development, provides a solution for managing peak demand, as with heat networks, and avoids high energy bills for occupants.

9.3.5 Where developments are proposed within Heat Network Priority Areas but are beyond existing heat networks, *the heating system should be designed to facilitate cost-effective future connection. This may include, for example, allocating space in plant rooms for heat exchangers and thermal stores, safeguarding suitable routes for pipework from the site boundary and making provision for connections to the future network at the site boundary. The Mayor is taking a more direct role in the delivery of district-level heat networks so that more new and existing communally-heated developments will be able to connect into them, and has developed a comprehensive decentralised energy support package. Further details are available in the London Environment Strategy.*

Figure 9.3, Heat Network Priority Areas



Policy SI 8 Waste capacity and net waste self-sufficiency

D. Development proposals for materials and waste management sites are encouraged where they:

… and/or

4) are linked to low emission combined heat and power and/or combined cooling heat and power (CHP is only acceptable where it will enable the delivery or extension of an area-wide heat network consistent with Policy SI 3 Energy infrastructure Part D1c)

Supporting text at paragraph 9.8.11

Land in Strategic Industrial Locations will provide the main opportunities for locating waste treatment facilities. Existing waste management sites should be clearly identified and safeguarded for waste use. Boroughs should also look to Locally Significant Industrial Sites and intensification of existing waste management sites. Large-scale redevelopment opportunities and redevelopment proposals should incorporate waste management facilities within them. The London Waste Map169 shows the locations of London's permitted waste facilities and sites that may be suitable for waste facility location.

Supporting text at paragraphs 9.8.15 to 9.8.17

9.8.15 Waste to energy facilities should be equipped with a heat off-take from the outset such that a future heat demand can be supplied without the need to modify the heat producing plant in any way or entail its unplanned shut-down. It should be demonstrated that capacity of the heat off-take meets the CIF at 100 per cent heat supply. In order to ensure it remains relevant, the CIF level will be kept under review.

9.8.16 Examples of the **'demonstrable steps'** required under Part E3 are:

- a commitment to source truly residual waste – waste with as little recyclable material as possible
- a commitment (via a Section 106 obligation) to deliver the necessary means for infrastructure to meet the minimum CO2 standard, for example investment in the development of a heat distribution network to the site boundary, or technology modifications that improve plant efficiency
- an agreed timeframe (via a Section 106 agreement) as to when proposed measures will be delivered
- the establishment of a working group to progress the agreed steps and monitor and report performance to the consenting authority.

9.8.17 To assist in the delivery of 'demonstrable steps' the GLA can help to advise on heat take-off opportunities for waste to energy projects, particularly where these are linked to GLA supported energy masterplans.

Supporting text at paragraph 9.8.19

…Opportunities for combined heat, power and cooling should be taken wherever possible. …

THAMESMEAD AND ABBEY WOOD OPPORTUNITY AREA PLANNING FRAMEWORK

Section 3.5, Environment, Energy and Utilities

Objectives, third bullet (page 87)

Create a smart, integrated energy system that allows new developments to achieve net zero-carbon, and the opportunity for existing buildings to connect to a low-carbon heat network.

Energy - Heat Networks (page 97)

Heat networks – in areas where heat density is high – form an important part of the energy transition and will be an integral part of the smart integrated energy systems that London creates to achieve its ambition of being zero carbon by 2050.

In addition to supplying heat to buildings. Heat networks will need to play an active role in decarbonising the energy system. This is achieved by making use of secondary heat sources, and through their ability to store electrical energy in the form of heat they will provide flexibility and resilience to the electricity networks as well as maximising the contribution that renewable can make to the energy mix.

Heat networks will also have an important strategic role in protecting the capacity of the electricity network in areas of high demand by meeting that heat demand. This is because heat networks, with thermal stores, can help minimise and manage the demand for electricity across the day and reduce the impact that the electrification of heat would have it otherwise met at an individual building or unit level.

Energy - Heat Networks (page 98)

The existing Riverside Resource Recovery (RRR) facility, an Energy from Waste (EfW) plant, will be the primary heat source and the heat network will supply the space heating and hot water demand of the OA. There are other sources of waste heat in the area that could be used in the heat network, including from Crossness sewage treatment plant and industrial operations in Belvedere.

…

Where connection to an existing heat network cannot be made immediately, major developments should investigate the feasibility of a site-wide heat network that is future-proofed so that it can be connected to the district heat network once built. Development should also maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

Figure 3.57, Proposed district heating network in Belvedere (page 99)

FIG 3.57 Proposed district heating network in Belvedere (Source: Bexley Energy Masterplan, Scenario 2 - Extended Beldevere and Thamesmead)

RRR EfW Facility (River Resource Recovery Ltd - Energy from Waste factory)
Phase 1 of proposed district heating network
Future phases of proposed district heating network

OA boundary
Borough boundaries
Green space
Water
Major roads

Energy - Heat Networks (page 100)

There are several waste heat sources in the area, including Crossness sewage treatment works and the Riverside Resource Recovery facility Energy from Waste plant, that could not only meet the expected heat demand of the OA but could also support the expansion of the heat network into the surrounding area.

LONDON ENVIRONMENT STRATEGY

Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools

Text at page 120

As a result, we must now consider alternative approaches. The London Plan introduces a heating hierarchy that will promote cleaner heating solutions, such as those based on secondary heat. The Mayor will encourage a similar approach when *existing or new plant is being replaced or installed outside the planning system.*

National Energy Supply

Text at page 210

Over the next two decades, dependence on natural gas must be reduced by increasing the use of low carbon heating (harnessing energy from water, ground and air using heat pumps), as well as capturing more of the heat wasted from our buildings and infrastructure and using heat networks in the densest areas of the city to distribute it to our homes and workplaces. Energy efficiency of our existing buildings must be improved and low emission vehicles scaled up.

London's existing buildings

Text at page 222

London's buildings have been built over hundreds of years, and their energy efficiency varies considerably. More energy is used to heat and power our buildings in London than for anything else (a breakdown of building energy use is shown in Figure 38). Buildings are responsible for around four fifths of London's total GHG emissions and 70 per cent of final energy use. In 2017 over £7bn128 was spent on heating and powering our buildings across London.

By 2050 the emissions footprint of London's buildings will need to be close to zero. Some will even need to be climate positive, that is, they will need to generate more clean energy than they consume. By 2050 some 1.3 million new homes and over ten million square metres of new schools, hospitals and workplaces are needed. This will lock in emission patterns for 60-120 years (the average building and infrastructure lifespan). These buildings will have to reduce their energy. This will be through better insulation and using more energy efficient products. They must also get their heat and power (including increasingly for cooling) from local and renewable energy sources, enabled by efficient systems such as heat networks.

Low carbon energy supply

Text at pages 255 and 256

Meeting the Mayor's zero carbon ambition by 2050 requires changes to the way we supply and use energy in new developments to ensure it is resource efficient and sourced from clean, low carbon and renewable sources. London will need to reduce its reliance on high carbon natural gas as a main energy source (for heat in particular) and increase use of local energy resources, including renewable and secondary heat sources, while ensuring air quality is not adversely affected.

To date combustion-based Combined Heat and Power (CHP) systems, predominantly gas-engine CHP, have been used in new development in London as a cost effective way of producing low carbon heat. However, the carbon savings from gas-engine CHP are now declining as a result of national grid electricity decarbonising, and there is increasing evidence of adverse air quality impacts.

As a result, we must now consider alternative approaches. The London Plan introduces a heating hierarchy that will promote cleaner heating solutions such as those based on secondary heat. The Mayor will encourage a similar approach when existing and new plant is being replaced or installed outside the planning system.

Heat networks are still considered to be an effective and low carbon means of supplying heat in London and offer opportunities to transition to zero carbon heat sources faster than individual building approaches. Where there remains a strategic case for combustion based CHP systems on very large heat networks, these will continue to be considered on a case by case basis by the Mayor, maximising CO2 savings while preventing air quality dis-benefits. Details of this approach will be set out in an update of the Mayor's Energy Planning Guidance.

OBJECTIVE 6.2 DEVELOP CLEAN AND SMART, INTEGRATED ENERGY SYSTEMS UTILISING LOCAL AND RENEWABLE ENERGY RESOURCES

Text at page 261

In addition to reducing the energy use of buildings in London, there is a need to transform the energy system so that power and heat for buildings and transport is generated from clean, local and renewable sources, such as solar and waste heat.

Policy 6.2.1 Delivering more decentralised energy in London

Proposal 6.2.1.a Help implement large scale decentralised and low carbon energy projects, including stimulating demand from the GLA group (page 263)

District heating networks and renewable energy supply account for approximately half of London's decentralised energy systems, delivering the equivalent of two per cent of total demand. There is the opportunity to increase this type of energy supply to 15 per cent of demand by 2030. There are opportunities for further decentralised energy projects, including large scale solar PV installations and heat networks utilising technologies such as heat pumps in combination with secondary heat sources.

Policy 6.2.2 Planning for London's new smart energy infrastructure

Proposal 6.2.2.a Encourage the identification and planning of decentralised energy in priority areas (page 267 and 268).

In order to maximise the supply of more local, decentralised, low carbon energy in London, it is important to identify the most appropriate areas, energy systems and technologies. To understand the suitability and location of decentralised energy opportunities, the London Heat Map will be maintained to include data for decentralised energy development, including secondary heat sources. The Mayor will continue to support all London boroughs to produce

Energy Master Plans and use them to identify areas where the most appropriate energy systems should be considered.

The boroughs can play an important role in identifying these suitable areas for decentralised, low carbon energy and support the development and installation, including through new developments. Once suitable sites have been identified, the Mayor will, through DEEP, work with stakeholders on the planning of decentralised energy by providing support to carry out heat mapping and energy masterplans.

This will include the potential to recover low-temperature waste heat and the implications of supplying heat to connected building heating systems.

Heat networks provide infrastructure for decentralised energy and are one of the main opportunities for the supply of low carbon heat in London. At present, most heat networks are built as part of new developments. However, to meet the Mayor's zero carbon ambition, it is likely that some of London's existing housing will also need to be supplied by heat networks. To enable this, the Mayor will support the identification of areas where existing buildings could be retrofitted for connection to local heat networks, with an aim of developing the business case for a pilot project that retrofits heating systems in existing buildings, so that they can be connected to a local heat network.

EXPECTATION IN BEXLEY

BEXLEY LOCAL PLAN

Policy DP31: Energy Infrastructure

Explanatory text (page 130)

7.32 The NPPF states that local planning authorities should design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts.

7.33 Part C of London Plan Policy SI 3 Energy infrastructure states that development plans should identify: the need for any necessary energy infrastructure requirements; existing heating and cooling networks; proposed locations for future heating and cooling networks; and opportunities for expanding existing networks as well as establishing new networks.

7.34 The Council is working closely with partners, including the Greater London Authority (GLA), on the development of a heat network within the borough. This decentralised energy network will capture affordable low carbon heat from waste to energy facilities, supplying it to residential and commercial buildings in the area, in the form of hot water and/or steam through a system of pipes to where it is needed.

7.35 The Bexley Energy Masterplan was commissioned to determine the potential for a district heat network in Bexley. The study centred on the north of the borough, with the total level of heat demand and annual consumption determined for all loads modelled for connection to an initial "Core Scheme" network. It was determined that the Belvedere, and Thamesmead and Abbey Wood Sustainable Development Locations (plus limited adjacent existing buildings/sites) could be met via heat offtake from Cory's Riverside Resource Recovery (RRR) Energy from Waste (EfW) facility. The Secretary of State granted a Development Consent Order for the construction and operation of the Riverside Energy Park in April 2020.

7.36 The Thamesmead and Belvedere Heat Network Feasibility Study (work package 2) has considered this further. The best opportunity for a heat network is for the EfW facility to supply heat to estate regeneration schemes in Thamesmead, Abbey Wood and Lower Belvedere, and other new housing or commercial development on the route west along Yarnton Way.

7.37 Feasibility work is continuing in regard to this potential heat network, in order to deliver significant economic, environmental and social benefits. These include facilitating inward investment and new jobs, providing affordable lower carbon heat to residents, businesses, industries and the public sector, helping to tackle fuel poverty by reducing heating costs and reducing London's carbon footprint, in line with London Plan policy.

7.38 To facilitate heat transfer for export from Cory's EfW facility, a heat exchange plant has been identified to be located adjacent to the existing turbine hall (150m2 split across 3 levels). New residential development will retain satellite energy centres with back up plans and thermal stores as they connect along the network; therefore, this will not be required in the main distribution plant.

7.39 In line with Cory's proposed annual availability of 90% for heat offtake, the provision of supplementary heat generation and storage is required to meet year-round demand and is proposed to comprise a mix of centralised and distributed plant. The centralised plant will only provide heat to those buildings that do not have their own localised heat source boilers, and this could be integrated with the heat exchange plant.

Network routing

7.40 The network scheme has been designed around minimising the distance travelled by primary transmission pipes between the largest load centres, as well as avoiding the need to cross major obstacles and utilises a combination of Norman Road and Yarnton Way. To connect into Belvedere, a crossing of the railway line could be through either a dedicated bridge, micro-tunnelling under the line or divert to the Picardy Manorway road bridge.

7.41 Secondary heat exchange located in the premises of residential development plantrooms. Further hydraulic separation would be introduced via the use of heat interface units within or local to individual flats/properties.

POLICY DP31 ENERGY INFRASTRUCTURE

1. Developments within heat network priority areas should be designed to facilitate cost-effective connections to the existing or proposed network in accordance with the London Plan.

2. In designated heat network priority areas, proposals for the development of decentralised energy network infrastructure and related apparatus, including the use of low carbon technology, will be supported.

3. Proposals for major developments that produce heat and/or energy should consider how they can contribute to the supply heat in a designated heat network priority area or demonstrate that this is not technically feasible or economically viable.

Policy implementation (page 131)

7.42 The Mayor of London has identified Heat Network Priority Areas (HNPAs), which can be found on the London Heat Map website. These identify where in London the heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers.

7.43 The London Heat Map identifies much of the north of Bexley borough, along with areas around Bexleyheath Town Centre, Welling and Sidcup as Heat Network Priority Areas, which therefore qualify as "competitive" opportunities for heat networks. Data relating to new and expanded networks will be regularly captured and made publicly available, therefore additional areas may be added in the future. Developers should refer to the London Plan policy on energy infrastructure for further requirements.

7.44 To realise significant emissions reduction using district heating, the heat in the networks must be provided from low carbon sources. As the electricity grid also decarbonises, this presents a potential opportunity to use heat pumps to deliver heat from sources to networks and from networks to buildings. New build networks serving thermally efficient buildings are able to operate at lower flow temperatures, thus increasing the efficiency of heat pumps providing heat to the network. The Government has produced a report on Heat Pumps in District Heating.

7.45 Renewable energy schemes will be strongly promoted in the borough and encouraged as part of development proposals where they are effective, viable and practical. Applications for renewable energy generation will be expected to demonstrate how the proposal has been sensitively designed to integrate into the local environment, minimising any potential negative impacts, both physically and environmentally.

Policy SP14: Mitigating and adapting to climate change

Explanatory Text (page 125)

7.10 Reducing overall energy consumption and being more energy efficient is vital to reducing GHG emissions and contributing to a secure energy future. Reducing energy consumption through more efficient buildings and appliances can also help to tackle issues of energy affordability and fuel poverty. Applying circular economy principles – reuse, remanufacture and recycle – to the built environment will also reduce GHG emissions.

POLICY SP14 MITIGATING AND ADAPTING TO CLIMATE CHANGE

1. The Council will actively pursue the delivery of sustainable development by:

   a. supporting developments that achieve zero-carbon and demonstrate a commitment to drive down greenhouse gas emissions to net zero;

   …

c. investigating opportunities for the funding and development of decentralised energy networks in the borough; and, supporting the provision of infrastructure, including safeguarding routes and land for such use, where necessary;

Policy implementation (page 126)

7.12 Proposals for zero carbon and zero carbon ready developments are strongly supported, including the sustainable retrofitting of existing development with provisions for the reduction of carbon emissions. The Council will promote and support the requirements and targets set out in national and regional planning policy and guidance, in particular the requirements set out in the Mayor's London Plan regarding reducing carbon dioxide emissions, flood risk management and sustainable drainage methodologies, as well as policies in this Local Plan.

ANNEX B – GLA REPORT (DECEMBER 2024)

BURO HAPPOLD

Local Energy Accelerator

Waste Heat Strategic Areas Summary

LEA-BH-XX-XX-REP-EN-00

0048596

4 December 2024

Revision P07

Revision	Description	Issued by	Date	Checked
P01	Draft	AG, EF, IC, BW, DC	11/02/2024	
P02	Draft	AG, EF, IC	04/03/2024	BW, DC
P03	Draft of final report	IC	18/04/2024	BW, DC
P04	GLA comments	IC	11/07/2024	DC
P05	GLA comments	IC	14/08/2024	BW, DC
P06	Final	DC	29/10/2024	BW
P07	Update prior to publication	DC / IC	04/12/2024	BW

https://burohappold.sharepoint.com/sites/048596/04_Outgoing/200 - Project Support/201 - Tools WP/Waste Heat Study/03 Outputs/241204 - Waste Heat Strategic Areas Summary P07.docx

Report Disclaimer

This Report was prepared by Buro Happold ("BH") for the sole benefit, use and information of the Greater London Authority for Local Energy Accelerator. BH assumes no liability or responsibility for any reliance placed on this Report by any third party for any actions taken by any third party in reliance of the information contained herein. BH's responsibility regarding the contents of the Report shall be limited to the purpose for which the Report was produced and shall be subject to the express contract terms with Greater London Authority. The Report shall not be construed as investment or financial advice. The findings of this Report are based on the available information as set out in this Report.

author	**Issy Cassidy, Dan Croft, Annalisa Guidolin, Ellie Farmer, Bill Wilson**
date	**04/12/2024**
approved	**Dan Croft, Bill Wilson**
signature	[redacted]
date	**04/12/2024**

..

Contents

Table of Tables

Table of Figures

Glossary

Term	Definition
API	Application Programming Interface
ASHP	Air Source Heat Pump
BEIS	Departement for Business, Energy, and Industrial Strategy
BH	Buro Happold
CAPEX	Capital Expenditure
CSE	Centre for Sustainable Energy
DEC	Display Energy Certificate
DESNZ	Department for Energy Security and Net Zero
DHN	District Heat Network
EDEC	Excel D Exhibition Centre
EfS	Energy from Sewage
EfW	Energy from Waste
EPC	Energy Performance Certificate
ERF	Energy Recovery Facility
ESCo	Energy Servicing Company
ESM	Eastern Strategic Main
EU	European Union
FME	Feature Manipulation Engine
GLA	Greater London Authority
IRR	Internal Rate of Return
LAEP	Local Area Energy Plans
LB	London Borough
LBWF	London Borough of Waltham Forest
LEA	Local Energy Accelerator
LHM	London Heat Map
LSOA	Lower Layer Super Output Area
NHS	National Health Service
NLWA	North London Waste Authority
NPV	Net Present Value
OPDC	Old Oak and Park Royal Development
OPEX	Operational Expenditure
PDU	Programme Delivery Unite
REPEX	Replacement Expenditure
SAP	Standard Assessment Procedure
SELCHP	South East London Combined Heat and Power
SDEN	Sutton District Energy Network
STW	Sewage Treatment Works
TEM	Techno-economic Modelling
TfL	Transport for London

1 Waste Heat Study: Executive Summary

1.1 Overview

This study takes London's largest known recoverable waste heat sources and examines how they could catalyse the development of strategic multi-borough heat networks that can support the decarbonisation of heat supply in London. This study identifies seven waste heat clusters in areas across London and proposes how they could catalyse the development of strategic multi-borough heat networks. These are indicative modelled heat networks and are intended to illustrate the opportunity that London's waste heat resource provides and give an indication of what heat networks using those waste heat sources could look like.

This study will feed into the sub-regional Local Area Energy Plans (LAEP) that the Greater London Authority (GLA) are undertaking in partnership with London Councils and London Boroughs (LB). It will create additional intelligence and greater evidence around the opportunity for multi-borough heat networks across London. Where these multi-borough heat networks fall within a LAEP sub-region many of the suggested 'Next Steps' could be progressed through the sub-regional LAEP process as the relevant London Boroughs will already be working in partnership to develop strategies and plans for decarbonising these areas. Where these heat networks inevitably cross sub-regional LAEP boundaries the relevant London Boroughs from the respective sub-regional LAEPs should be contacted and a similar process undertaken.

The study illustrates the significant amount of waste heat that is available in London and could be recovered to supply large low carbon multi-borough heat networks. The size and distribution of the waste heat sources across London has led to the study suggesting the consideration of seven low carbon multi-borough heat networks that could:

- Cover **25** of the 32 London Boroughs and Corporation of London
- Utilise over **7900 GWh/yr** of Rejected Waste Heat to meet up to **3700 GWh/yr** of heat demands, with the potential for further recovery through infill and/or expansion
- Incorporate **~487 km** of pipework
- Require over **£2.3 billion** of CAPEX for the primary network to each heat cluster
- Save **~40 million tCO2e** over the next 40 years.

The introduction of Heat Network Zoning is designed to catalyse the development of large-scale strategic heat networks and in London this means they will often be multi-borough heat networks. This will bring technical financial and political challenges which will need to be assessed through further project development and tackled through partnership working between the relevant London Boroughs.

Detailed below are the main outputs of the study which include the clusters of strategic waste heat sources assessed in the study and the potential heat networks that could be developed to utilise them.

Table 1—1 Summary of key findings – high level estimates

	Strategic Area	Boroughs Covered	Waste Heat Available (GWh/yr)	Potential Heat Load (GWh/yr)	Length of Pipework (km)	Estimated CAPEX (£)
A	North London Waste Authority	7 Enfield, Waltham Forest, Haringey, Barnet, Camden, Islington, Hackney	2050	1004	59	225m
B	Beddington	7 Kingston upon Thames, Merton, Wandsworth, Sutton, Croydon, Lambeth, Bromley	524	386	70	308m
C	Royal Docks	3 Tower Hamlets, Barking & Dagenham, Newham	1029	1011	90	394m
D	Mogden & Twickenham	3 Ealing, Hounslow, Richmond upon Thames	673	222	58	331m
E	Hayes & West Drayton	2 Hillingdon, Ealing	1558	218	43	225m
F	Crossness & South Bermondsey	5 Bexley, Greenwich, Lewisham, Southwark, Lambeth	1971	943	119	644m
G	Old Oak and Park Royal (OPDC)	3 Brent, Ealing, Hammersmith & Fulham	379	276	48	235m
	Total	**25 Borough**	**7957 GWh/yr**	**3668 GWh/yr**	**487 km**	**£2.3bn**

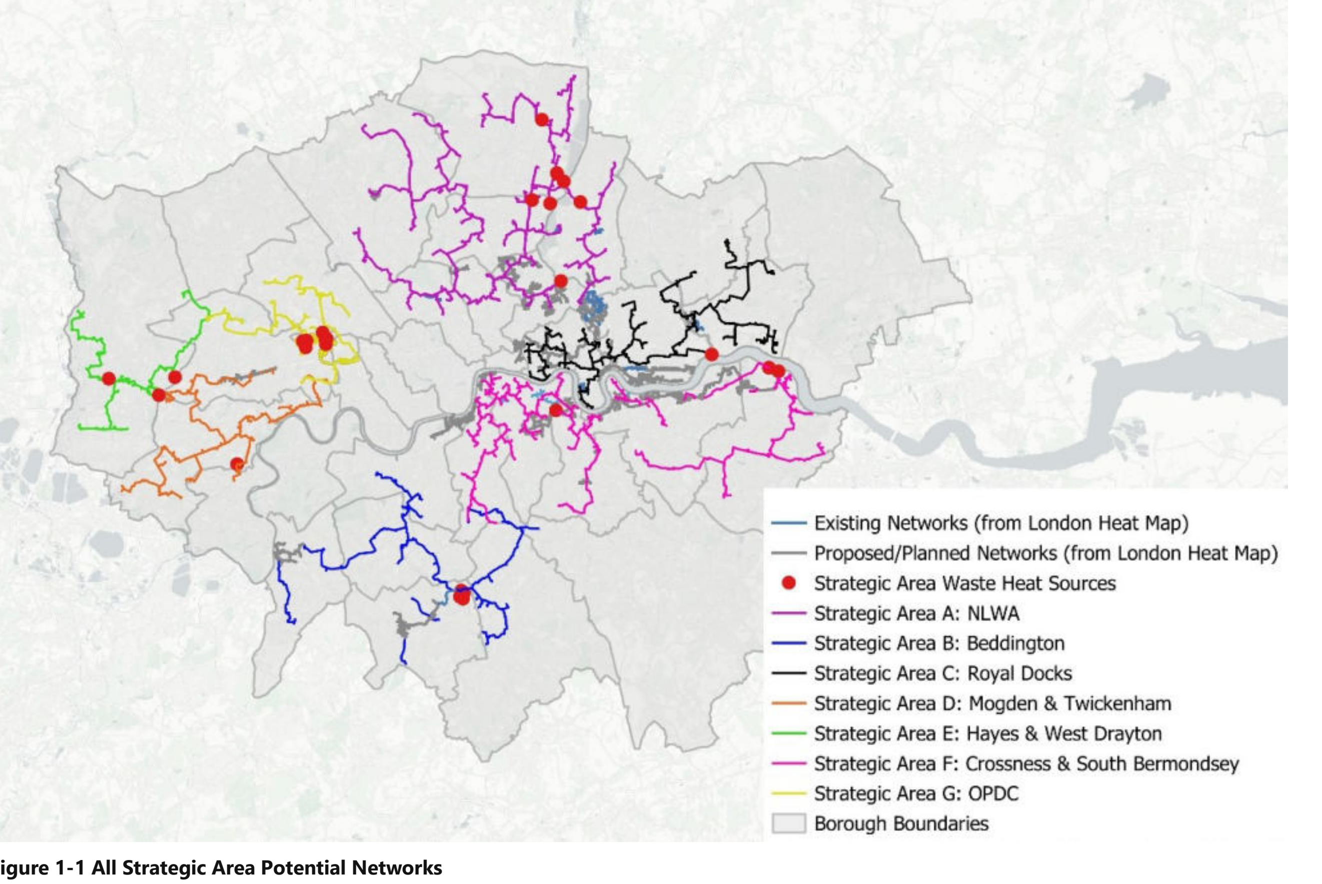


Figure 1-1 All Strategic Area Potential Networks

A comparison between Heat Network Zones from the first run of the National Zoning Model (publish in the Department for Energy Security and Net Zero (DESNZ) Heat Network Zoning Consultation 2023) and the strategic area networks is presented in Appendix A.

1.2 Methodology

The study uses analytical methods to assess appropriate heat demand to create potential clusters and that use the strategic waste heat sources identified in each strategic area. An indicative heat network routing to utilise the heat has been identified using the Steiner Tree method that prioritises a linear heat density of 8+MWh/m. These have been used to provide an indication of potentially viable heat networks to help initiate discussions between relevant London Boroughs, where possible as part of the sub-regional LAEP process, on their appetite for pursuing further investigations of the opportunity together.

1.3 Next Steps

To better understand the opportunity that each of these multi-borough heat networks represent for London and the boroughs in which they are located the following steps are suggested:

- To integrate this report and its findings into the sub-regional LAEPs and use that process and the existing partnerships to help develop these opportunities where there is interest and support to do so.
- The GLA and London Councils to work with the relevant Boroughs for each of the seven areas to discuss the opportunity and then, their appetite and preferred approach for taking each of the strategic heat networks forward.
- For each strategic heat network area where there is an interest from the relevant Boroughs, they along with the GLA and London Councils should establish a Working Group of relevant Borough officers to develop and agree an approach, including a governance structure, for how the heat network could be taken forward.
- For each Working Group that wanted to develop the opportunity further they would need to undertake an Outline Business Case, this would include developing more detailed techno-economic models.
- The outputs of the Outline Business Case can then be utilised by the relevant Boroughs to decide if they want to progress the work and what their preferred Delivery Model could be. That would mean either putting the project out to tender and using the Outline Business Case as the basis for Heat Network Developers to bid for the project or undertaking further work to develop a Detailed Business Case to inform the decision around the preferred Delivery Model and help the relevant London Borough partners decide how they want to proceed with the project.

2 Introduction

2.1 Overview

As part of the Programme Delivery Unit (PDU) role on the Local Energy Accelerator (LEA), Buro Happold carried out a study of the various waste heat opportunities across London. The Waste Heat Study focused on identifying and quantifying waste heat sources across the Greater London. Details on these waste heat sources have been uploaded to the London Heat Map (except where confidentiality issues arise).

There were many different sources of waste heat identified: including transformers, data centres, industrial sites, wastewater treatment plants, energy generation sites, and food retail. Figure 2-1 is an overview of the waste heat sources across London displaying their annual heat rejected by symbol size and categorised by waste heat type.

This study explores the strategic opportunities around some of these major waste heat sources. Early-stage analysis has been carried out to highlight the potential scale of these opportunities for London and its boroughs and sets out what associated multi-borough heat network routes could look like in the context of the forthcoming Heat Network Zoning. This document summarises the waste heat locations which have been tested to date. It is envisaged that the outputs of this report will be used to initiate discussions between London boroughs and support the development of partnerships in these key strategic areas to decide if they want to work together and, if so, how they will undertake further studies to test the feasibility of these potential heat networks in more detail.

Note - there are several areas of waste heat availability that either are not being considered for heat network development (as per Buro Happold knowledge) due to their being too small to establish a network on but they could be used once a network is established or are already being studied, such as the River Thames, and therefore not considered in this study. As heat networks are further planned in the coming years it will be important to consider all the opportunities in London within a strategic context so that opportunities for interconnection and/or heat supply across networks are maximised to provide heat networks that provide London and Londoners with the most affordable low carbon heat supply.

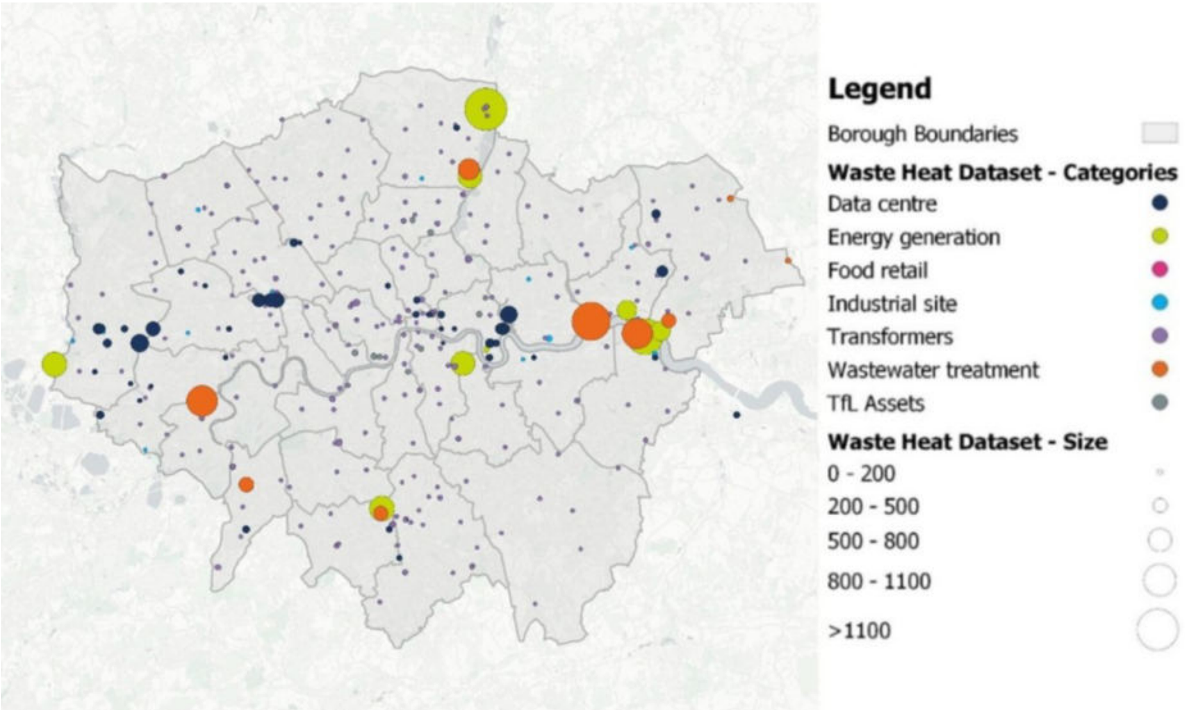


Figure 2-1 Overview of the location of Waste Heat Sources across London

2.2 Strategic areas

This study aims to demonstrate the significant London-wide opportunity that waste heat offers for creating low carbon heat networks that can help decarbonise London's heat supply. Therefore, a wide range of waste heat sources across a number of geographical locations in London have been examined. The strategic areas and the potential size of their associated heat networks have been identified based upon the amount of waste heat available and the potential heat loads in the surrounding area.

The strategic areas identified are as follows:

A. North London Waste Authority (NLWA) - North London Heat Network Study *
B. Beddington
C. Royal Docks
D. Mogden & Twickenham
E. Hayes & West Drayton
F. Crossness & South Bermondsey
G. Old Oak and Park Royal Development (OPDC).

*Note – Analysis of the NLWA strategic area has been completed as part of a separate and more detailed study that was funded by DESNZ, the North London Heat Network Study. As such, the analysis for this area varies a little in methodology and provides outputs at a greater level of detail than the others. This area study includes several different routing options, and a more detailed Techno-Economic Model assessment compared to the other areas, which only include a high-level CAPEX assessment. But if partner boroughs decided to pursue the opportunities identified in any of the other strategic areas then, with additional funding, the next stage would be to undertake a study similar to the North London Heat Network Study.

Figure 2-2 shows the geographical location of the waste heat sources and the potential heat network coverage in each of the strategic areas.

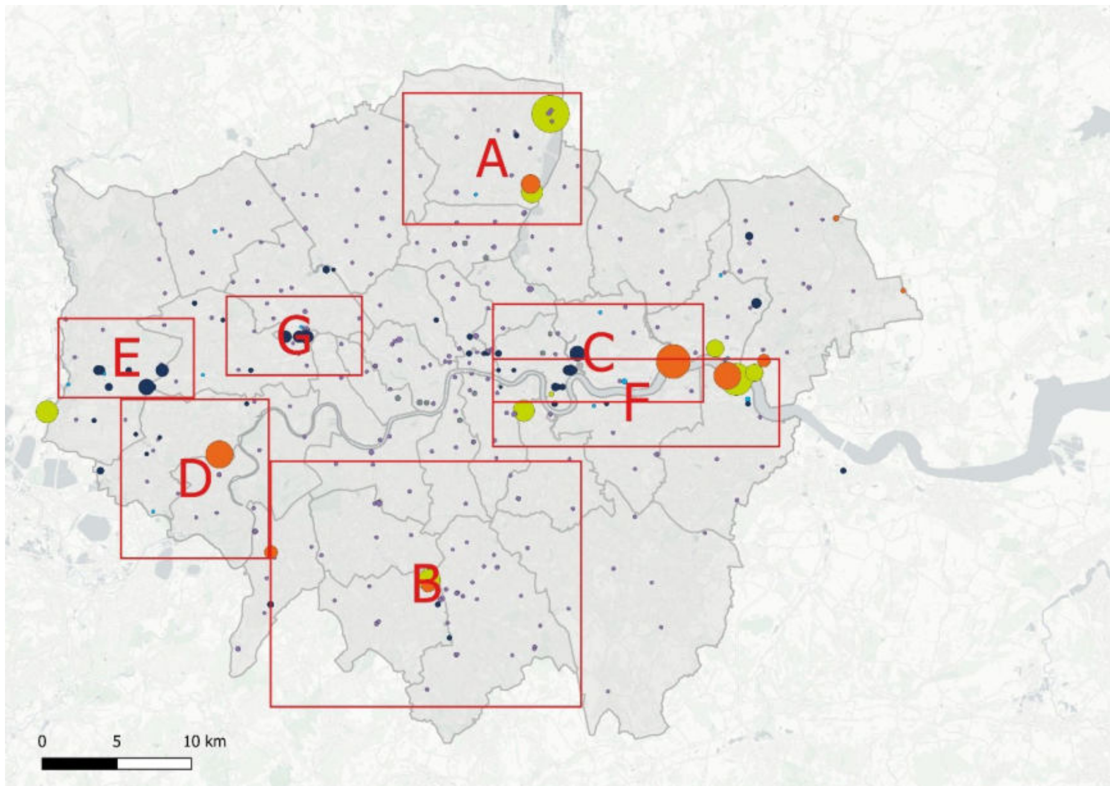


Figure 2-2 Strategic areas

Table 2—2 gives an overview of the strategic areas shown in Figure 2-2. Each Strategic Area has various types of waste heat sources that may be able to be utilised, in some areas a combination of various heat sources has been modelled due to their proximity. Additionally, the table sets out the boroughs that are within each of the strategic areas.

There are two different types of waste heat sources: high and low grade waste heat. High grade will not require upgrading to reach the required temperatures suitable for a heat network and therefore requires no additional energy to upgrade its temperature. Whereas low grade heat will require upgrading (typically through heat pumps) to reach the temperatures required for a heat network. Table 2—1 shows what types of waste heat sources are assessed in this study and which category either high or low grade they fall into.

Table 2—1 Heat Grade Classifications

Heat Grade	Source
Low	Data Centre, Energy from sewage (EfS), Transformers, Waste management facility
High	Energy from waste / energy recovery facility (EfW), Power Stations

Table 2—2 Strategic areas and their Waste Heat Sources and Heat Rejected

Label	Strategic Area	Main Waste Heat Sources modelled	Annual Heat Rejected (GWhr/yr)	Potential Boroughs Covered
A	North London Waste Authority	Edmonton's EfW Facility, Deepham Sewage Treatment Works, Ark Meridian, HACK1 National Grid substation, Virtus London 1, Sainsburys (Northumberland Park), TOTT1 National Grid substation, Sainsburys (Walthamstow Avenue)	2,050 (1200, 440, 310, 60, 16, 16, 5, 5, 5)	Barnet, Enfield, Haringey, Camden, Islington, Hackney, Waltham Forest.
B	Beddington	Beddington Sewage Treatment Works, Beddington Energy Recovery Facility, Unit B Prologis Park Data Centre, Pro-Logis Greenland Way Transformer.	541.4 (130, 400, 11, 1.4)	Kingston Upon Thames, Richmond upon Thames, Wandsworth, Merton, Sutton, Lambeth, Bromley, Croydon.
C	Royal Docks	Beckton Sewage Treatment Works.	1,029	Tower Hamlets, Newham, Barking & Dagenham.
D	Mogden & Twickenham	Mogden Sewage Treatment Works.	673	Hounslow, Ealing, Richmond upon Thames.
E	Hayes & West Drayton	Virtus London 8, Virtus London 7, Virtus London 5, Virtus London 6, Union Park, Colt London 4.	516 (37, 59, 50, 34, 210, 126)	Hillingdon, Hounslow, Ealing, Harrow.
F	Crossness & South Bermondsey	Riverside, Crossness Sewage Treatment Works, South East London Combined Heat and Power (SELCHP)	1971 (918, 652, 401)	Bexley, Greenwich, Lewisham, Southwark, Lambeth.
G	Old Oak and Park Royal Development (OPDC)	Equinix LD3, Equinix LD9, Vantage LHR1 / Park Royal (Upcoming Site), Vantage LHR2, London Colt West, Vodaphone Matrix Park, Alliance Park.	379.2 (4.4, 61, 42, 139, 104, 21, 6.8)	Brent, Ealing, Hammersmith & Fulham.

3 Methodology

3.1 Heat Sources

The available heat sources within each Strategic Area have been identified and mapped. Then, based on the type and size of the heat source, a prioritisation process has been undertaken to identify which heat sources are best used in order to meet the potential heat load in the surrounding area. Figure 3-1 shows the waste heat sources across London that were considered when identifying the strategic areas.

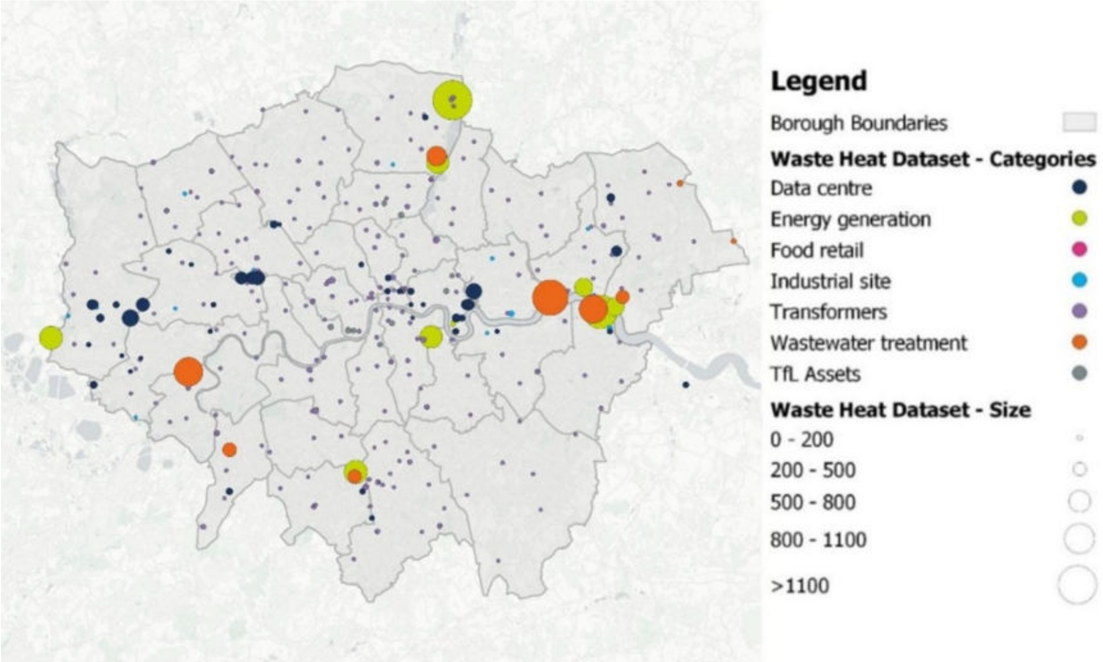


Figure 3-1 Potential Waste Heat Sources identified by type and size

3.1.1 Data Sources for Waste Heat

Heat demand mapping was crucial in identifying anchor loads and new developments withing the study area.

The following data sources were used to gather heat load data:

- The London Heat Map (LHM) provided data on existing heat loads, as well as a limited number of existing planning permissions. The data included diversified annual and peak heat loads (by each building). These heat loads are based on Energy Performance Certificate (EPC)/Display Energy Certificate (DEC) data or building geometry predictions.
- The London Datastore Application Progeamming Interface (API) provided data on developments in planning. The number of residential units and commercial square meters were provided, which were then used alongside benchmarks to estimate the annual and peak demands.
- For NLWA (Strategic Area A) Local policy documents and local plan maps were examined and used to identify future site allocations. Like the planning permissions API data, the site allocations did not include estimated annual and peak heat loads, so these were estimated alongside benchmarks using the number of residential units and commercial square meters. The specific local policy documents that were sourced, have been referenced in Appendix A. Note: some of the identified site allocations had no information attached to them, but they have been flagged as opportunities, nonetheless.

A gap analysis was conducted to ensure none of the data overlapped and loads were not double counted.

Heat network strategic areas were then identified close to the prioritised waste heat sources, where the high heat demand would make the heat network investment economically attractive. In particular, only heat sources with a potential to reject more than 1 GWh of waste heat were investigated as they were considered strategically important and of a sufficient size to allow the build out of a district heat network.

In terms of potential heat network connections, only those considered to be potentially mandatable loads in the context of heat network zoning were considered. A mandatable load is dependent on building type, on-site facilities, energy consumption and its existing heating system. As zoning is currently in the consultation phase, what makes a mandatable load required to connect in any future zone may well be subject to change.

A map showing the demand data in London with only loads deemed to be mandatable (over 100 MWh) is presented in Figure 3-2.

3.1.2 Risks of Waste Heat Sources

There are various risks associated with utilising waste heat sources such as:

- **Inaccurate data provided**: Discrepancies in data quality can hinder effective utilisation of waste heat such as the impact of different methodologies used to calculate the waste heat which can vary depending on the data source (whether it is the Departement for Business, Energy, and Industrial Strategy (BEIS), the European Union (EU) or the GLA). The heat demand is also likely to vary from the London Heat Map dataset. This could impact the modelled areas and the heat load that the waste heat source could serve.

- **Economic considerations:** Fluctuations in energy prices and market dynamics can influence the viability of utilising waste heat. Potential shifts in energy demand and pricing structures could impact the feasibility of waste heat sources.

- **Regulatory changes & compliance:** Clear policies and supportive frameworks are essential for encouraging waste heat integration. Additionally compliance with regulatory standards and requirements related to waste heat recovery and utilisation may pose challenges for businesses, particularly in terms of meeting emissions limits and ensuring safe operation.

- **Technology changes:** It is possible some types of waste heat sources, such as data centres, will undergo technological changes that improve the energy efficiency and therefore there is a decrease in rejected heat which would impact the heat load that the network is then able to serve.

- **Space and Infrastructure Requirements:** Depending on the scale of the waste heat source and the technology used for recovery, significant space and infrastructure may be required to implement waste heat recovery systems. It is uncertain whether all the waste heat sources used in this study have sufficient space for the required infrastructure.

- **Environmental Concerns:** The process of capturing and utilising waste heat may involve environmental risks, such as emissions from the equipment used of potential environmental impacts if not managed properly. It is possible that these concerns will vary on a site-by-site basis depending on location, type of waste heat and available infrastructure.

- **Operational challenges:** Integration of waste heat recovery systems into existing infrastructure may pose operational challenges, including maintenance requirements, system compatibility issues, and reliability concerns.

- **Social acceptance and stakeholder engagement:** Public perception and community acceptance of waste heat recovery projects may vary, potentially leading to opposition or resistance from stakeholders and communities, which could impact project feasibility and implementation. As a result this could increase the financial barriers for implementing and integrated waste heat sources into heat networks.

3.2 Heat Demands

Heat demand mapping was crucial in identifying anchor loads and new developments withing the study area.

The following data sources were used to gather heat load data:

1. The LHM provided data on existing heat loads, as well as a limited number of planning permissions. The data included diversified (by each building) annual and peak heat loads. These heat loads are based on EPC/DEC data or building geometry predictions.
2. The London Datastore API provided data on developments in planning. The number of residential units and commercial square meters were provided, which were then used alongside benchmarks to estimate the annual and peak demands.
3. For NLWA (Strategic Area A) Local policy documents and local plan maps were examined and used to identify future site allocations. Like the planning permissions API data, the site allocations did not include estimated annual and peak heat loads, so these were estimated alongside benchmarks using the number of residential units and commercial square meters. The specific local policy documents that were sourced, have been referenced in the Appendix A. Note: some of the identified site allocations had no information attached to them, but they have been flagged as opportunities, nonetheless.

A gap analysis was conducted to ensure none of the data overlapped and loads were not double counted.

Heat networks strategic areas were then identified close to some waste heat sources, where the high heat demand would make the investment economically attractive. In particular, only sources with a potential to reject more than 1 GWh of waste heat were investigated.

In terms of potential heat network connections, only potentially **mandatable loads** in heat network zoning areas were considered. A mandatable load is dependent on their building type, facilities, energy consumption and existing heating system – as zoning is currently in the consultation phase, what makes a load required to connect in any future zone may be subject to change.

A map showing the demand data in the Strategic Area with only loads deemed to be mandatable (over 100 MWh) is presented in Figure 3-2.

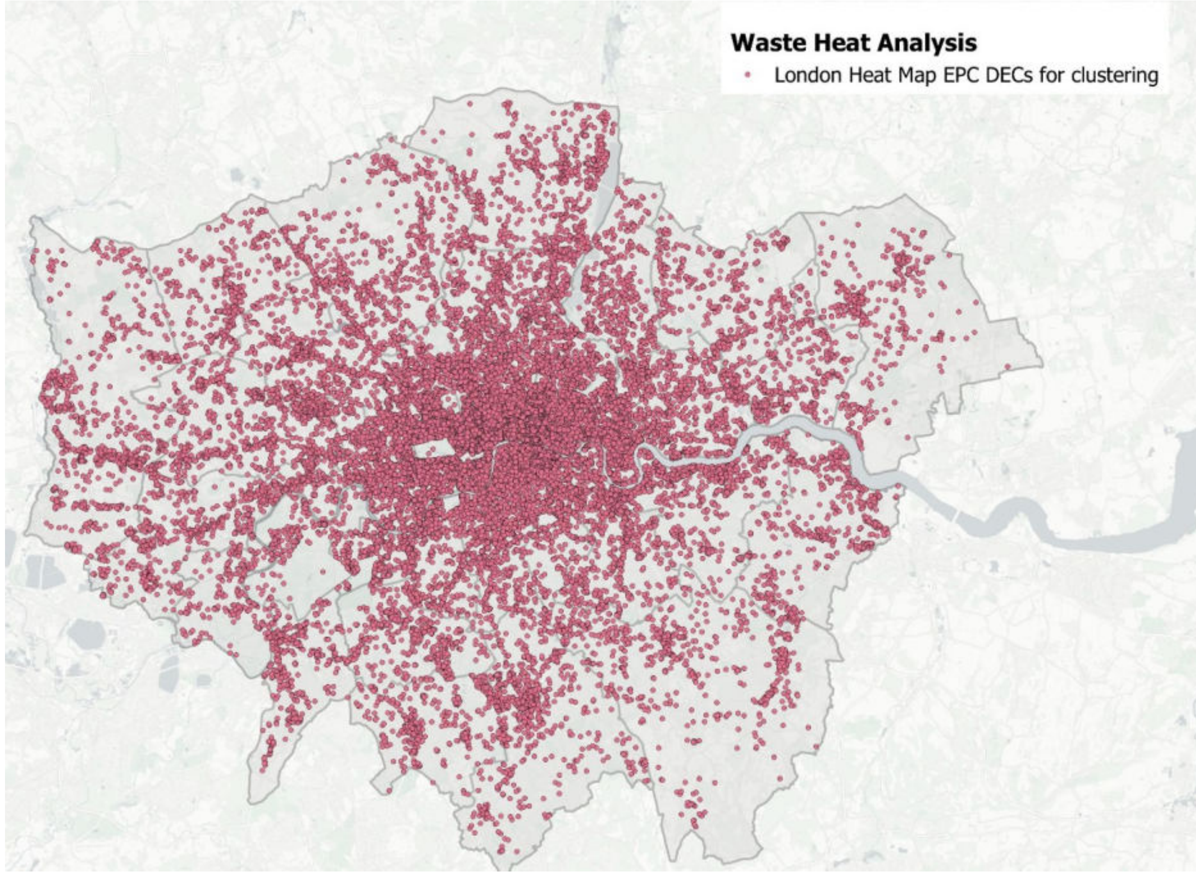


Figure 3-2 London Heat Loads Over 1 GWh

1. Following the identification of potential heat demands for connection to a network, adjacent demands were clustered together based on linear heat density method to form clusters suitable for assessment and for connection. This methodology is explained in further detail in section 3.3.

3.3 Cluster Methodology

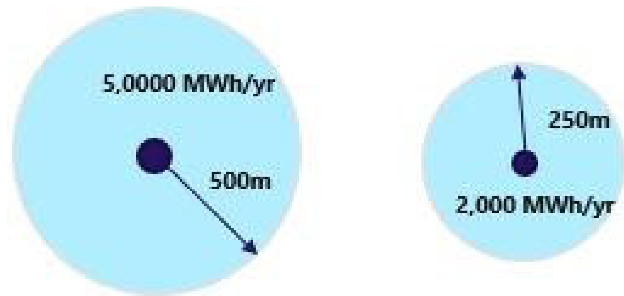


Figure 3-3 Cluster radius methodology

Clusters of heat demands have been formed using a 'buffered linear heat density' assessment. In this method, the annual heat of each demand was divided by 8MWh/yr/m to calculate a distance at which any demand closer than this could be connected and maintain a good linear heat density. A buffer can then be drawn around each demand with a radius of this distance. Radii are limited to a certain radius to avoid buffers being generated around the largest demands consuming an unrealistic area. For example, a heat demand of 2,000 MWh/yr has a radius of 250m, and 5,000 MWh/yr would have a radius of 625m, but is limited to 500m. This is demonstrated in Figure 3-3. Figure 3-5 shows the final result of the clustered heat loads across the entirety of London for a linear heat density of 8MWh/yr/m and a radius limit of 500m. This radius size has been used in order to demonstrate the London-wide heat load potential and higher demand areas.

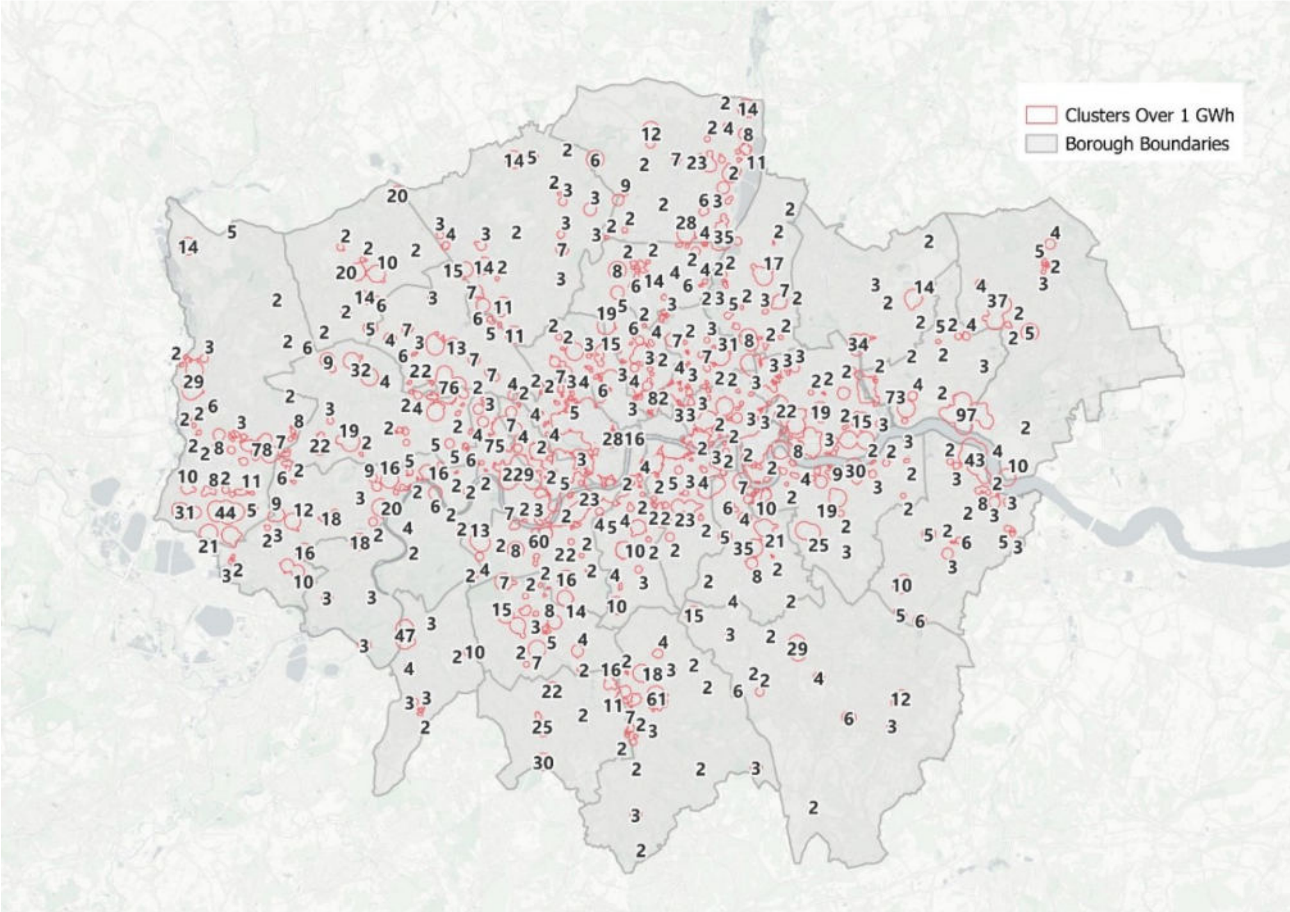


Figure 3-4 Clustered heat loads that sum to greater than 1 GWh across all London Boroughs

Depending on the size of each of strategic area being examined, the cluster size has been based on a size that is suitable for that area individually. The smaller areas, that are not as limited by the processing speed of our routing methodology utilised smaller radius clusters in order to produce a more accurate potential heat network.

3.4 Network Route Methodology

The routing methodology connected the centroids of the clusters to the chosen heat source via the Steiner-tree methodology.

The Steiner Tree minimum distance algorithm has been used to calculate the shortest routing option between clusters and heat sources following road networks. This method is applied in an internal Feature Manipulation Engine (FME) processing tool, giving the shortest network lengths. Figure 3-5 shows and example of the OSMaps layer of potential highways for routing. A processing tool is first applied to this OSMap to connect each cluster and energy centre to the road network. This altered OSMap is then used in the Steiner processing tool in order to find the shortest route. In order to decrease the processing time, the map can be trimmed to remove excess roads that have no possibility of being used.

An example showing pipe route connecting cluster points along the highways network is presented in Figure 3-6.

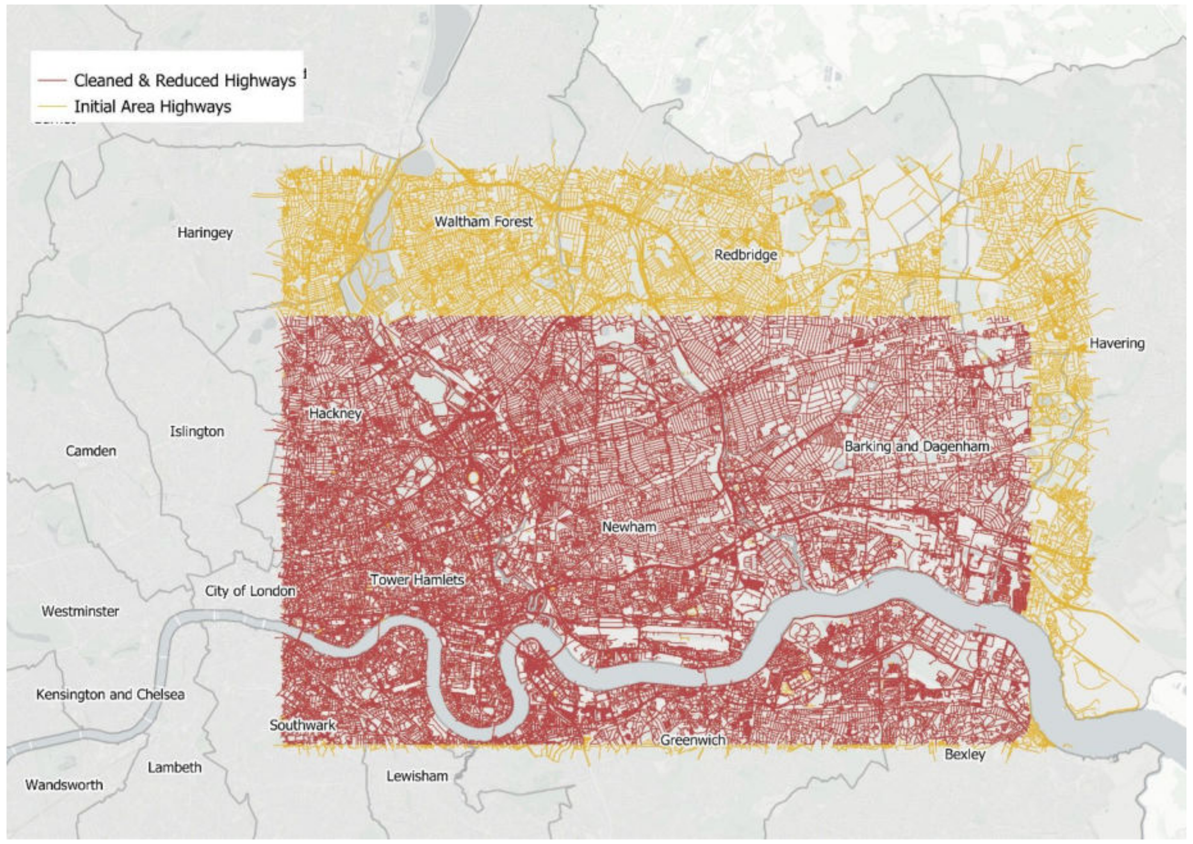


Figure 3-5 Potential Highways for Connection

Figure 3-6 Pipe Route Cluster Connection

After an initial network was produced from the Steiner tool, an additional internal FME processing tool was utilised in order to give the anticipated linear density of the different pipelines of the potential network. This processing tool uses the summed heat loads of the clusters to determine the linear density of that pipe branch. An example of the visual output shown in Figure 3-7. This sized the pipework for the network and classified it into linear heat densities of either:

- 0-2 MWh/yr/m
- 2-4 MWh/yr/m
- 4-8 MWh/yr/m
- 8+ MWh/yr/m.

From this outputted linear density network, only the pipework with a linear heat density of 8+ MWh/yr/m is carried forward to be used in the final network. Then each strategic area is analysed on a case-by-case basis with necessary manual alterations required as a result of incorporating any existing or proposed heat networks (from London Heat Map).

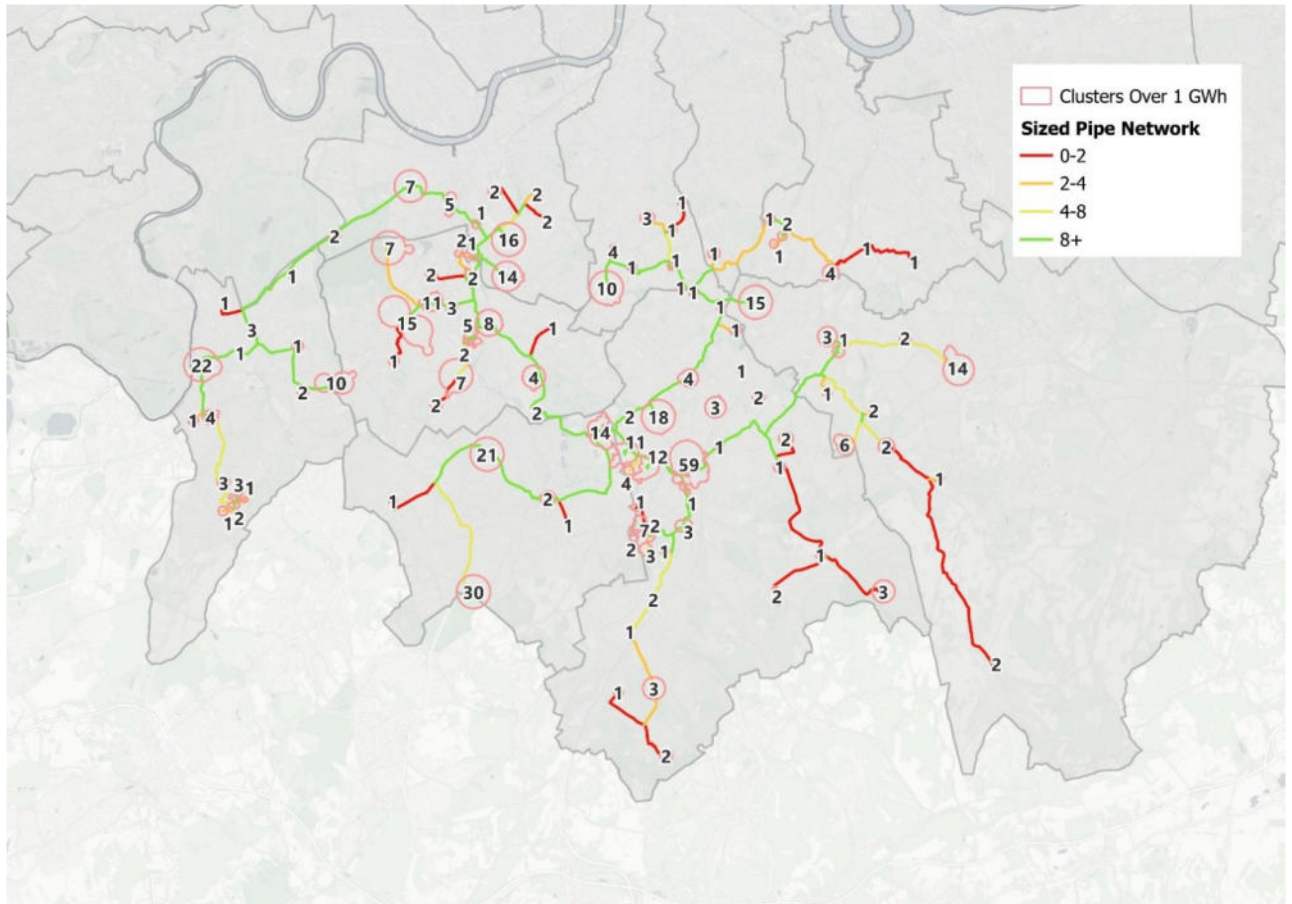


Figure 3-7 Output of Linear Density Tool

3.5 Correlation of Strategic Areas with GLA Potential District Heat Network (DHN) Project Areas

A study carried out on behalf of the GLA by the Centre for Sustainable Energy (CSE), the organisation who designed the London Heat Map, using their cost optimisation and heat network model was run to produce a London-wide map of areas with potential savings from heat supply through a heat network over heat supply through an individual building-level Air Sourced Heat Pump (ASHP), which was the counterfactual scenario. This cost optimisation and heat network model quantified the savings over the ASHP counterfactual from high to low and they are illustrated by the set of shapes (areas) illustrated in Figure 3-8. The model indicated areas where heat networks may be a highly viable approach for the decarbonisation of heat in the area compared to a building level ASHP, using a similar approach to the DESNZ National Zoning Model, and where there would be value in investigating the opportunity in these heat network project areas further. All the coloured project areas indicate a saving compared to the counterfactual scenario with the 'red' coloured areas indicating the highest savings and the blue areas the lower savings.

The strategic areas examined within this study have been reviewed for alignment with these higher saving areas and the analysis shows a good correlation with the outputs of the CSE cost optimisation and heat network model.

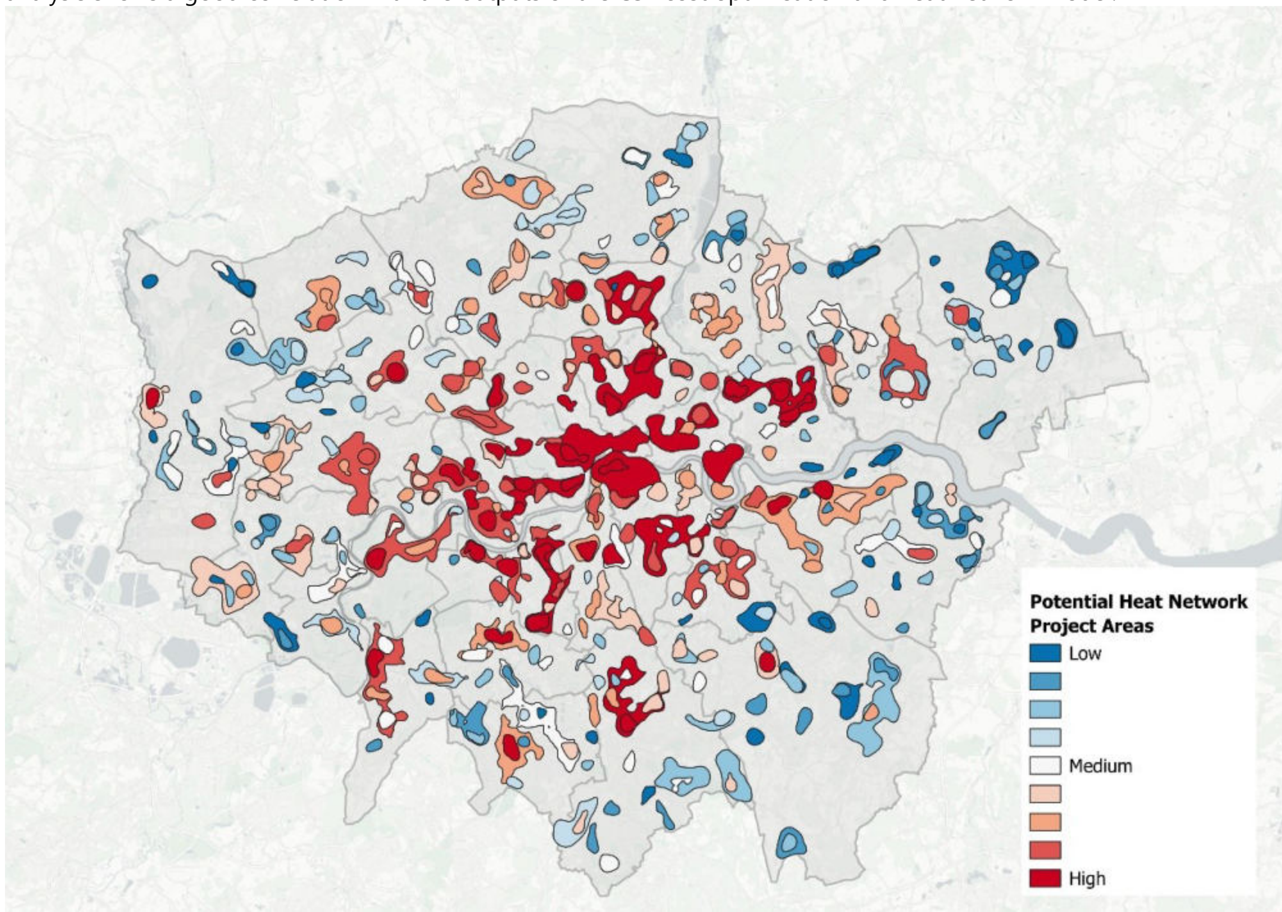


Figure 3-8 Potential Heat Network Project Areas

3.6 Costing

The costings and values used are similar to those previously used in the North London Heat Networ Study. These are very high-level costings intended to give an order of magnitude, but they are likely to change as more in-depth costing analysis is undertaken.

The assumptions for CAPEX and Replacement Expenditure (REPEX) are shown in Table 3—1. The heat grade associated with the type of waste heat source determines the anticipated CAPEX. High grade heat sources use recovered heat costs whereas, low grade heat sources use water source heat pump costs, as they are required to boost temperatures for supplying into the network. The CAPEX costs associated for pipework and civils only includes the main pipe trunk costs, not the localised pipework which would involve additional costs.

Table 3—1 CAPEX and REPEX Assumptions

Variable	Value	Lifetime (years)	Notes
Recovered heat	£0.75m/MW	60	DESNZ Assumption
Water Source Heat Pump	£1m/MW	20	DESNZ Assumption
Pipework and civils	3000 £/m	60	Buro Happold (BH) Project Experience
Plant and energy centre	£1m/km	35	DESNZ Assumption

3.7 Carbon

Carbon emissions of each of the proposed cluster networks have been assessed over the 40 year project lifetime.

3.7.1 Counterfactual Carbon Calculation Methodology

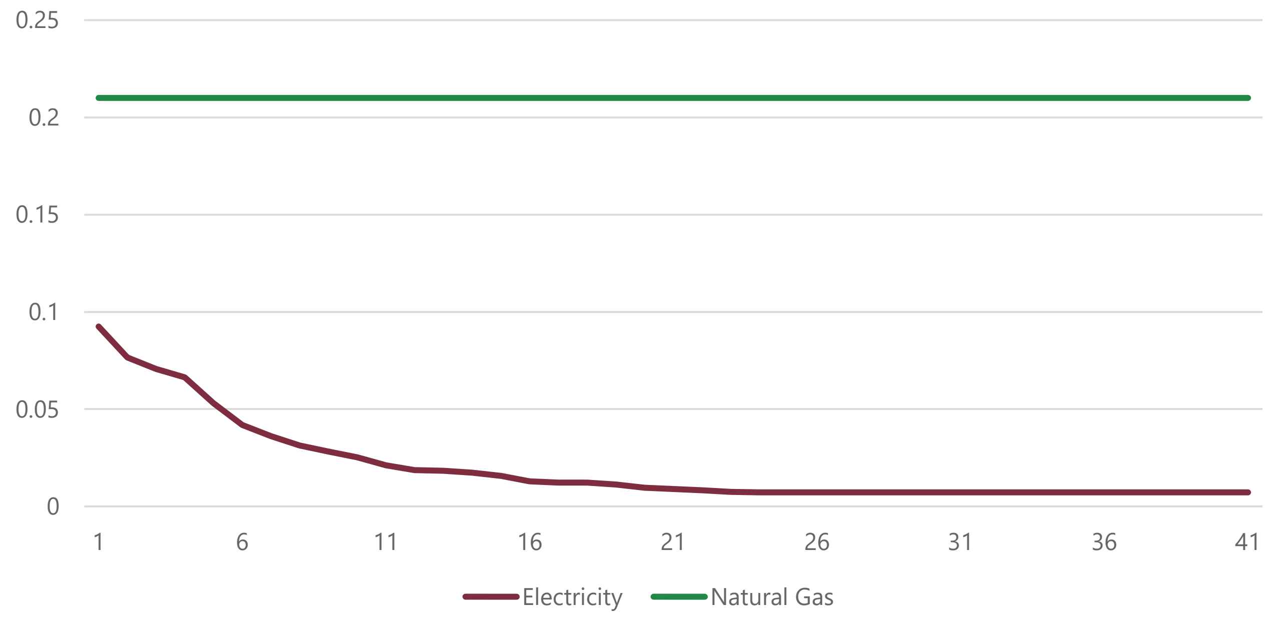


Figure 3-9 DESNZ Grid Carbon Factor Forecast

Carbon emissions of each of the proposed cluster networks have been assessed over the project lifetimes. Given that all the proposed schemes generate heat via electrified sources, this assessment has used the Grid Average consumption based commercial/public sector carbon factors of UK grid electricity published by DESNZ. Gas fuel carbon factors have been used for the existing buildings in the counterfactual options that may retain gas boilers. The gas grid carbon factor, also forecast by DESNZ, remains at a constant 0.184 kgCO2/kWh for the lifetime of the project. Figure 3-9 shows the predicted carbon factor of grid electricity and gas from 2025-2065 from the Government valuation of energy use and greenhouse gas emissions published in 2022. The electricity carbon factor is forecast to decrease significantly overtime due to the increased feed of renewable power generation into the grid.

For all the strategic areas the counterfactual option is a fully gas boiler scenario that has a 85% efficiency and meets 100% of the heat load. The Carbon Factors are shown graphically for grid electricity and natural gas in are applied to the different strategic areas over a 40 year period.

3.7.2 Waste Heat Carbon Calculation Methodology

The waste heat sources utilised in this study vary in heat grade. The only high grade heat sources utilised in this study was EfW with all other heat sources falling under the low grade heat classification. These different heat grade classifications have different associated carbon emission factors.

Low Grade Waste Heat Sources: The heat is available at temperatures too low to be supplied directly into the heat network. In order to use this heat it must be elevated to a higher temperature, usually using a heat pump, with an associated input of electricity. Therefore, the carbon associated with the low grade heat source is the carbon produced from the electricity required to upgrade the temperature of the heat source to meet the district network's operating temperatures so that it can be supplied into the network. A COP of 3.2 was applied to upgrade electricity and the electricity carbon factor presented in Figure 3-9 was used to give the projected annual carbon emissions.

High Grade Waste Heat Sources: As the heat is already at a high temperature, therefore there is no need for energy to be expended to upgrade the heat source. To calculate the carbon factor a 'Displaced Electricity Method' methodology was used as replicated in the Standard Assessment Procedure (SAP) 10.2[1].

The z-factor, the number of units of heat gained for every unit of electricity, has been used to define the carbon content of the heat. Heat is available at low temperatures with almost no losses in electricity output whereas when heat is available at higher temperatures more electricity output is 'lost' for the same fuel input. For the energy from waste facilities, that are the high grade heat sources used in this study the z-factor is considered to be 5. Equation 1 shows the calculation of the 2026 high grade waste heat calculation. As the electricity displaced from grid value changes year on year based on the DESNZ UK Grid Electricity published figures, the carbon factor is recalculated annually.

Equation 1 High Grade Waste Heat Carbon Factor Calculation (2026)

$$Electricity\ displaced\ from\ grid\ (0.09248 kgCO2e/kWhe) \times Electricity\ reduced\ output\ \left(\frac{1}{5}\right)$$
$$= \boldsymbol{Carbon\ factor\ of\ heat (0.01849 kgCO2e/kWh)}$$

The resultant 40 year carbon factors for both types of waste heat grade sources are shown in Figure 3-10.

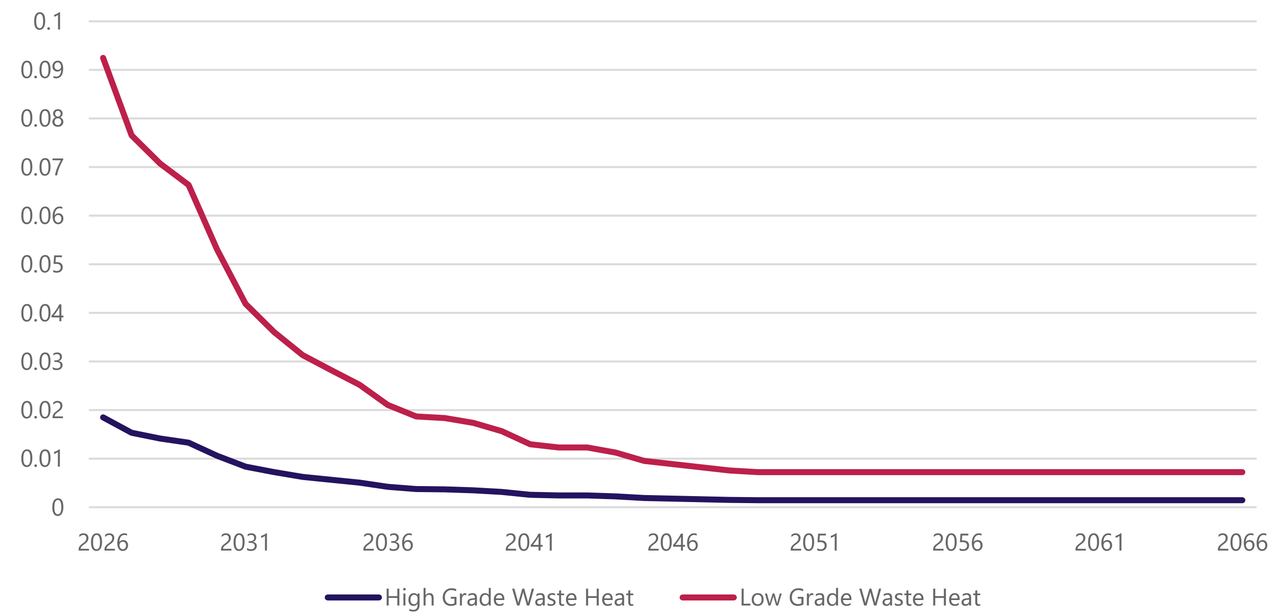


Figure 3-10 High and Low Grade Heat Factors from 2026 to 2066

[1] SAP 10.2 - 11-04-2023.pdf (bregroup.com)

4 Strategic Area A: North London Waste Authority (NLWA)

Note: Analysis of the North London Waste Authority Waste Heat Study area was completed as part of a separate, more detailed study funded by DESNZ, the North London Heat Network Study.

As such, the analysis for this area varies slightly in methodology and the level of detail of results is greater than that for the other areas. For example, this area includes several routing options, and a more detailed Techno-Economic Model assessment compared to the others, which have only had a high level CAPEX assessment undertaken as part of their initial feasibility work.

4.1 Overview

The North London Heat Network Study found that there is sufficient waste heat available in the NLWA area to support at least 1004 GWh/yr of heat demand across the 7 boroughs. There are network routing options that run through the boroughs considered and connect to demand clusters that could enable access to surplus waste heat from sources primarily in Enfield. To achieve this significant multi-borough heat network that utilises waste sources in north London there are a range of technical, political, and commercial challenges that will have to be overcome by partnership working across the boroughs through which the network would run.

The scope of this study looked at the possibility of utilising waste heat sources across North London (and further afield if necessary) to develop multi-borough strategic heat networks that can provide low carbon, affordable heat to homes and businesses. This involved reviewing existing energy masterplans and studies, engagement with relevant London Boroughs and other stakeholders, heat demand and heat source mapping, energy modelling, network design, techno-economic modelling, costing, and a summary of potential options.

A summary of the North London Heat Network study report will be included in this report to give a further case study on a multi-borough district heating network involving the clustering methodology.

The difference between the North London Heat Network Study method and the method used for the other strategic areas is that it tiered the heat loads (into the categories below) and all loads below 0.5 GWh/a have been removed:

- **Tier 1:** 10 GWh /a – 100,000 GWh /a
- **Tier 2:** 2 GWh /a – 10 GWh /a
- **Tier 3:** 0**.**5 GWh /a – 2 GWh /a.

Tier 1 includes possible anchor loads with a high annual heat demand. Tier 2 are loads with a potential to contribute to an established network. Note: future site allocations with no indication of heat load have been classed as Tier 2 because they present an opportunity which should be investigated further. Finally, Tier 3 are loads that are unlikely to facilitate district heat network development but have potential to connect to a network in the future once it is built out.

4.2 Waste Heat Sources and Heat Loads

This study was completed before waste heat data had been added to the London Heat Map. As such, data was collected from the DESNZ waste heat tool, European Waste Heat Map, Baxel, and National Grid substation waste heat data.

4.2.1 Heat Sources

The top opportunities have been highlighted in Table 4—1 and were the focus of this study.

Table 4—1 Waste Heat Opportunities

Heat Source	Available Waste Heat (GWh/yr)	Available Heat Offtake (MW)
Enfield Power Station	~1,200 (not included in modelling)	Unknown
Edmonton's EfW Facility	~440	60MW
Deepham Sewage Treatment Works	~310	Unknown
Ark Meridian data centre	~60	Unknown
HACK1 National Grid electric substation	~16	Unknown
Virtus London 1	~16	Unknown
Sainsburys supermarket (Northumberland Park)	~5	Unknown
TOTT1 National Grid electric substation	~5	Unknown
Sainsburys supermarket (Walthamstow Avenue)	~5	Unknown
Total	**2,050**	**-**

4.2.2 Excluded Heat Sources

Enfield Power Station has been excluded due to uncertainties around it's future due to it being a fossil fuel power station and its ownership. It should be noted that Enfield are understood to have had some positive engagement with the owners/operators around the potential for heat offtake which depending on thew longevity of the plant might mean that there is far more heat available in this area than has been estimated in this study.

A 2020 study, conducted by Arup, looked at quantifying the opportunity that exists from harnessing waste heat from ventilation shafts on the London Underground system. The study analysed 55 ventilation shafts and 20 pumped groundwater locations to assess the technical, economic, operational, construction and deliverability. The study found that theoretically 38% of the city's heat demand could be met from the waste heat available. The Bunhill 2 Energy Centre uses the recovery of waste heat from the London Underground Northern line to supply its heat network. The opportunity presented from the London Underground sites, due to their size, means that they are better suited to supporting local heat networks as opposed to being of the size required for initiating the development of these multi-borough strategic heat networks. As such, this analysis has not been included in this study and therefore no engagement with Arup or Transport for London (TfL).

As part of the London Borough of Waltham Forest Heat Mapping and Energy Masterplan, Coppermills Water Treatment Plant was identified as having large potential for waste heat. E.ON conducted a high level study that estimated the opportunity could be as high as 100MW, however this was based on some high level assumptions and a delta T of 2^{o}C. Further engagement with Thames Water concluded that any opportunity is far from realisation, and therefore this has been excluded, however it should be investigated further in the future.

Additionally, there are many parks, sports pitches and rivers located across the boroughs that could be used to utilise low grade heat via a ground source heat pump. Given the scale of this study, these have not been considered for these multi-borough strategic heat networks but could be utilised for the local networks.

4.2.3 Heat Loads

The heat load opportunities in Figure 4-1 were used to identify the key clusters of anchor loads, which informed potential opportunities. The background heat map density layer further illustrates areas with high energy density and more favourable areas for connection.

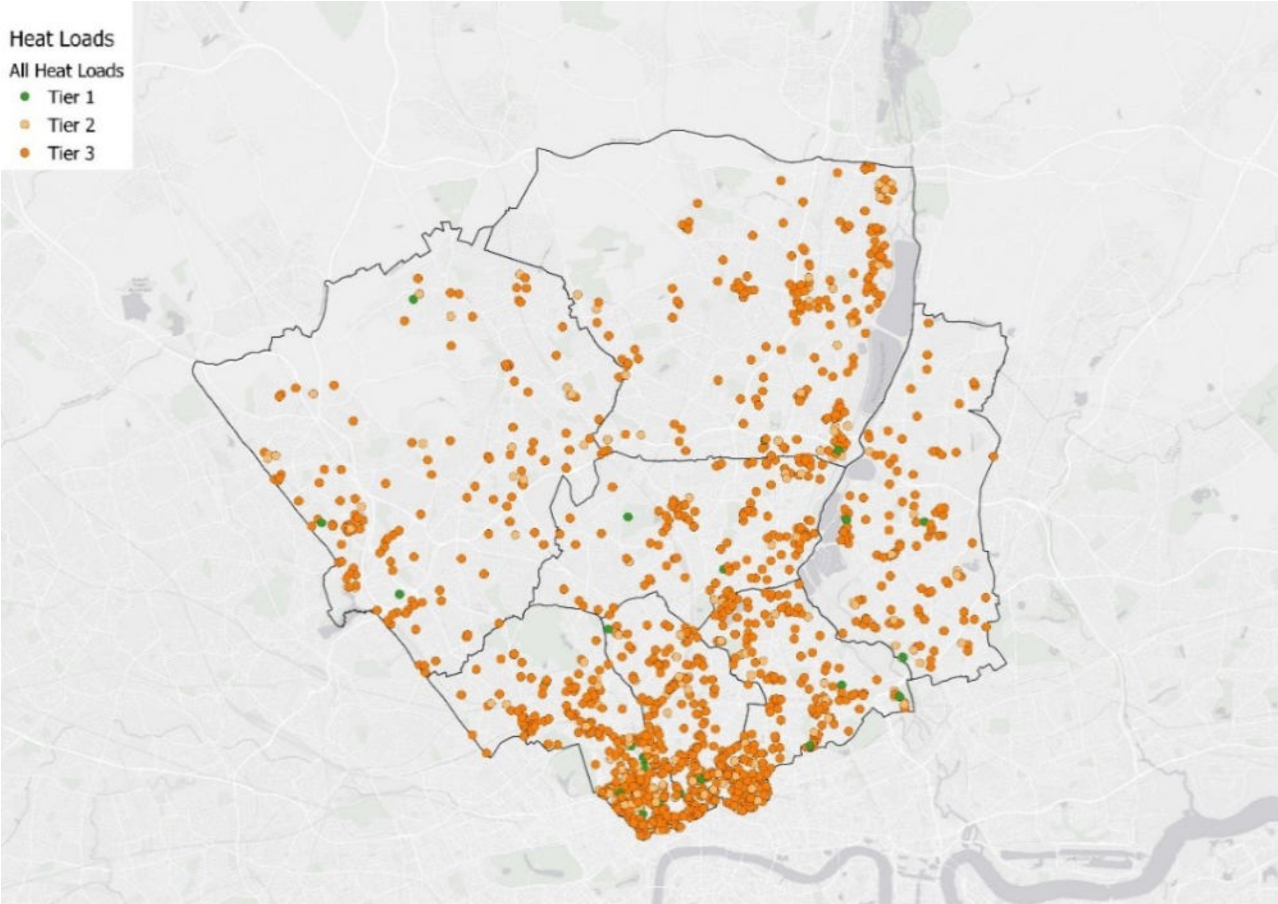


Figure 4-1 Tiered Loads Heat Demand Map

Clustering was performed, as per the methodology described in section 3.3, but with the additional tiering system as to prioritise the larger loads that the heat sources should serve when there is greater demand in the area than available supply.

Tier 1 and Tier 2 loads have been analysed together to find the large and main clusters. Separately Tier 3 loads have been analysed to indicate where clusters of Tier 3 may have been missed in the initial Tier 1 and Tier 2 cluster analysis. For example, in Figure 4-2 there is an 8 GWh/a Tier 3 cluster in Hackney, which is larger than some of the Tier 1 and Tier 2 clusters, this could therefore be considered in further analysis. Along with this many of the Tier 3 clusters lie within Tiers 1 and 2 clusters increasing the argument for taking these areas forward into further analysis.

Clusters below 3 GWh/year were removed giving the final clustering to be taken forward into the routing analysis.

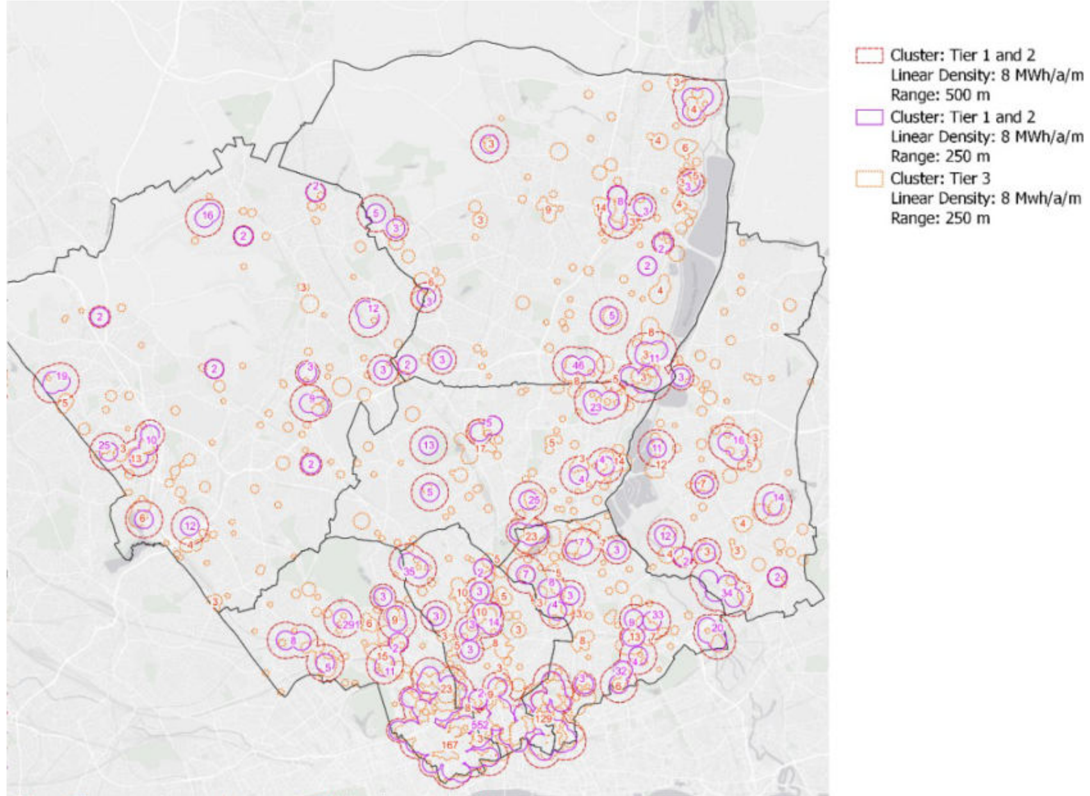


Figure 4-2 Initial Clustering, numbers shown are cluster annual demand in GWh/a

Clusters across the study were generated using the mentioned methodology with resulted shown in Figure 4-3.

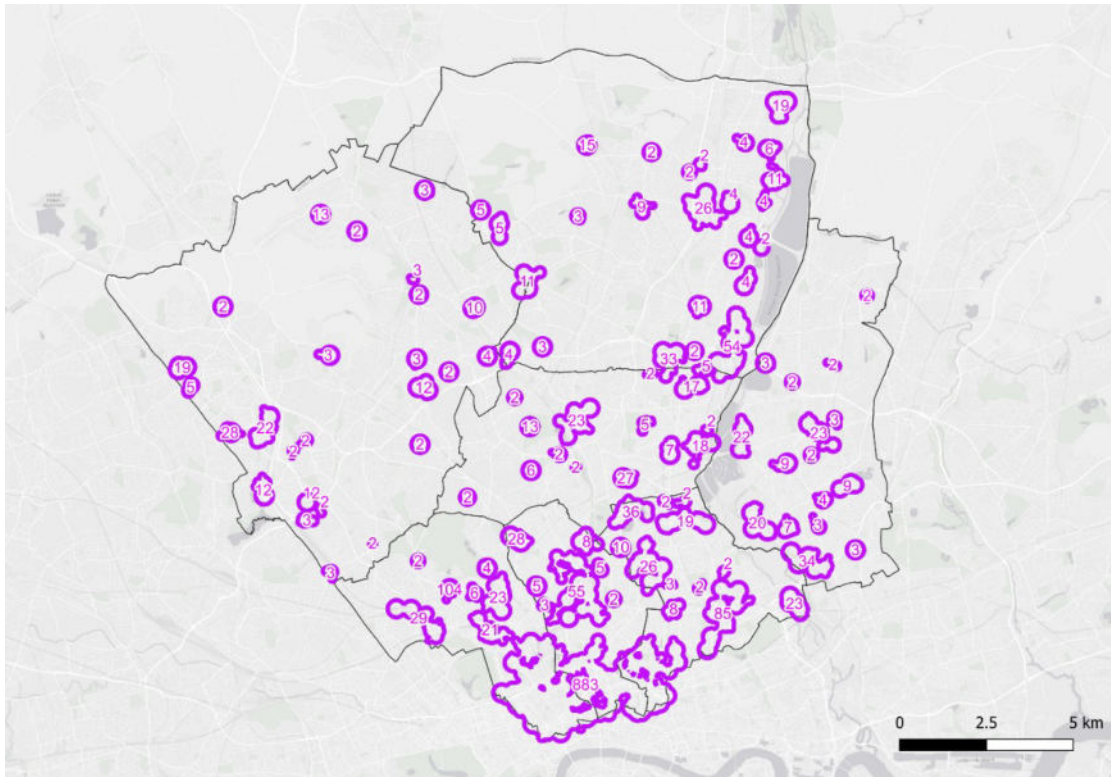


Figure 4-3 Resultant Clusters, numbers shown are cluster annual demand in GWh/a

4.3 Potential Network & Mapping

Given the difference between heat demand and available heat supply, a methodology to prioritise which clusters to connect has been developed. A description of the four different prioritisation methods can be seen in Table 4—2 below.

Table 4—2 Cluster Prioritisation Options

Cluster option	Description
1. Geographic	Look to serve clusters radially outwards from the largest heat supply opportunities (found in Edmonton, Enfield) until no waste heat remains.
2. Geographic weighted	Look to serve clusters radially outwards from the largest heat supply opportunities (found in Edmonton, Enfield) until no waste heat remains, however omits Barnet which has low density connections.
3. Central	Considers that it would be best to focus the heat supply opportunities to serve the harder to decarbonise Central London area from the largest heat supply opportunities (found in Edmonton, Enfield)– this reduces numbers of connections and pipework and reduces service in those boroughs it crosses.
4. Eastern Strategic Main (ESM)	Takes into account the existing plans for a 35MW offtake from the EcoPark by Energetik, currently planned to serve demands in Enfield, Haringey, and North Hackney. In this option the 35MW of heat has been excluded, as well as the clusters planned for connection to this network to give a more realistic view of the opportunity with remaining waste heat.

As this report is not NLWA or DESNZ focused, an overview of the **'Geographic'** route is presented in detail as this is most similar to the methodologies used for the other strategic areas. The other strategic areas in this study all have a sufficient amount of heat sources to meet the heat demand in the area the network is modelled in. The Geographic cluster prioritisation method has been used to model these clusters within each of the strategic areas. Please refer to the full NLWA report for greater detail on all the network routing options.

The loads used for the Steiner network processing tool are shown in Figure 4-4, with the outputted network shown in Figure 4-5. The proposed route begins in Edmonton and serves clusters in Enfield whilst also traveling downwards with a main trunk passing through Haringey, Hackney, Islington, and Camden before branching into Barnet and back into Haringey. There is also a branch to serve Waltham Forest.

Figure 4-4 Geographic clusters

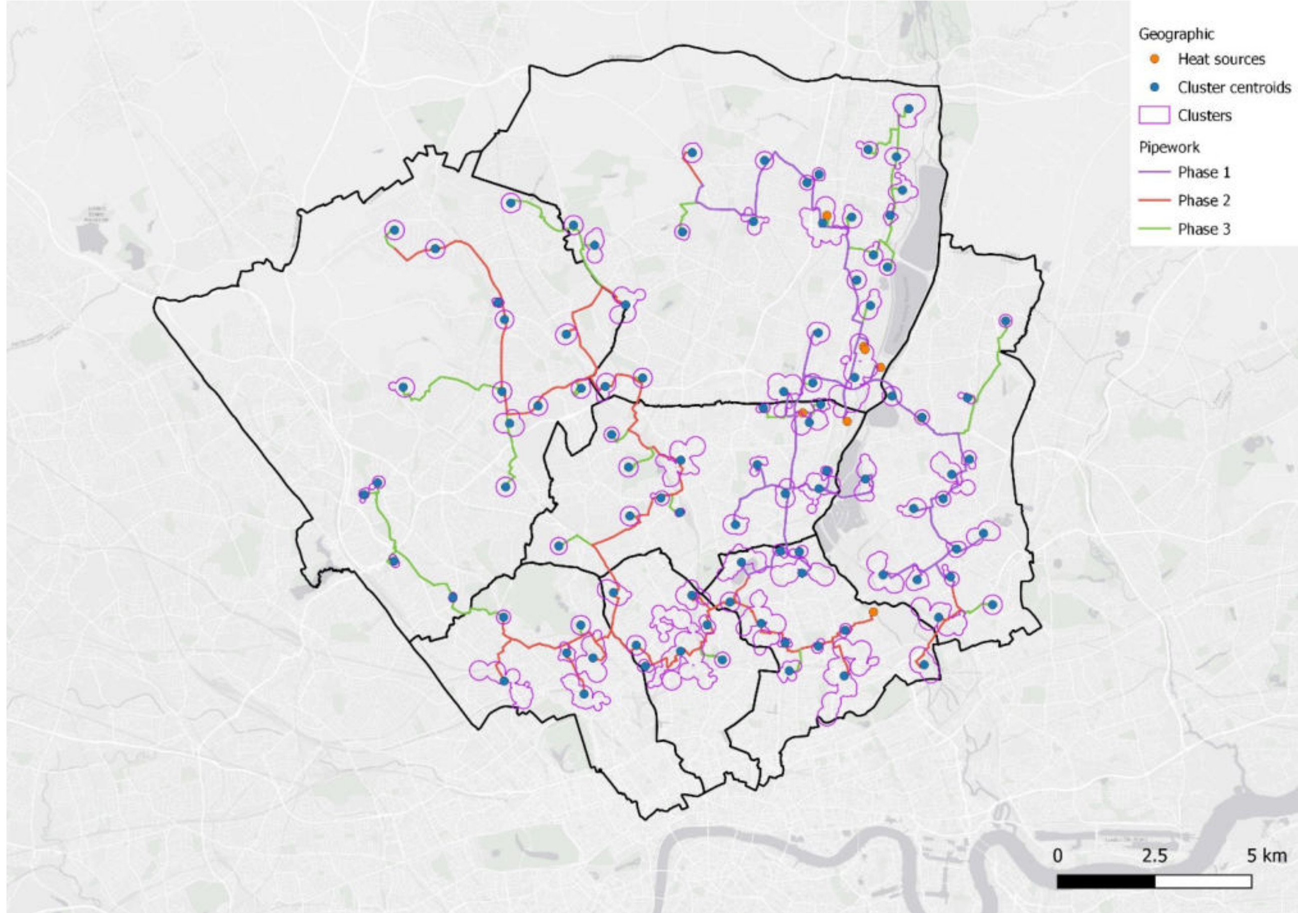


Figure 4-5 Geographic route

4.3.1 Phasing

As shown in Figure 4-5 there has been phasing included. This is for the benefit of the high-level techno-economic analysis, each route has been split into 3 phases. These are presented in Figure 4-6.

Figure 4-6 Phasing Methodology

4.4 Potential Scale of Investment

This study is further developed than the other strategic areas and therefore has further in-depth costing and a techno-economic model.

A simple technoeconomic cashflow model (TEM) has been produced to assess the scenario. The model looks at the project over a 40-year period from the perspective of an Energy Servicing Company (ESCo) operating the network between the connections to heat sources and cluster level heat substations.

The TEM was built in Microsoft Excel, using the DESNZ economic model as a template. The model combines technical details of the network, such as CAPEX and Operational Expenditure (OPEX), with revenue and cost inputs to generate annual cashflow. This allows for an assessment of viability and means of comparison between the scenarios.

The cost of waste heat from the various sources split between high grade and low-grade heat, with difference waste heat costs for each. With these fixed, the heat sales price to the clusters was changed until the scenarios achieved a 10% Internal Rate of Return (IRR). The scenario with the lowest heat sales price would be deemed the most economically viable. To make this possible, grant funding equalling 30% of the scenario CAPEX was assumed in each case.

All results presented are pre-tax. The assumptions for this modelled are further details in the full North London Heat Network study report.

Table 4—3 Geographic Route TEM results

Variable	Value
Net Present Value (NPV) @40years	£453,900,000
IRR @40years	10%
Lifetime CAPEX	£582,000,000
Lifetime CAPEX (assuming 30% grant funding)	£407,400,000
Heat sales price to achieve 10% IRR@40 years	13.46p/kWh

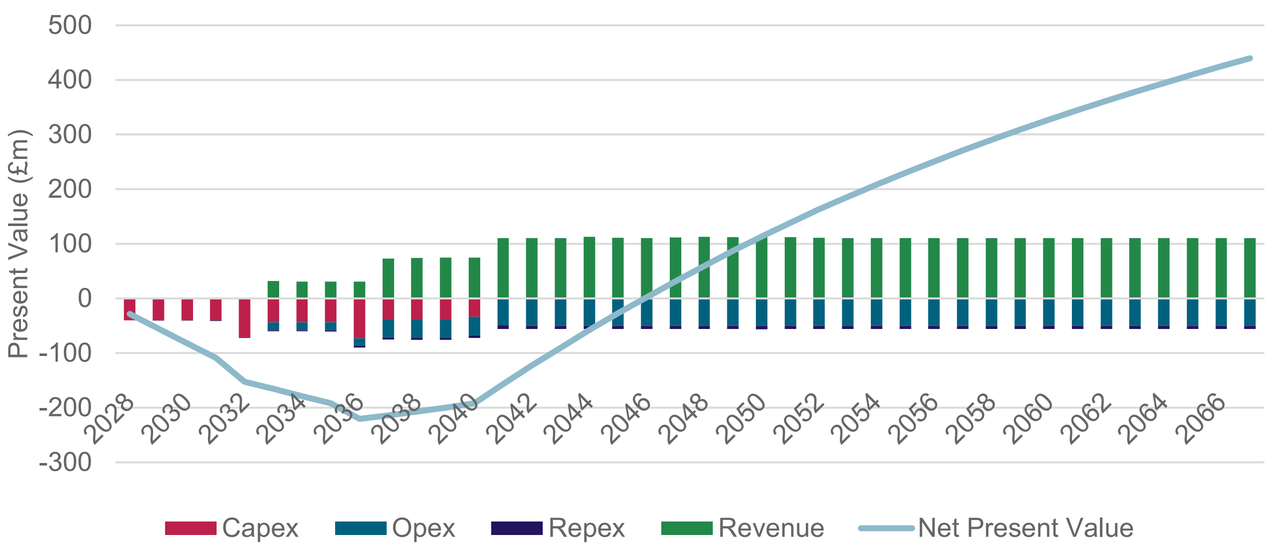


Figure 4-7 Geographic Route NPV Line

4.5 Carbon Results

Carbon reduction realised by connecting the proposed clusters to the final network for NLWA, calculated as set out in the methodology (3.7) are presented in Table 4—4 below. These carbon results are over a 40 year lifetime.

Table 4—4 Carbon Results

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
11,187,000	232,000	10,955,000	98%

5 Strategic Area B: Beddington Waste Heat Strategic Area

5.1 Waste Heat Sources and Heat Loads

The Beddington Waste Heat Strategic Area is located in South West London, in the London Borough of Sutton near the boundary with the London Borough of Croydon. It has been identified as a waste heat Strategic Area as it has four waste heat sources available within a close proximity as well as some large heat loads in the surrounding area. The four main heat sources are detailed below in Table 5—1 with their geographical location shown.

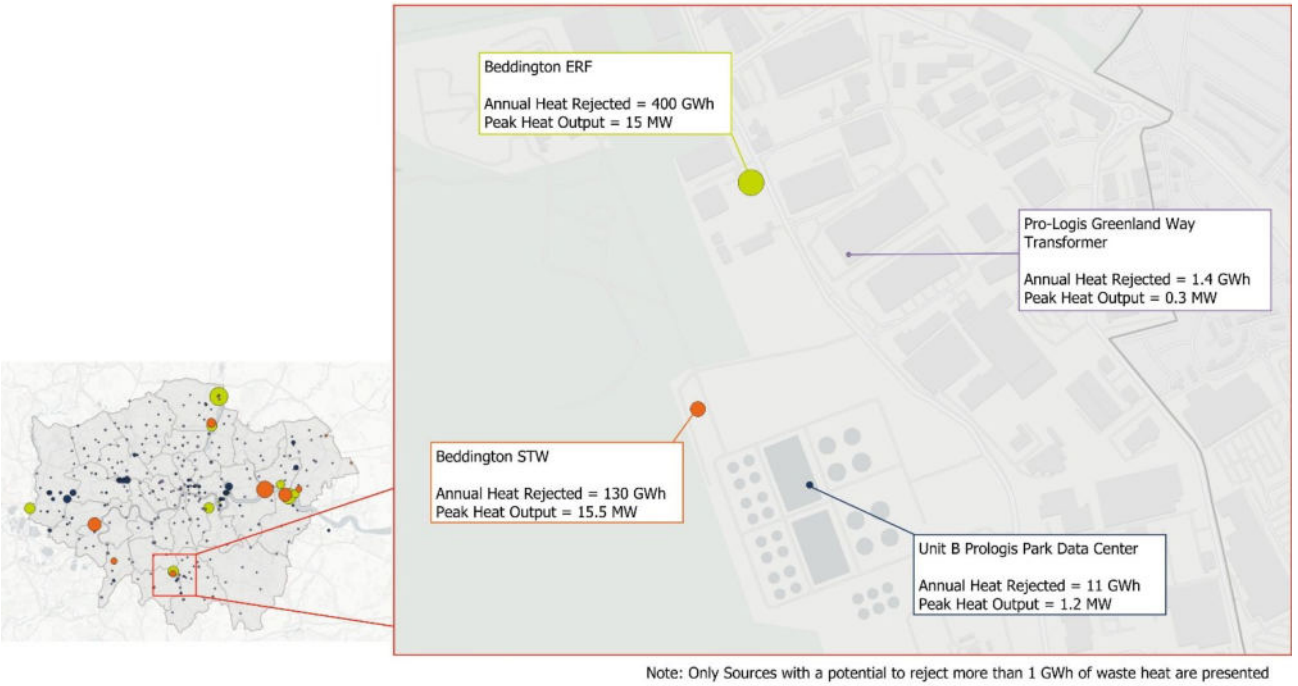


Figure 5-1 Waste heat sources in the Beddington Strategic Area

Due to the proximity of the four waste heat sources, for modelling purposes they have been summed together and considered as one large heat source. Table 5—1 shows the breakdown of each of these sources.

Table 5—1 Beddington Main Heat Sources

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Beddington Sewage Treatment Works (STW)	Sewage Treatment	130	15.5
Beddington Energy Recovery Facility (ERF)	Energy Recovery	400*	15
Unit B Prologis Park Data Centre	Data Centre	11	1.2
Pro-Logis Greenland Way Transformer	Transformer	1.4	0.3
Total		**542**	**32**

*Note this value is in question as Sutton have indicated that only 15MW is thought to be available which may limit output.

5.2 Potential Connections and Network

The clustering methodology, explained in 3.3, was utilised with the heat loads that fell within the Beddington area that totalled to less than the annual heat rejected from the chosen heat sources for the Strategic Area. Due to the scale of annual heat rejected from the waste sources, 542 GWh, there is potential to serve a large area. Figure 5-2 shows the geographical location of the Beddington Strategic Area with the clusters with a total over 1 GWh demands alongside an indication of the location of the main waste heat sources to be utilised.

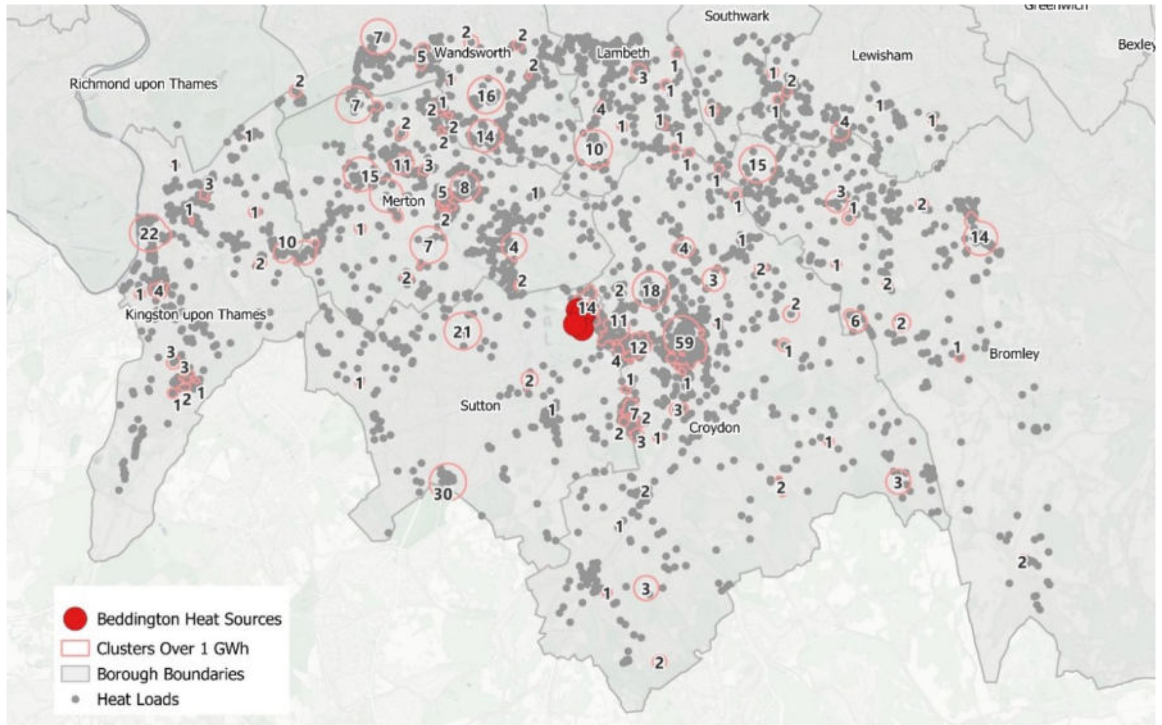


Figure 5-2 Beddington Area with potential Heat Loads and Clusters over 1 GWh

A network has been identified by running Steiner Tree analysis to connect up clusters via the shortest route and shortlisting only pipework with a linear density of **8+ MWh/yr/m**. Exceptions to this were based around a combination of factors such as cluster proximity (that was not picked up as a result of the processing speed limitation over a large area), large individual heat load size and whether there are any existing or proposed heat networks in the immediate area. The final output showing the network between connected clusters and waste heat sources, as well as existing and proposed networks is presented in Figure 5-3 The heat load of this potential network is **~ 386 GWh/yr**.

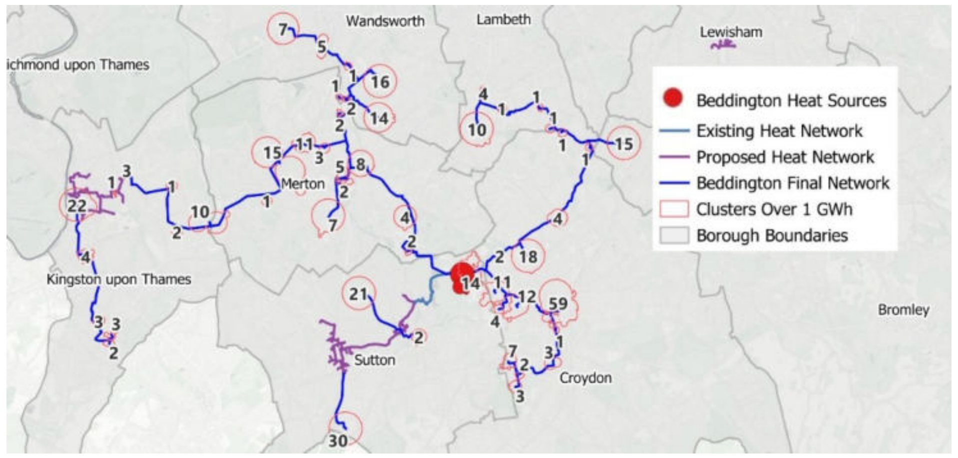


Figure 5-3 Final Network based off linear density and existing/proposed networks

A map showing existing heat networks in the area, the initial Steiner Tree outputs, explicit results of the linear heat assessment, and alignment of the final network with the GLA's Potential District Heat Network (DHN) Project Areas can be found in B.4.

5.3 Connection Opportunities

The proposed network will be a cross-borough network reaching all the largest heat clusters. It will cover the London Boroughs of Croydon, Merton, Sutton, Kingston, Wandsworth and Lambeth. Looking at the 20 largest loads connected in the area gives an understanding of the main stakeholders that need to be involved in the potential network.

Table 5—2 shows the geographical location of these points identified in numerical order dependent on their annual heat demand.

Table 5—2 20 Largest Heat Loads in the Potential Beddington Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included in Network
1	The Royal Marsden Hospital	Sutton	Hospital	27100	13500	4-8	Included
2	St. Helier Hospital	Sutton	Hospital	18600	9300	8+	Included
3	Crystal Palace National Sports Centre	Bromley	Sports Centre	13500	6700	8+	Included
4	Vernon House	Wandsworth	Office Building	11800	5900	8+	Included
5	Croydon University Hospital	Croydon	Hospital	7500	3800	8+	Included
6	Lunar House	Croydon	Office Building	5100	2600	8+	Included
7	Streatham Ice & Leisure Centre	Lambeth	Leisure Centre	4700	2400	8+	Included
8	Merton Civic Centre	Merton	Government Building	4700	2400	4-8	Included
9	Parkside Hospital	Merton	Hospital	4200	2100	2-4	Not Included
10	Kingston-upon-Thames Crown Court	Kingston-upon-Thames	Courthouse	4100	2100	8+	Included
11	Royal Hospital for Neuro Disability	Wandsworth	Hospital	3800	1900	8+	Included
12	Wimbledon College	Merton	Education	3700	1900	8+	Included
13	Bromley Police Station	Bromley	Police Station	3700	1800	4-8	Not Included
14	Wimbledon College of Arts	Merton	Education	3600	1800	8+	Included
15	St Georges Hospital	Wandsworth	Hospital	3500	1800	8+	Included
16	1 Merton High Street	Merton	Commercial Building	3100	1600	8+	Included
17	Canons Leisure Centre 18	Merton	Leisure Centre	2700	1400	8+	Included
18	New Addington Leisure Centre	Croydon	Leisure Centre	2700	1400	0-2	Not Included
19	Reedham Park Av	Croydon	Residential	2700	1400	2-4	Not Included
20	Shannon Commercial Centre	Merton	Commercial Centre	2600	1300	8+	Included

Table 5—2 indicates that 16 of the 20 loads all have high linear heat densities indicating that these loads should be prioritised for connection to the final network. Only 3 of the loads have linear heat densities under 4 MWh/yr/m. Figure 5-4 shows the geographical location of all the top 20 loads in the Beddington area.

Note that the proposed Kingston heat network is also looking at waste heat from a waste water treatment plant and this site could add another >50 GWh/yr of heat to the network which would allow for further expansion and may be required if the Beddington ERF heat output is less than currently modelled.

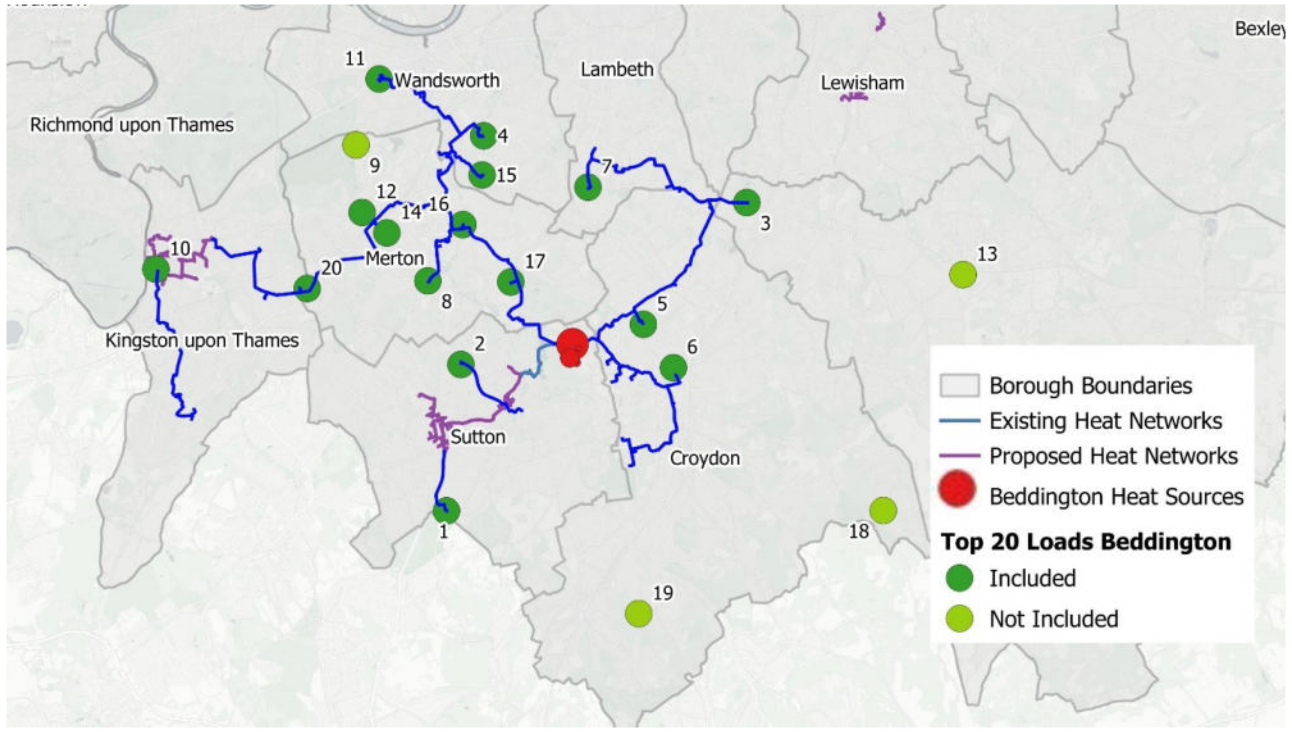


Figure 5-4 Final Network with Top Loads

5.3.1 High Social Housing Areas and NHS Trust Sites

Figure 5-5 shows the Lower Layer Super Output Area (LSOA) areas where there are high densities of social housing. The darkest regions indicate the densest areas of social housing (rented from local authority or other) in each LSOA across the Beddington Strategic Area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the network to these areas could support the decarbonisation of social housing as well as the major non-domestic loads in the area that were identified within the Top 20 loads. This figure also indicates the locations of NHS (National Health Service) Trust sites and these are included within the proposed heat networks to show the potential for the heat network to support the NHS in decarbonising these sites.

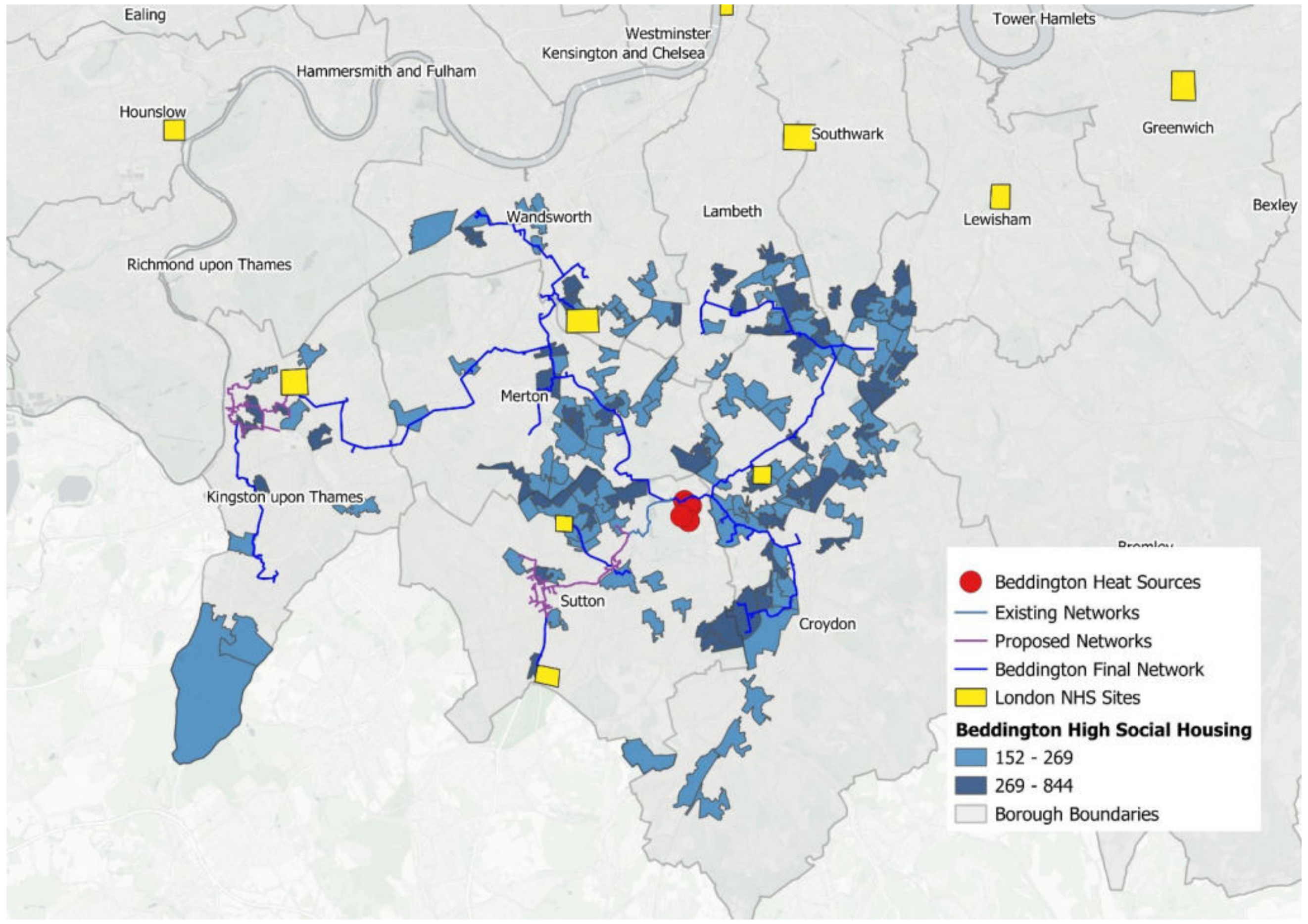


Figure 5-5 Areas of high LSOA Social Housing Density and NHS Trust Site Locations

5.4 Potential Scale of Investment

In total this multi-borough heat network would have a total pipework length of ~70km and the estimated costs for the proposed network are outlined in Table 5—3 with a total of circa £309m.

Table 5—3 Capex

	Unit	Unit Cost	Total Cost
Pipework and Civils	70 km	3,000 £/m	£210m
Water Source Heat Pump	17MW	£1m/MW	£17m
Recovered Heat	15MW	£0.75m/MW	£12m
Plant and Energy Centre	70 km	£1m/km	£70m
		Total	**£309m**

5.5 Carbon Results

Carbon reductions realised by connecting the proposed clusters to the final Beddington network, calculated as set out in the methodology (3.7), are presented in Table 5—4 below and these carbon results are over a 40 year lifetime.

Table 5—4 Carbon Results Summary

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
4301000	104000	4197000	98%

5.6 Key Next Steps

London Boroughs: Croydon, Kingston, Lambeth, Merton, Sutton and Wandsworth

- Engage with LB Sutton and Sutton District Energy Network (SDEN) to highlight the scale of the opportunity and gauge initial thoughts/appetite to explore additional heat sources and expansion of the network.
- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area heat network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.
- Engage with Trinsic and/or Thames Water on the potential for heat offtake at Beddington STW.

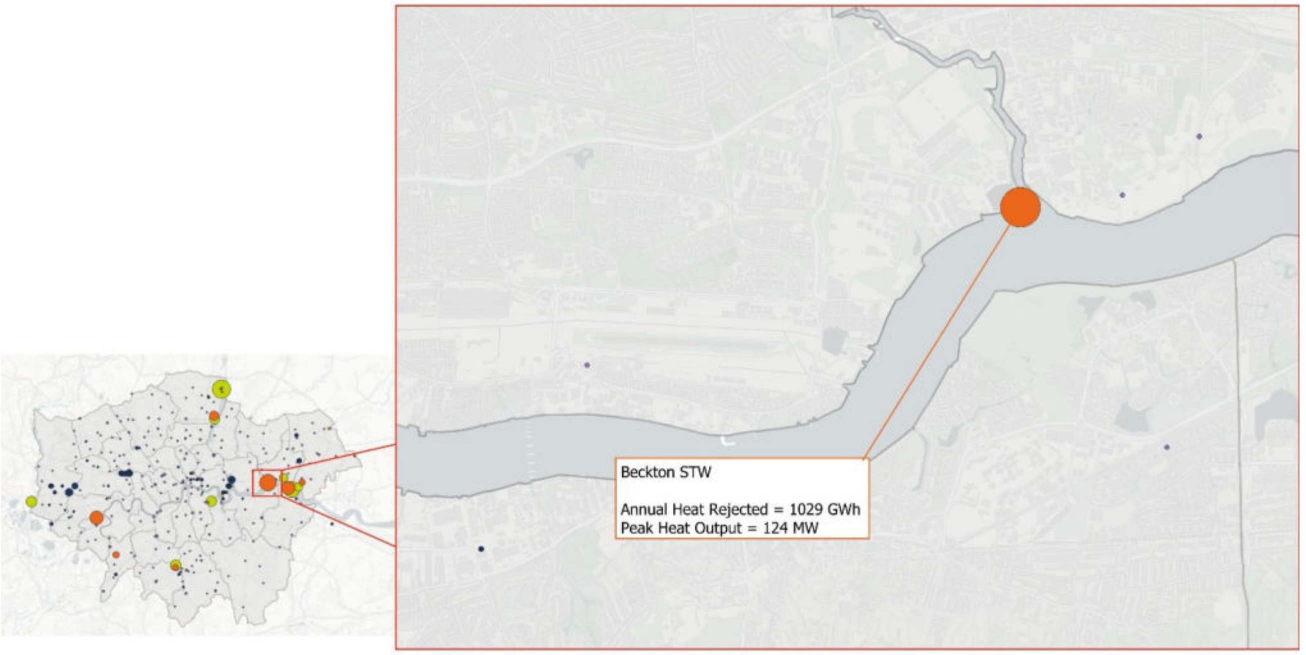
Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.

6 Strategic Area C: Royal Docks Strategic Area

6.1 Waste Heat Sources and Heat Loads

This Strategic Area utilises one main heat source shown in Figure 6-1. The potential heat loads for this Strategic Area were bound by the borough boundaries of Tower Hamlets, Redbridge, Newham and Barking and Dagenham.



Note: Only Sources with a potential to reject more than 1 GWh of waste heat are presented

Figure 6-1 Waste heat sources in the Royal Docks Strategic Area

In this Strategic Area there are a significant number of waste heat sources, however one waste heat source is substantially larger than the others in the area and therefore to simplify the modelling for the area only this one large waste heat source was used. Figure 6-1 shows this selected heat source.

Table 6—1 Docks Waste Heat Source

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Beckton STW	Sewage Treatment	1029	124

6.2 Potential Connections and Network

The clustering methodology, explained in 3.3, was utilised with the heat loads that fell within the Royal Docks area totalling less than the annual heat available from the chosen heat source in the Strategic Area. Figure 6-2 shows the geographical location of the Royal Docks Strategic Area with over 0.5 GWh clusters of heat demands alongside a representation of the waste heat source to be utilised.

The clustering methodology, explained in 3.3, was utilised with the heat loads that fell within the Royal Docks area totalling less than the annual heat available from the chosen heat source in the Strategic Area. Figure 6-2 shows the geographical location of the Royal Docks Strategic Area with over 1 GWh of heat demands alongside a representation of the waste heat source to be utilised.

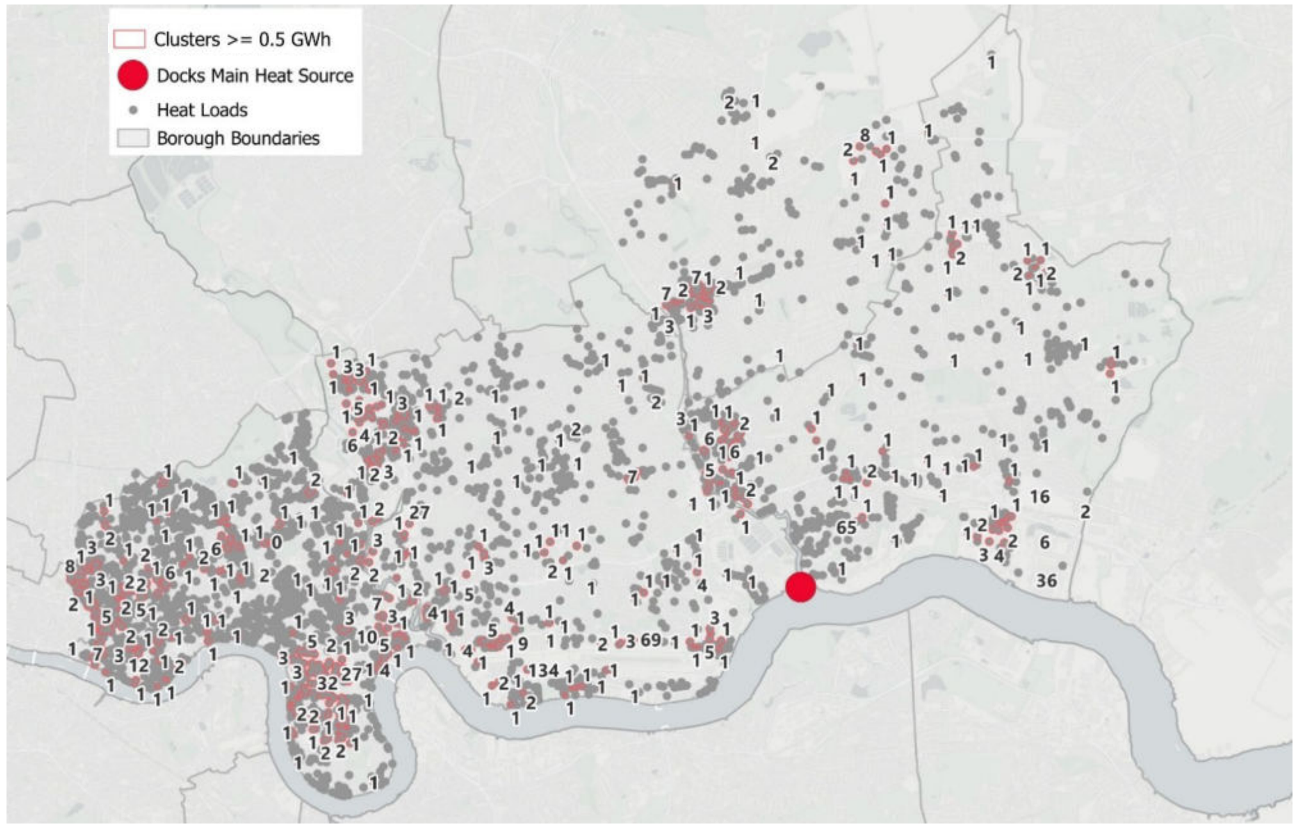


Figure 6-2 Royal Docks Area with potential Heat Loads and Clusters over 0.5 GWh

This network is an output from the Steiner tree analysis, connecting the clusters and the heat source via the highways and paths network through the shortest route. Linear density of the pipework was calculated to shortlist a network with a linear density of **8+ MWh/yr/m**. The Royal Docks Strategic Area has 4 existing heat networks (Olympic Park, Barkantine, Gascoigne East/Barking Town and Excel D Exhibition Centre (EDEC) alongside 7 proposed networks (or network extensions). Where these existing and proposed networks are located, the output of the final network was manually altered to integrate with these heat networks.

The final network is shown in Figure 6-3. The total annual heat demand of the network, from the cluster totals is **~1011GWh/yr**. Of this 1011 GWh/yr of potential heat load there is ~326 GWh/yr of loads that are included in either existing or proposed heat networks (these are on the London Heat Map). Whilst some of these heat networks may be currently installing other on-site heat sources as part of their decarbonisation strategy (e.g. heat pumps and heat recovery from cooling towers on the Olympic Park), the modelling assumes that the waste heat source is used in full to create a decarbonised heat network.

Since the clustered total heat load for this area seeks to utilise 98% of the identified waste heat source, there are other important waste heat sources in the area (e.g. several data centres and Tate and Lyle sugar factory) that should be investigated as part of further work on this Strategic Area to supplement the heat network with additional waste heat that can be used to expand and grow the heat network.

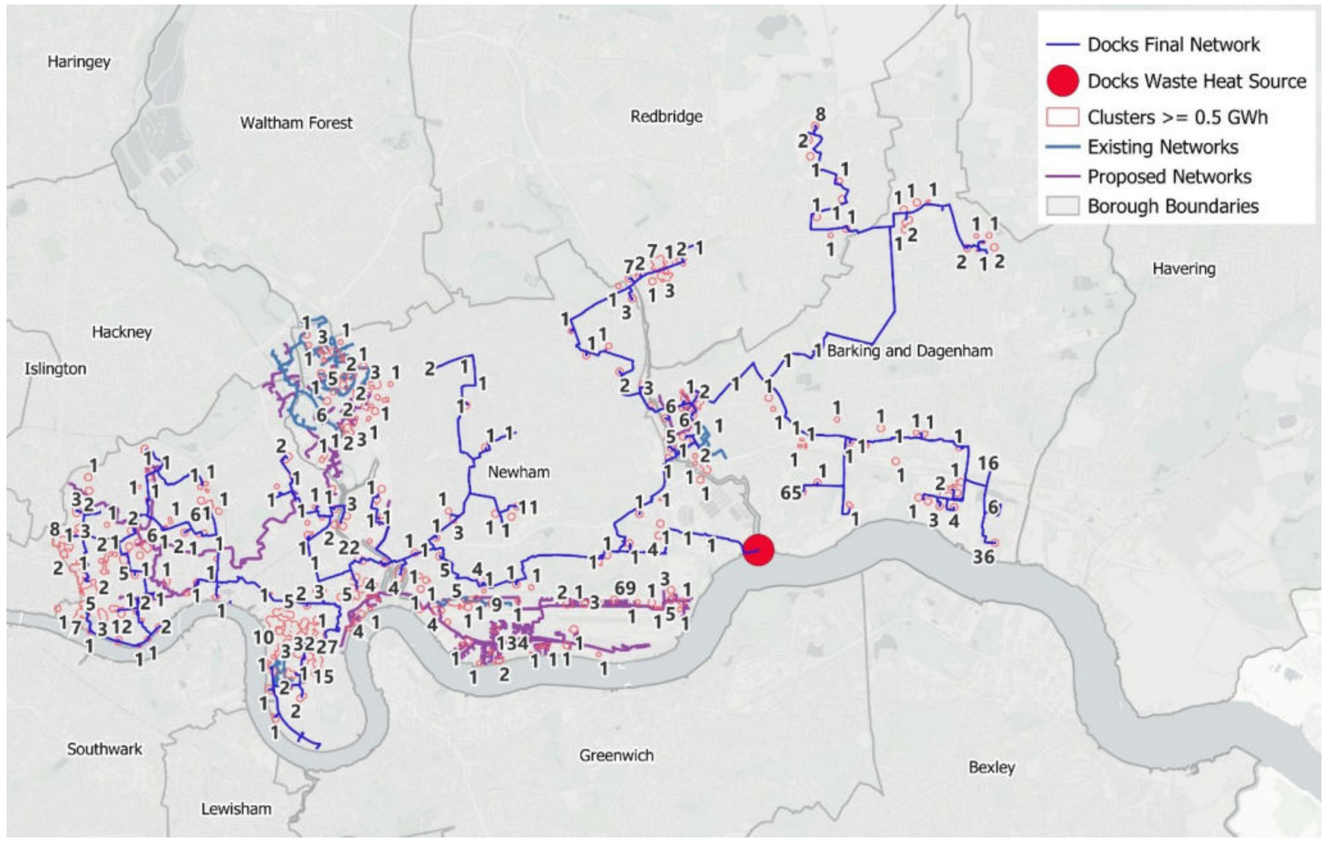


Figure 6-3 Final Network based off linear density and existing/proposed networks

6.3 Connection Opportunities

The proposed network will be a multi-borough heat network that will reach all the main heat clusters. It will cover the London Boroughs of Tower Hamlets, Redbridge, Newham and Barking and Dagenham. Looking at the 20 largest loads to be connected gives an understanding of the main stakeholders that will need to be engaged and involved in the heat network. Figure 6-4 shows the geographical location of these points identified in numerical order dependent on annual heat demand.

Table 6—2 20 Largest Heat Loads in the Potential Royal Docks Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included in Network
1	Silvertown Quays	Newham	Industrial Site	133500	66300	Proposed Network	Included
2	Royal Albert Dock	Newham	Dock	68800	34200	Proposed Network	Included
3	Multiple Companies Industrial Site	Barking and Dagenham	Industrial Site	65400	32500	8+	Included
4	Dagenham Engine Plant	Barking and Dagenham	Engine Plant	35800	17800	8+	Included
5	TwelveTrees Park	Newham	Development	27400	13600	8+	Included
6	Poplar Riverside	Tower Hamlets	Riverside Development	17200	8600	8+	Included
7	We–tfield - Stratford City	Newham	Shopping Mall	16600	8200	Existing Network	Included
8	Dagenham Green (Peabody) School	Barking and Dagenham	School	16100	8000	8+	Included
9	Newham University Hospital	Newham	Hospital	11200	5600	8+	Included
10	Pennington Warehouse London Docks	Tower Hamlets	Warehouse	10900	5400	8+	Included
11	CitiBank	Tower Hamlets	Office Building	10800	5400	8+	Included
12	Blackwall Reach	Tower Hamlets	Residential Development	9500	4800	8+	Included
13	BGC Brokers	Tower Hamlets	Financial Institution	9000	4500	8+	Included
14	ExCel Centre	Newham	Convention Centre	8800	4400	Existing Network	Included
15	Bank of America / HSBC	Tower Hamlets	Office Building	8700	4400	8+	Included
16	King George Hospital	Redbridge	Hospital	7500	3800	8+	Included
17	Travelodge London City / Hub Club / Hayloft Point	Tower Hamlets	Hotel	6800	3400	8+	Included
18	Cordwainer House / Pattern Makers Court	Tower Hamlets	Residential Buildings	6700	3300	8+	Included
19	BT	Redbridge	Office Building	6500	3200	8+	Included
20	Mile End Hospital	Tower Hamlets	Hospital	6400	3200	8+	Included

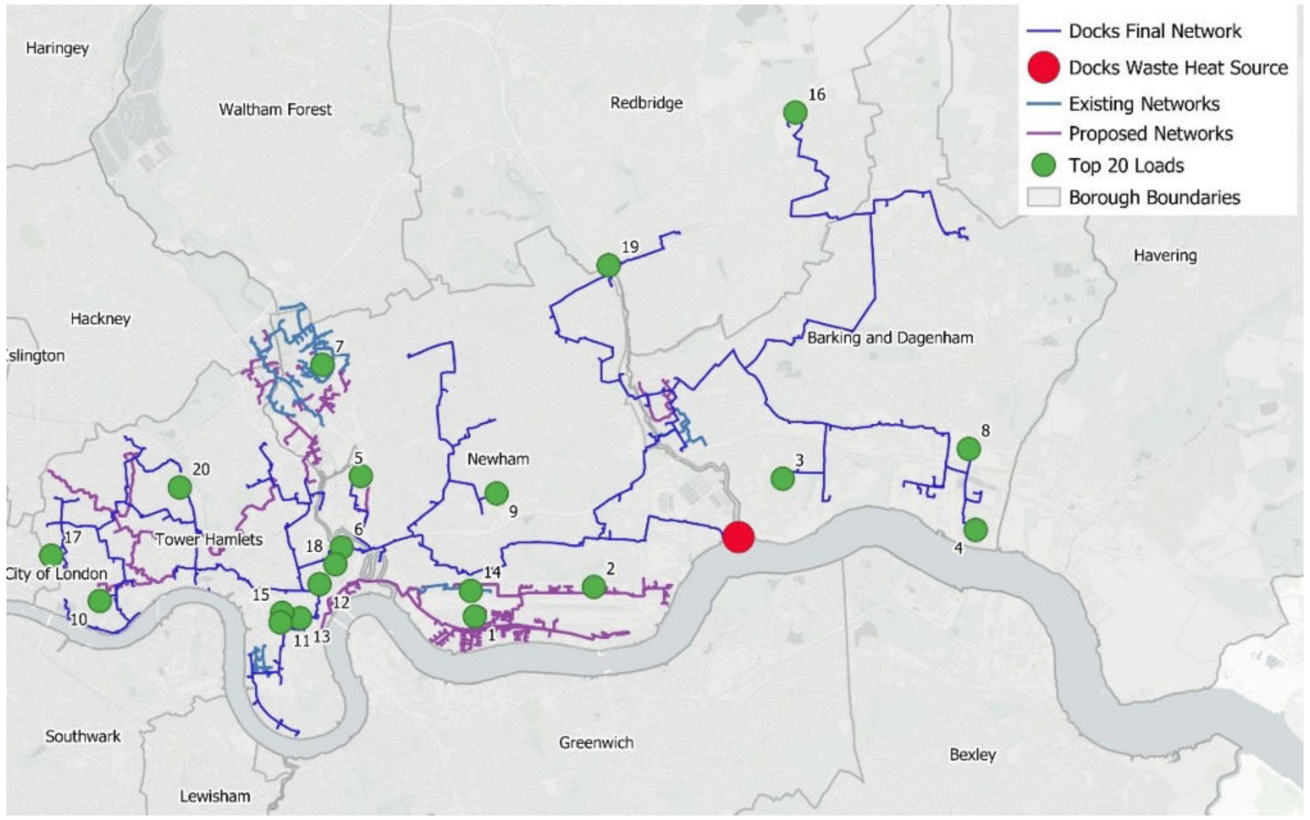


Figure 6-4 Final Network with Top Loads

6.3.1 High Social Housing Areas and NHS Trust Sites

Figure 6-5 shows the LSOA areas where there are high densities of social housing. The darkest regions indicate the densest areas of social housing (rented from local authority or other) in each LSOA across the Royal Docks Strategic Area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the network to these areas could support the decarbonisation of social housing as well as the major non-domestic loads in the area that were identified within the Top 20 loads. This figure also indicates the locations of NHS Trust sites and these are included within the proposed heat networks to show the potential for the heat network to support the NHS in decarbonising these sites.

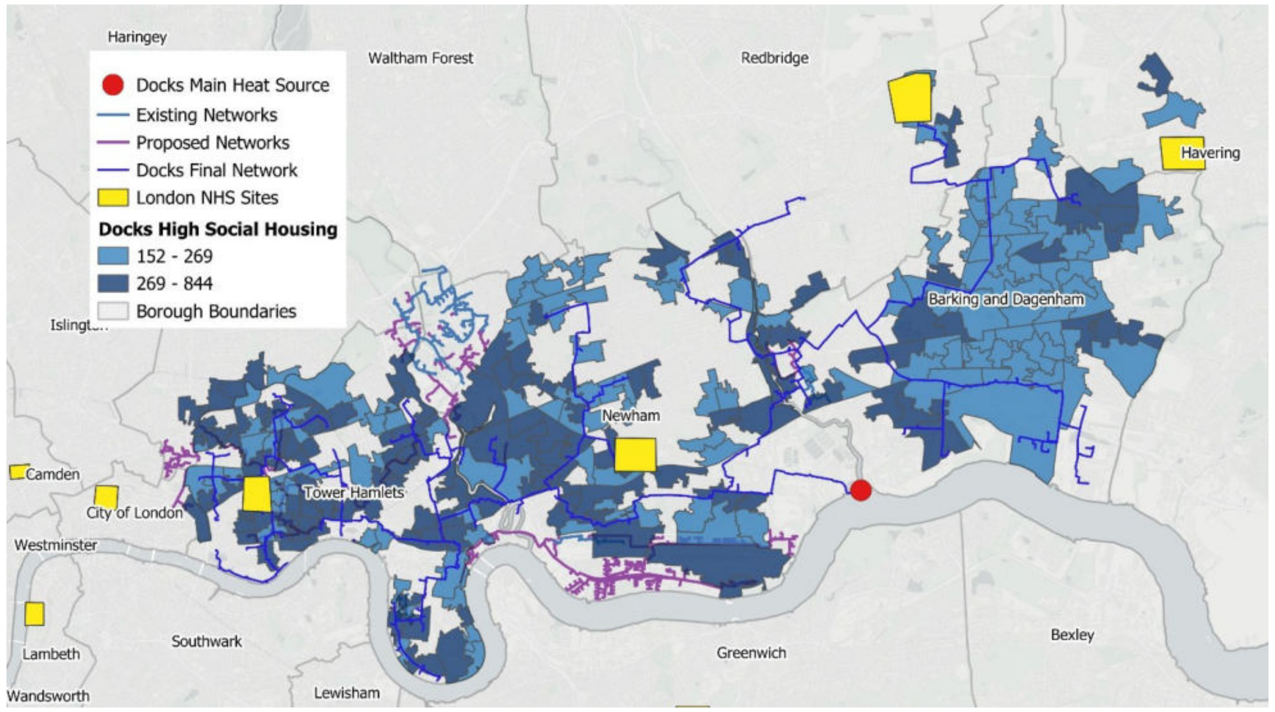


Figure 6-5 Areas of high LSOA Social Housing Density and NHS Trust Site Locations

6.4 Potential Scale of Investment

In this study, the estimated cost for the pipework is produced from a 3000 £/m estimate and Section 3.6 gives detail on the assumed costs used. Overall, this multi-borough heat network would have a total pipework length of **~90km** and the estimated costs for the proposed heat network, which has one waste heat source, are outlined in Table 5—3 with a total of circa £394m.

Table 6—3 Capex

	Unit	Unit Cost	Total Cost
Pipework and Civils	90 km	3,000 £/m	£180m
Water Source Heat Pump	124 MW	£1m/MW	£124m
Plant and Energy Centre	90 km	£1m/km	£90m
		Total	**£394m**

6.5 Carbon Results

The carbon reduction realised by connecting the proposed clusters to the heat network for the Royal Docks, calculated as set out in the methodology (3.7), are presented in Table 6—4 below. These carbon results are over a 40 year lifetime.

Table 6—4 Carbon Results Summary

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
11265000	287000	10978000	97%

6.6 Key Next Steps

London Boroughs: Barking & Dagenham, Newham, Redbridge and Tower Hamlets.

- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area heat network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.
- Maintain contact with LB Barking and Dagenham and LB Newham who are currently undertaking coordinated studies looking at the Beckton STW with Thames Water and the opportunity it provides.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.

Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.

7 Strategic Area D: Mogden & Twickenham Strategic Area

7.1 Waste Heat Sources and Heat Loads

In the Mogden and Twickenham Strategic Area there has been one major waste heat source identified and that is the Mogden STW. The selection of the heat loads considered in this analysis were limited to the London Boroughs of Ealing, Hounslow and Richmond upon Thames . The geographical location of the clusters and the heat source details are shown in Table 7—1 and Figure 7-1.

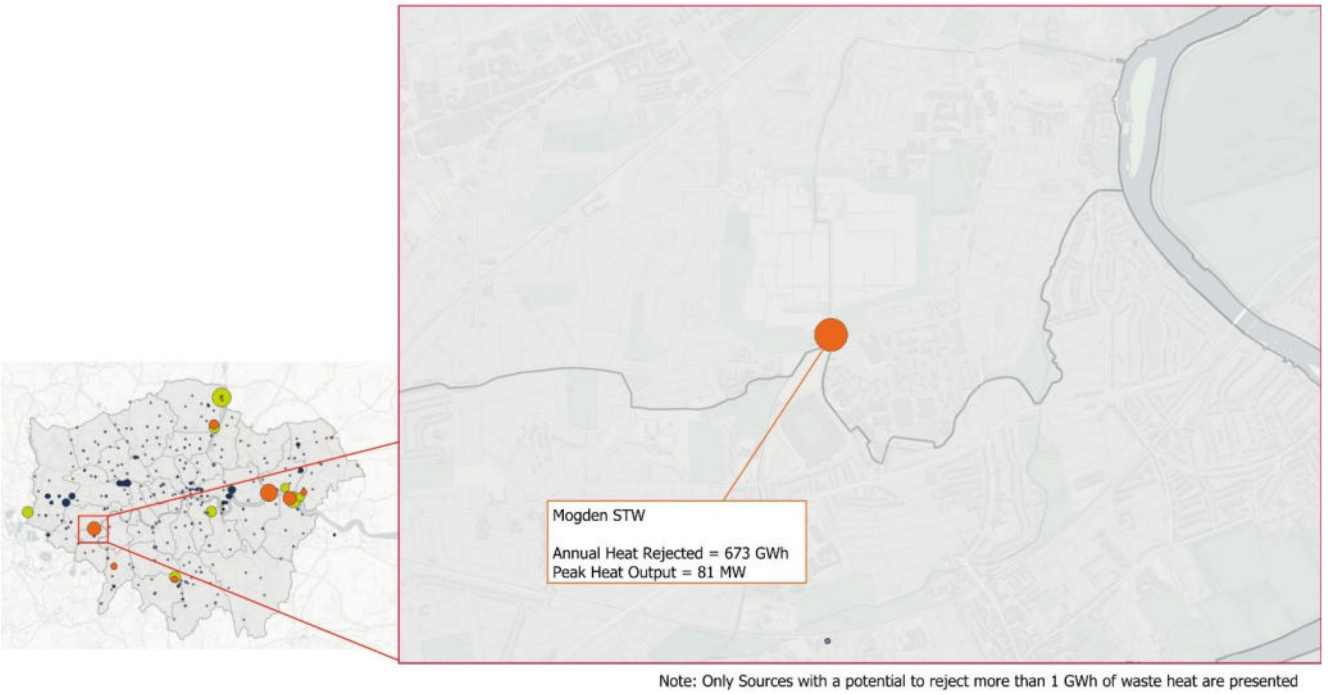


Figure 7-1 Waste heat source in the Mogden & Twickenham Strategic Area

Table 7—1 Mogden & Twickenham Heat Sources

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Mogden STW	Sewage Treatment	673	81

7.2 Potential Network

The clustering methodology, explained in 3.3, was utilised for the heat loads that fell within the Mogden & Twickenham area and they totalled less than the annual heat available from the selected heat sources for this Strategic Area. The clusters and heat loads assessed along with their geographic location are shown in Figure 7-2.

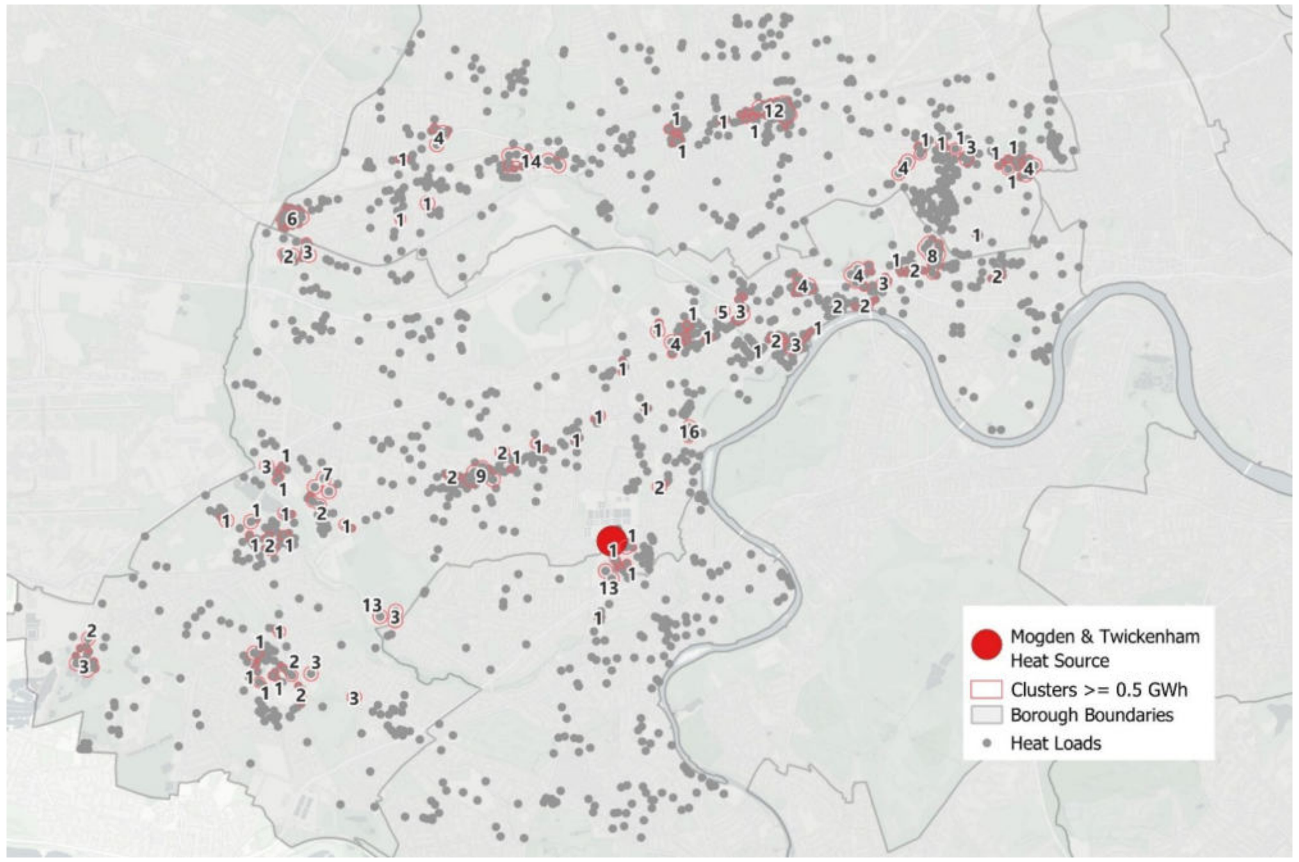


Figure 7-2 Mogden & Twickenham Area with potential Heat Loads and Clusters over 0.5 GWh

The final network is shown in Figure 7-3. The total annual heat demand of the heat network, calculated from the cluster totals, is **~ 222 GWh/yr.** This suggest that there is still significant surplus waste heat that might be able to be captured and supplied into the heat network as future loads come forward.

The network analysis carried out only shortlists pipework routes with a linear density of 8+ MWh/yr/m. The potential heat network in Ealing town centre area, shown in grey in Figure 7-3, has been included as part of the Strategic Area heat network with associated heat loads.

A map showing existing heat networks in the area, the initial Steiner Tree outputs, explicit results of the linear heat assessment, and alignment of the final network with the GLA's Potential Project Areas can be found in Appendix C.

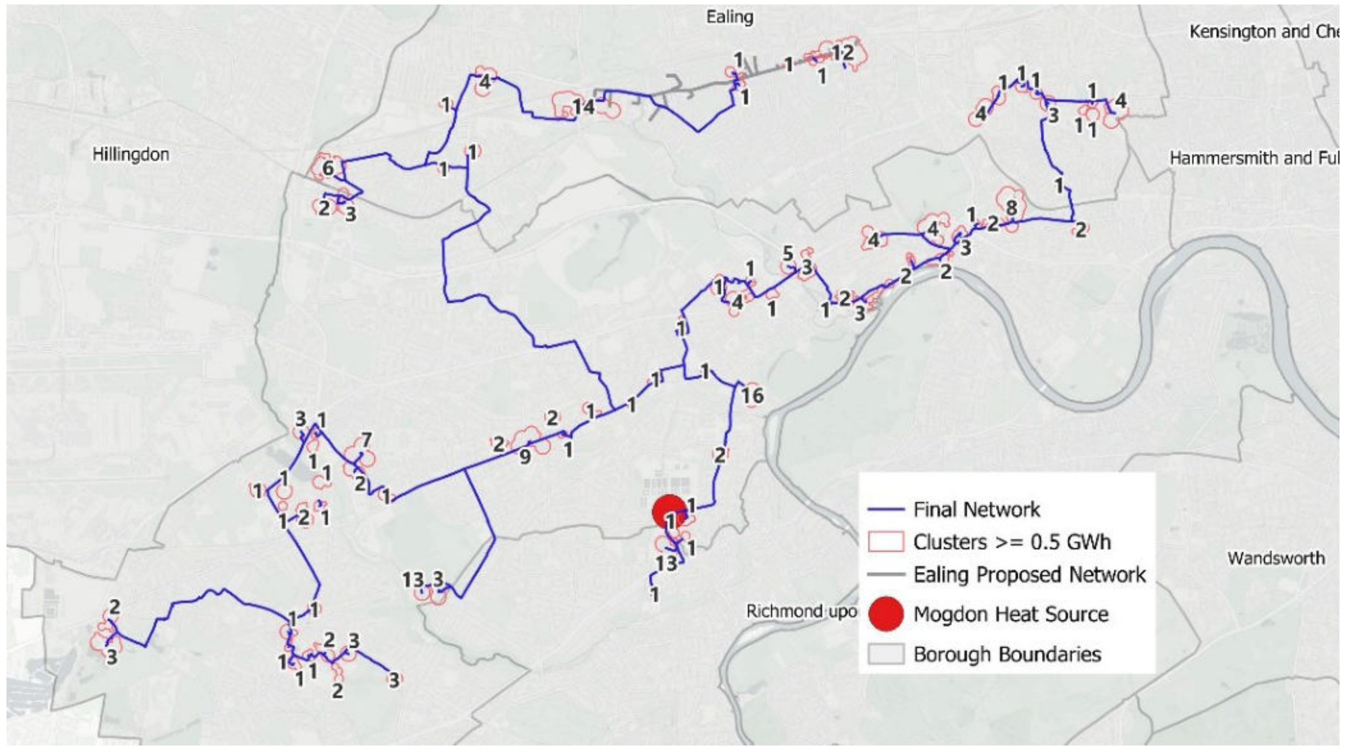


Figure 7-3 Final Network based off linear density and existing/proposed networks

7.3 Connection Opportunities

The proposed network will be a multi-borough heat network that will reach all the main heat clusters. It will cover London Boroughs of Hounslow, Richmond and Ealing. Looking at the 20 largest loads to be connected gives an understanding of the main stakeholders that will need to be involved in the heat network. Figure 7-2 details the Top 20 heat loads.

Only 1 of the 20 heat loads has a linear density less that 8+ MWh/yr/m. Figure 7-4 shows the 20 largest potential heat loads in the Mogden & Twickenham Area.

Table 7—2 20 Largest Heat Loads in the Potential Mogden & Twickenham Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included in Network
1	West Middlesex University Hospital	Hounslow	Hospital	15500	7700	8+	Included
2	Roy–l Mail - Jubilee Mail Centre	Hounslow	Mail Centre	12500	6200	8+	Included
3	Twickenham Stadium	Richmond	Stadium	10900	5400	8+	Included
4	Clerkenwell House & Tulk House	Ealing	Office Buildings	5800	2900	8+	Included
5	G S K House	Hounslow	Office Building	4800	2400	8+	Included
6	Prologis Park – Morgan Stanley	Hounslow	Industrial Park	3700	1800	8+	Included
7	Treaty Centre	Hounslow	Shopping Centre	3200	1600	8+	Included
8	Heathrow Causeway Centre	Hounslow	Office Building	3200	1600	8+	Included
9	Hanworth Air Park Leisure Centre & Library	Hounslow	Leisure Centre and Library	3000	1500	8+	Included
10	Feltham Community College	Hounslow	Education	3000	1500	8+	Included
11	Brentford Fountain Leisure Centre	Hounslow	Leisure Centre	2700	1300	8+	Included
12	Lady Eleanor Holles School	Richmond	Education	2600	1300	4-8	Not Included
13	Ealing Hospital	Ealing	Hospital	2500	1200	8+	Included
14	Hounslow House & Library	Hounslow	Government Building	2400	1200	8+	Included
15	Acton Old Town Hall	Ealing	Historical Building	2200	1100	8+	Included
16	Gilette Corner	Hounslow	Commercial Building	2100	1100	8+	Included
17	Prologis Park – British Airways	Hounslow	Industrial Park	2100	1000	8+	Included
18	Isleworth Leisure Centre and Library	Hounslow	Leisure Centre and Library	2000	1000	8+	Included
19	England Rugby/ World Rugby Museum	Richmond	Museum and Offices	2000	1000	8+	Included
20	Great Western Industrial Park	Ealing	Industrial Park	2000	1000	8+	Included

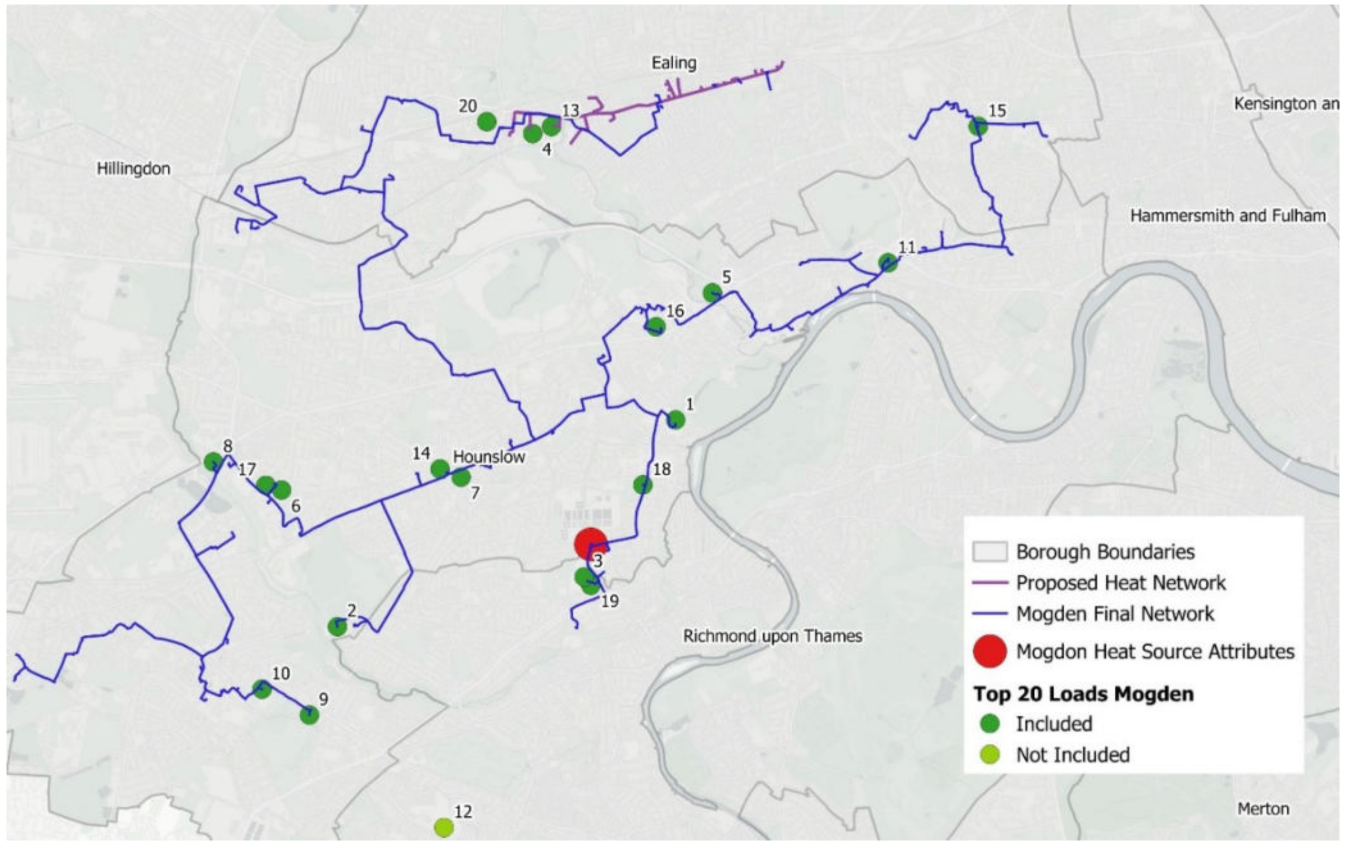


Figure 7-4 Final Network with Top 20 Loads

7.3.1 High Social Housing Areas and NHS Trust Sites

Figure 7-5 shows the LSOA areas where there are high densities of social housing. The darkest regions indicate the densest areas of social housing (rented from local authority or other) in each LSOA across the Mogden & Twickenham Strategic Area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the network to these areas could support the decarbonisation of social housing as well as the major non-domestic loads in the area that were identified within the Top 20 loads. This figure also indicates the locations of NHS Trust sites and these are included within the proposed heat networks to show the potential for the heat network to support the NHS in decarbonising these sites.

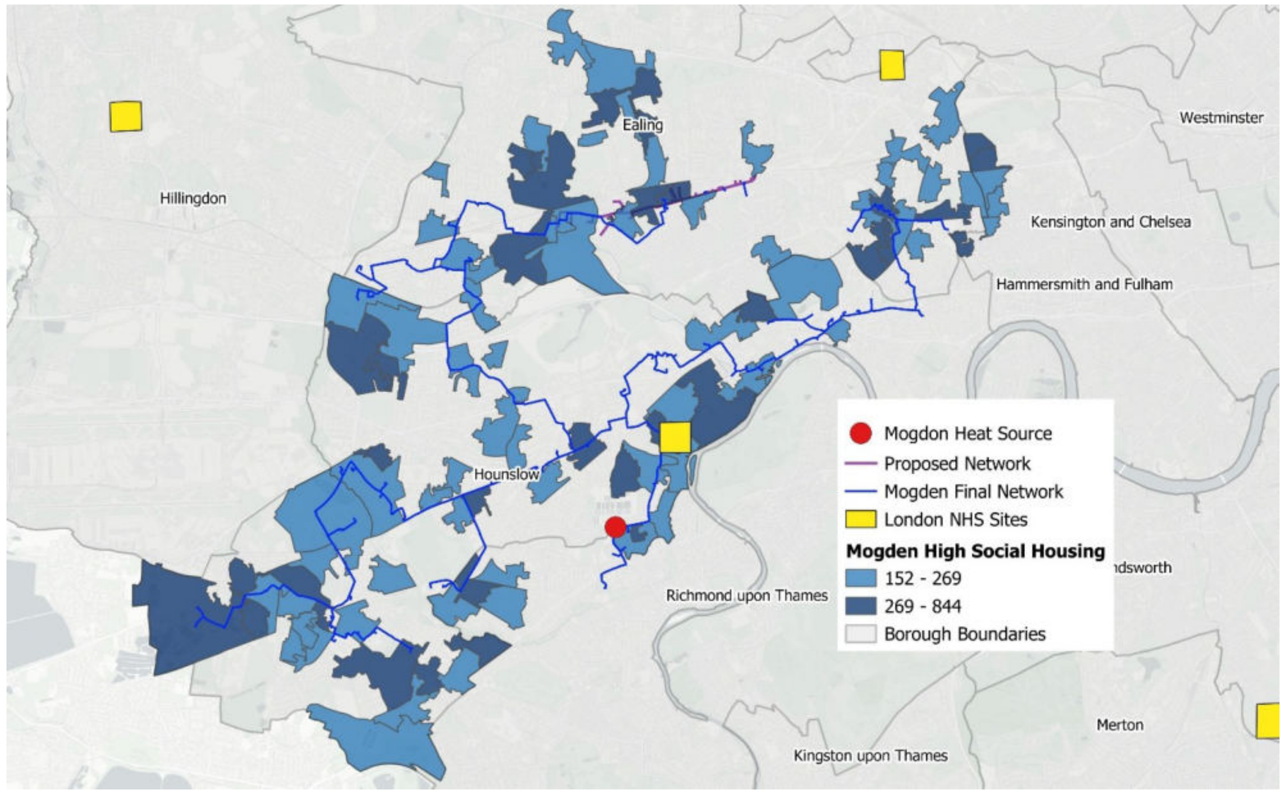


Figure 7-5 Areas of high LSOA Social Housing Density and NHS Trust Site Locations

7.4 Potential Scale of Investment

Overall, this multi-borough heat network would have a total pipework length of **~58km** and the estimated costs which are set out in Figure 7-3 shows the total to be circa **£331m.**

Table 7—3 CAPEX Costs

	Unit	Unit Cost	Total Cost
Pipework and Civils	58 km	3,000 £/m	£ 174m
Water Source Heat Pump	91 MW	£1m/MW	£ 91m
Plant and Energy Centre	58 km	£1m/km	£ 58m
		Total	**£331m**

7.5 Carbon Results

The carbon reduction realised by connecting to proposed clusters to the heat network for Mogden & Twickenham, calculated as set out in the methodology (3.7), are presented in Figure 7-4 below. These carbon results are over a 40 year lifetime.

Table 7—4 Carbon Results Summary

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
2,474,000	63,000	2,411,000	97%

7.6 Key Next Steps

London Boroughs: Ealing, Hounslow and Richmond upon Thames

- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area Heat Network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.
- Maintain contact with LB Barking and Dagenham and LB Newham who are currently undertaking coordinated studies looking at the Beckton STW with Thames Water and the opportunity it provides.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.
- Engage Trinsic and/or Thames Water around the opportunities for Mogden STW to be a waste heat source.

Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.
- Consider the proximity of the neighbouring Strategic Area Hayes & West Drayton there is the possibility for a combined larger heat network (see section 9).
- It is understood (since this analysis) that Hounslow undertook a Feasibility study for a heat network in the borough which shows strong correlation with that shown from our analysis. Discussions with Hounslow should initially be held to understand their planned next steps and the next steps for this study.

8 Strategic Area E: Hayes & West Drayton Strategic Area

8.1 Waste Heat Source and Heat Loads

There are understood to be 6 data centres in the LB of Hillingdon which could provide waste heat to the Borough and beyond, including supporting extensions into Ealing. The six main waste heat sources, associated with three companies, are detailed below in Table 8—1 with their geographical location shown in Figure 8-1. The six Data Centres combined are estimated to reject up to 515 GWh/yr of waste heat (see Table 8—1).

Figure 8-1 Waste heat sources in the Hayes & West Drayton Strategic Area

Table 8—1 Waste Heat Sources in the Hayes & West Drayton Strategic Area

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Virtus London 5,6,7,8	Data Centre	180	20
Union Park	Data Centre	210	24
Colt London 4	Data Centre	125	12
Total		**515**	**56**

8.2 Potential Connections and Network

The clustering methodology, explained in 3.3, was utilised to identify potential heat network connections that fell within the Hayes & West Drayton area, totalling less than the annual heat available from the identified heat sources. Only cluster loads that were equal or greater than 0.5 GWh were assumed as potentially viable at this stage for the strategic network.

Figure 8-2 shows the resultant clusters and their heat loads.

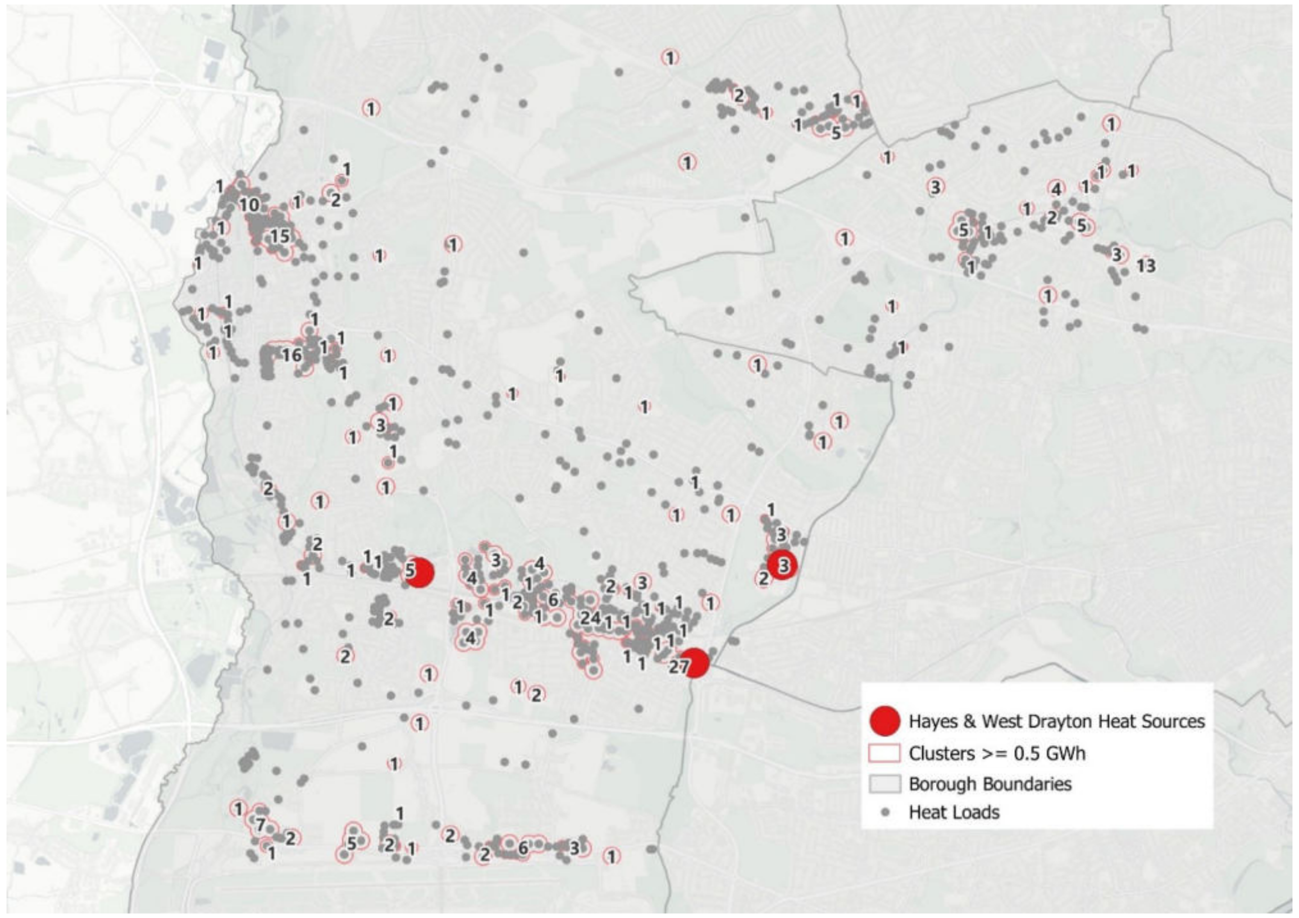


Figure 8-2 Hayes & West Drayton Area with potential Heat Loads and Clusters over 0.5 GWh

Modelling has been carried out to identify potential networks to interconnect these clusters with the final heat network only built up of pipework with a linear density of 8+ MWh/yr/m. For the proposed heat networks in the area, identified from the London Heat Map and shown in grey in Figure 8-3, the proposed pipework from the model that overlapped with the proposed networks already in the London Heat Map was removed from the analysis to avoid duplication.

The final network is shown in Figure 8-3. The total annual heat demand of the network, from the clusters total **~ 218 GWh/yr.** This suggests that there is significant amount of surplus waste heat that could be supplied into the heat network in the area as it expands and grows to connect future loads as they come forward.

A map showing existing heat networks in the area, the initial Steiner Tree outputs, explicit results of the linear heat density assessment, and alignment of the final network with the GLA's Potential DHN Project Areas can be found in Appendix E.

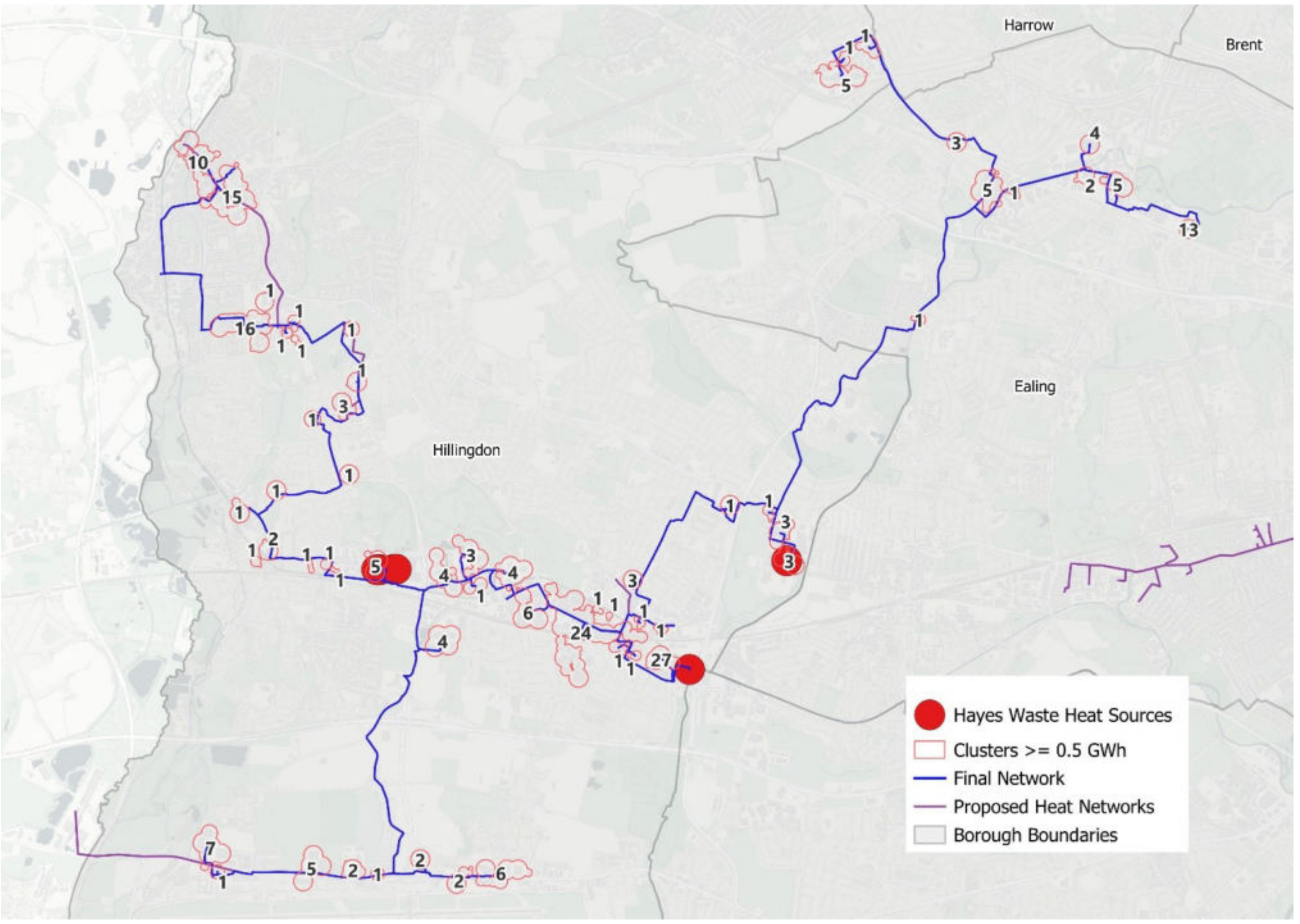


Figure 8-3 Final Network based off linear density and existing/proposed networks

8.3 Connection Opportunities

The proposed network will be a multi-borough heat network that will reach all the main heat clusters. It will cover the London Boroughs of Hillingdon and Ealing. Looking at the 20 largest loads to be connected gives an understanding of the main stakeholders that will need to be involved in the potential network. Note the analysis currently excludes Heathrow Airport which could be a major load if they are interested but currently it is understood that they are looking at on-site solutions for decarbonisation.

Table 8—2 indicates that 18 of the 20 loads all have linear densities of 8+ MWh/yr/m indicating that the pipelines connecting these have greater opportunity for inclusion in an overall network. Figure 8-4 shows the geographic location of all the potential highest loads in the Hayes & West Drayton Area. A large number of the loads in close proximity to the data centres appear to be industrial which is a typically challenging typology in estimating loads – therefore these would need to be confirmed early in any further work as there is a risk that loads in this area may vary considerably.

The London Heat Map appears to suggest that there are large heat demands at 2 of the data centre sites (8, 17), this may be an anomaly and again requires verification through stakeholder engagement in any future work.

Table 8—2 20 Largest Heat Loads in the Potential Hayes & West Drayton Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included
1	Truscon House	Hillingdon	Office Building	24700	12300	8+	Included
2	Royal Mail Greenford Mail Centre	Ealing	Mail Centre	13000	6500	8+	Included
3	Hillingdon Civic Centre	Hillingdon	Government Building	5600	2800	8+	Included
4	Brunel University London	Hillingdon	Education	5100	2600	8+	Included
5	Sainsburys Greenford Distribution Centre	Ealing	Distribution Centre	3700	1900	8+	Included
6	Northolt Leisure Centre Library	Ealing	Leisure Centre and Library	3300	1600	8+	Included
7	Colnbrook Immigration Removal Centre	Hillingdon	Immigration Removal Centre	2700	1400	8+	Included
8	Virtus London 7	Hillingdon	Data Centre	2700	1400	8+	Included
9	Wincanton Plc	Ealing	Retail/Commercial Building	2700	1300	8+	Included
10	Botwell Green Sports & Leisure Centre	Hillingdon	Sports and Leisure Centre	2600	1300	8+	Included
11	DHL	Hillingdon	Logistics Company	2500	1300	8+	Included
12	Hillingdon Hospital	Hillingdon	Hospital	2500	1300	8+	Included
13	Brunel University	Hillingdon	Education	2200	1100	8+	Included
14	Greenford Green Business Park	Ealing	Business Park	2100	1100	8+	Included
15	Wincanton Plc	Ealing	Entertainment Venue	2100	1100	8+	Included
16	Lufthansa Technik	Hillingdon	Aircraft Maintenance Facility	2000	1000	8+	Included
17	Virtus London 8	Hillingdon	Data Centre	2000	1000	8+	Included
18	Uxbridge College	Hillingdon	Education	1900	1000	8+	Included
19	Platinum Jubilee Leisure Centre	Hillingdon	Leisure Centre	1800	900	2-4	Not Included
20	Harlington School	Hillingdon	Education	1800	900	2-4	Not Included

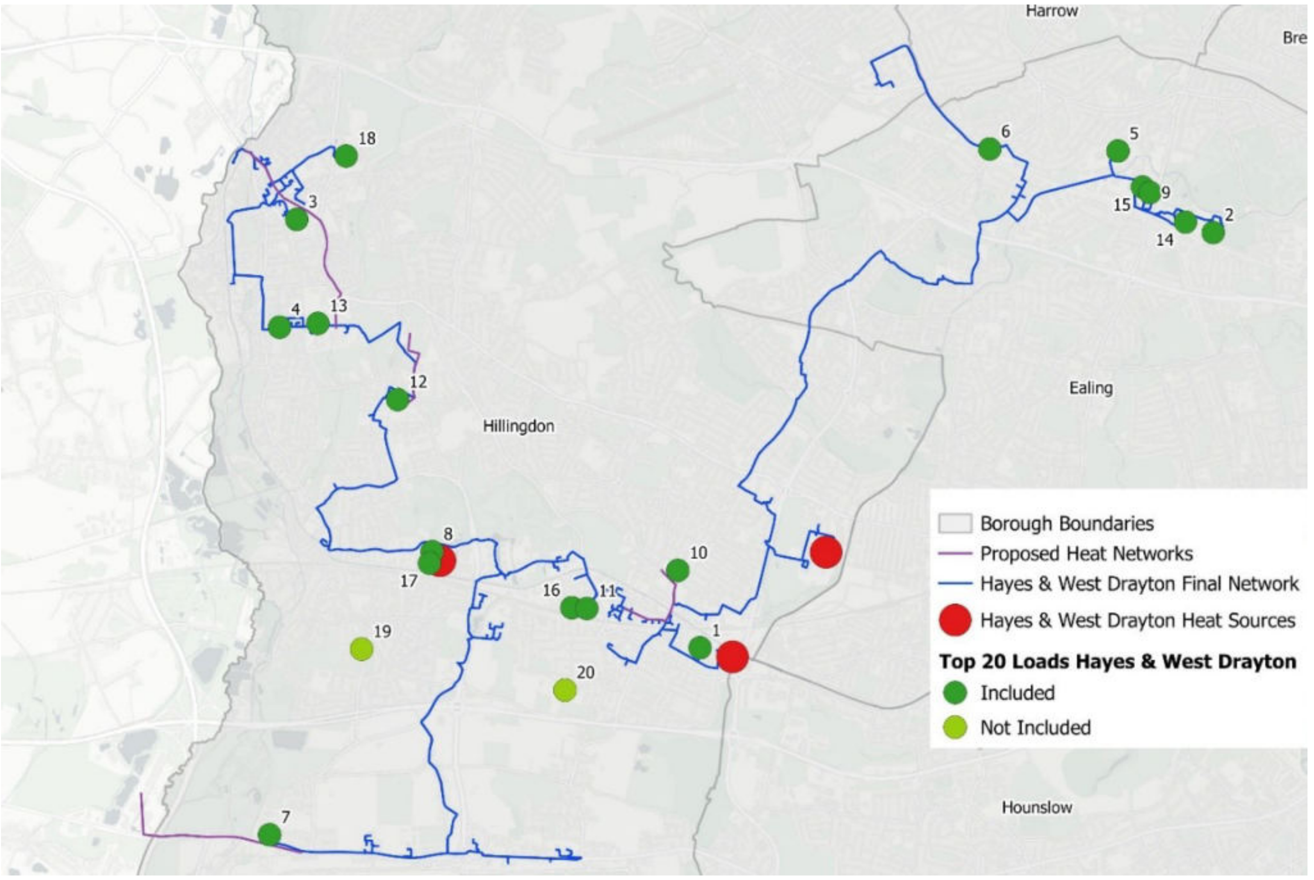


Figure 8-4 Final Network with Top Loads

8.3.1 High Social Housing Areas and NHS Trust Sites

Figure 8-5 shows the LSOA areas where there are high densities of social housing. The darkest regions indicate the densest areas of social housing (rented from local authority or other) in each LSOA across the Hayes & West Drayton Strategic Area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the network to these areas could support the decarbonisation of social housing as well as the major non-domestic loads in the area that were identified within the Top 20 loads. This figure also indicates the locations of NHS Trust sites and these are included within the proposed heat networks to show the potential for the heat network to support the NHS in decarbonising these sites.

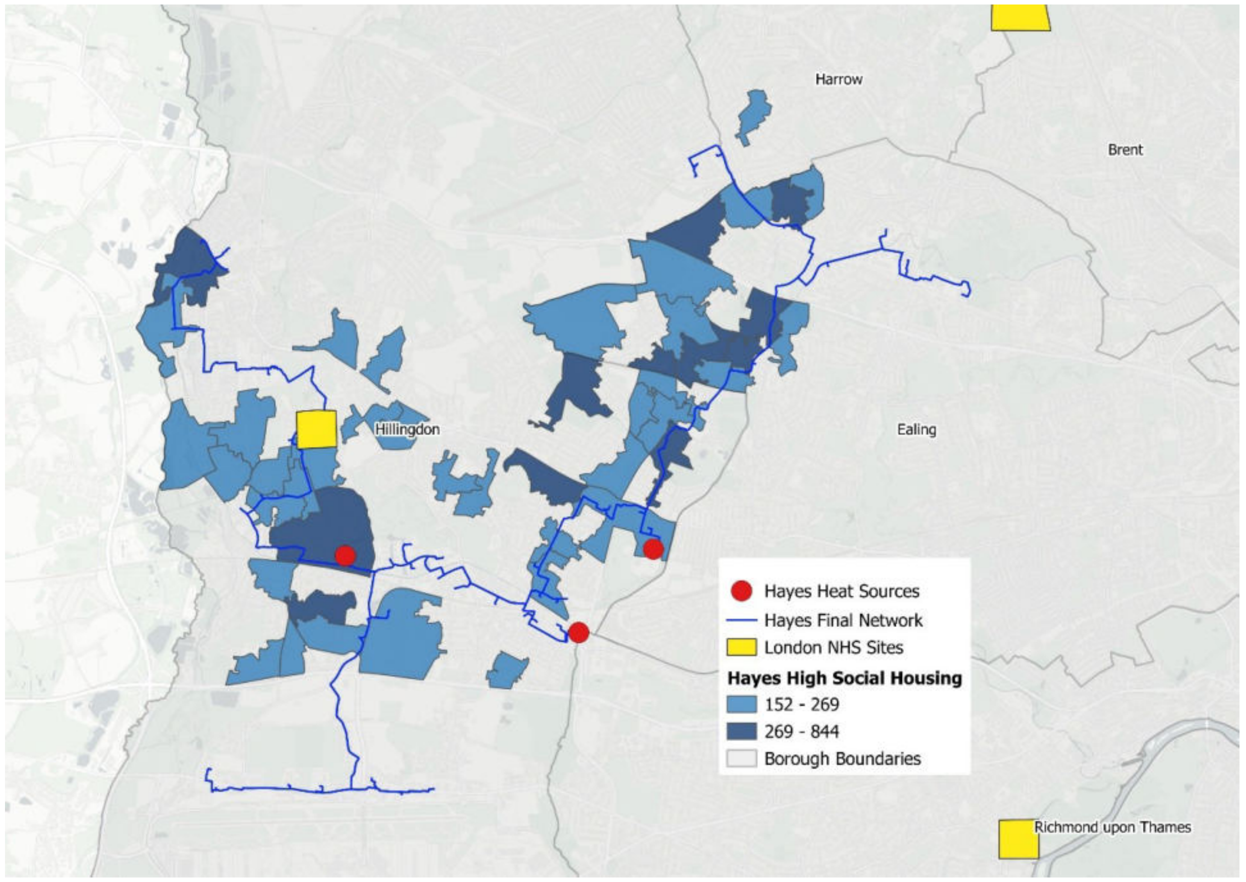


Figure 8-5 Areas of high LSOA Social Housing Density

8.4 Potential Scale of Investment

Overall this network gives a total pipework required of **~43km.** As all the heat sources utilised in this strategic area are data centres which are low grade heat sources therefore they are costed as water source heat pumps with a total build out cost estimated in the region of **£225m**. Table 8—3 shows the estimated costs.

Table 8—3 CAPEX Costs

	Unit	Unit Cost	Total Cost
Pipework and Civils	43 km	3,000 £/m	£126m
Water Source Heat Pump	56 MW	£1m/MW	£56m
Plant and Energy Centre	43 km	£1m/km	£43m
		Total	**£225m**

8.5 Carbon Results

The carbon reduction realised by connecting the proposed clusters to the proposed heat network for Hayes & West Drayton, calculated as set out in the methodology (3.7), are presented in Table 8—4 below. These carbon results are over a 40 year lifetime.

Table 8—4 Carbon Results Summary

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
2429000	62000	2367000	97%

8.6 Key Next Steps

London Boroughs: Ealing and Hillingdon.

- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area heat network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.
- Engage with Lakeside EfW to understand their plans and opportunity as an additional waste heat source.
- Engage with the data centres in this area to establish longer term plans for the site and validate current estimates for heat availability.

Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.
- Carry out a more detailed feasibility in the Hillingdon area to verify load estimates (as many are industrial which are hard to accurately estimate) and also impact of constraints such as the canals and major roads in the area.

9 West London: Combined Strategic Areas D and E & Lakeside EFW Heat Source Sensitivity.

9.1 Combining Strategic Areas D and E

Due to the close proximity of areas D (Mogden & Twickenham) and E (Hayes & West Drayton) there is the ability to see the large scale potential network that encompasses the majority of west London.

The benefit of this includes sharing of waste heat sources which may provide heat at different times.

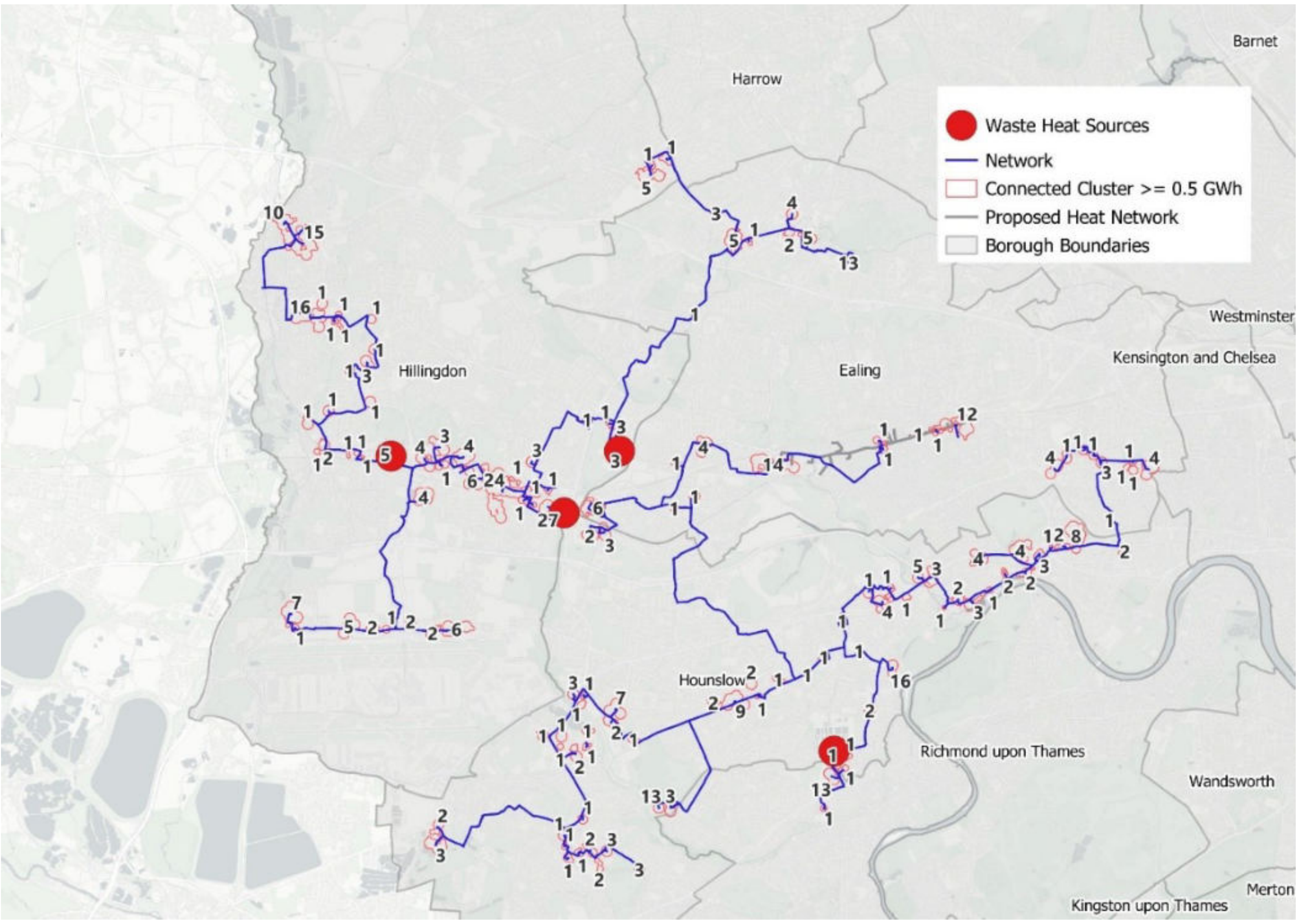
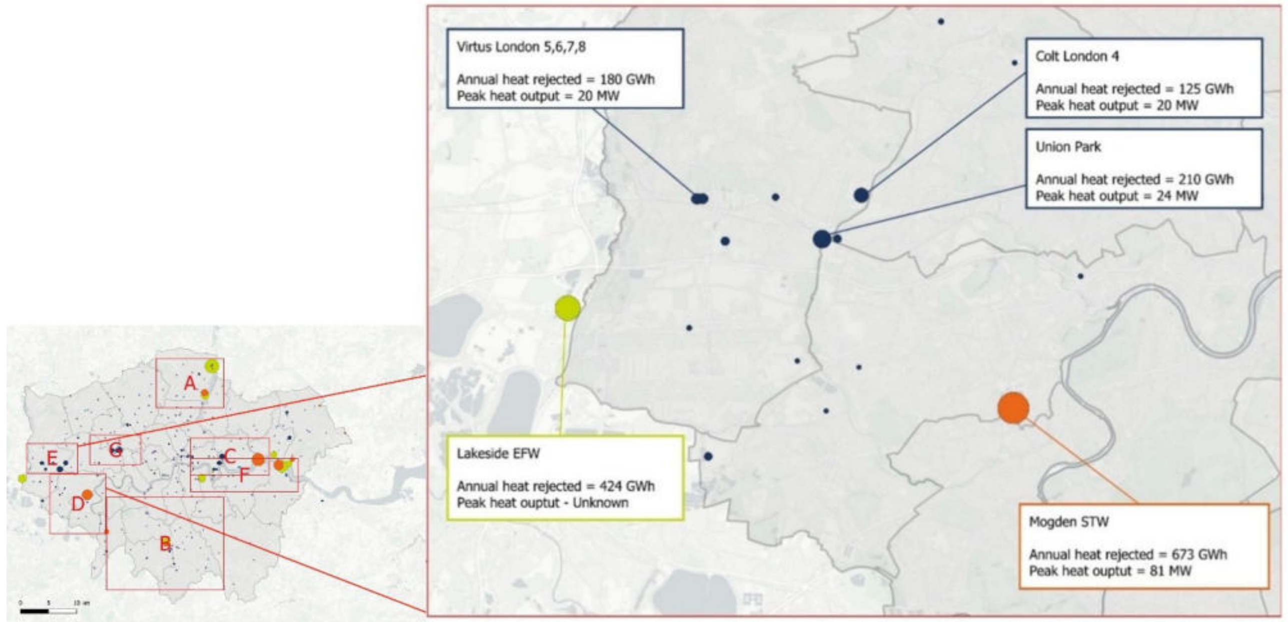


Figure 9-1 Combining two strategic areas to demonstrate the opportunity across West London

9.2 Addition of Lakeside EfW

There is an additional heat source, Lakeside EfW, located near Heathrow Airport just outside of LB Hillingdon to the West. The details on this waste heat source are shown in Figure 9-2 with the geographic location. There is limited understanding on the availability of this as a heat source and therefore a key recommendation is to engage with the operators to understand their plans as it could act as a major high grade heat source in the area.

This section looks at the impact of the inclusion of this additional waste heat source on the amount of load that a west London regional network could serve. In carrying out this sensitivity the heat loads located at Heathrow Airport were included who were discounted in the previous analysis on the basis that they are currently understood to be pursuing an on-site strategy for decarbonisation (to be verified).



Note: Only Sources with a potential to reject more than 1 GWh of waste heat are presented

Figure 9-2 West London – Impact of including the Lakeside EFW Heat Source

The addition of the Lakeside waste heat source increases the available rejected heat by **~36%** and results in a total of ~1612 GWh of annual heat rejected across this entire west London area. Therefore this amount of waste heat could serve additional boroughs such as Brent, Hammersmith & Fulham and potentially further towards central London. Figure 9-3 shows all the loads the waste heat sources could serve limited by proximity to Hillingdon, Ealing, Hounslow and Richmond upon Thames.

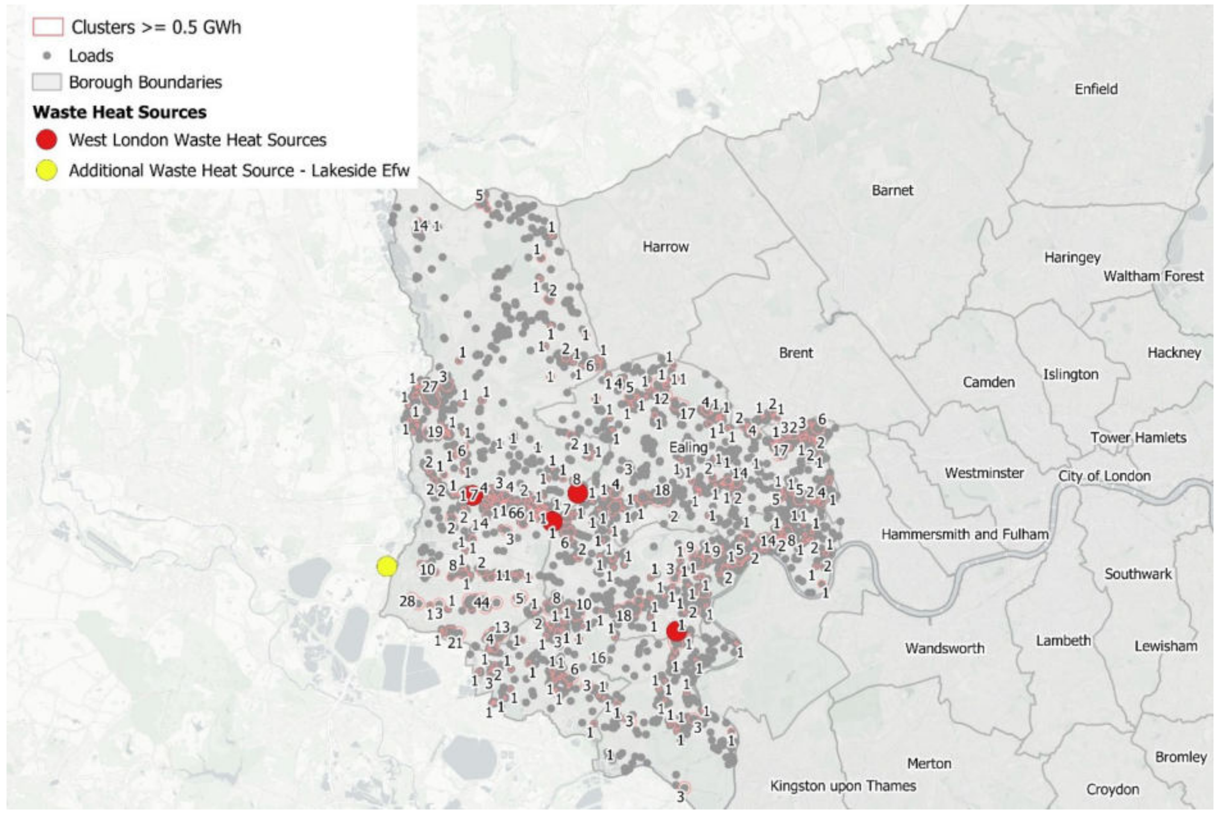


Figure 9-3 Potential Heat Loads in the West London Area with the Additional Heat Source

10 Strategic Area F: Crossness & South Bermondsey Strategic Area

10.1 Waste Heat Sources and Heat Loads

The Crossness & South Bermondsey Strategic Area is located in East London, and it is understood that there are four main waste heat sources which could provide waste heat to the LB of Bromley, Greenwich, Southwark and Lewisham. These four main heat sources are detailed below in Table 10—1 with their geographical locations shown in Figure 10-1.

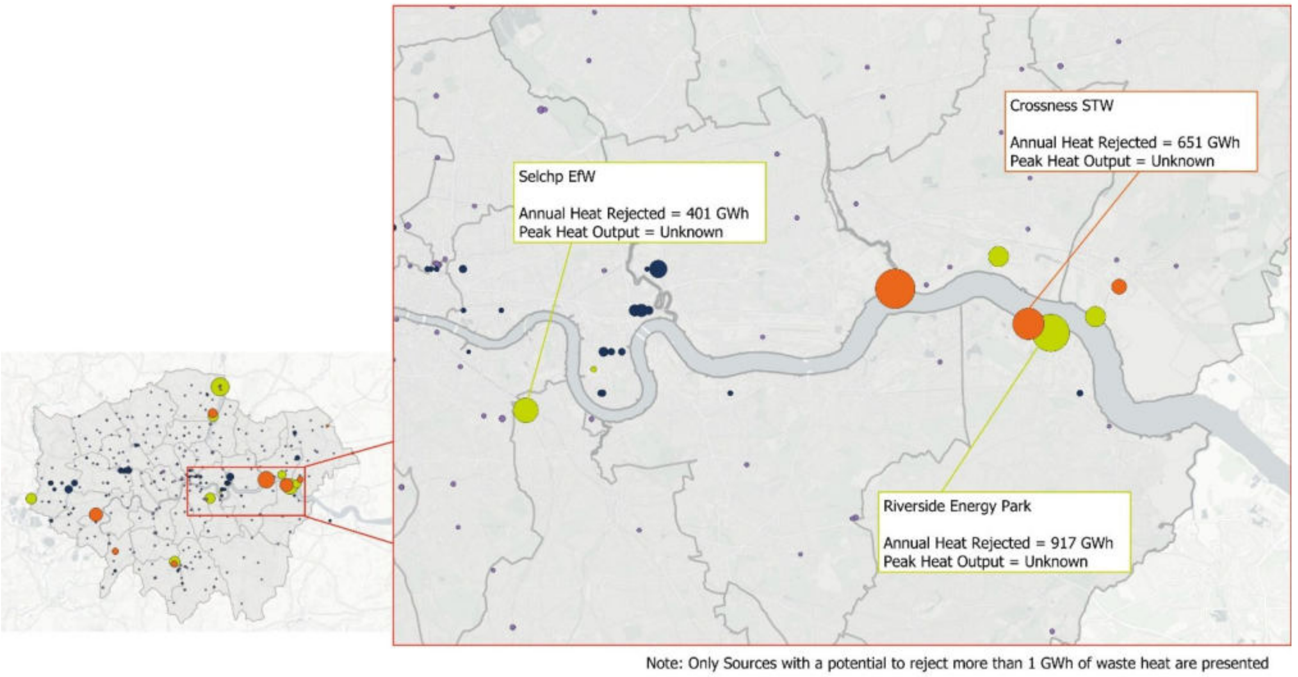


Figure 10-1 Waste Heat Sources in the Crossness & South Bermondsey Strategic Area

There is a lack of data availability for the peak heat output for the majority of these sources, however the annual heat rejected was taken from the London Heat map. Estimates of peak heat have been made for the EfW plants based on previous discussions with operators.

Table 10—1 Crossness & South Bermondsey Waste Heat Sources

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Riverside Energy Park	Energy Recovery Facility	918*	60
SELCHP EFW	Energy Recovery Facility	401	60
Crossness Sewage Treatment Works (STW)	Sewage Treatment Plant	652	78
Total		**1971**	**198**

* Annual heat rejected exceed what is possible from the understood peak output, therefore to be verified.

10.2 Potential Connections and Network

The clustering methodology, explained in 3.3, was utilised with the heat loads that fell within the Crossness & South Bermondsey area with clustering applied to the heat loads with a line density of 8 MWh/yr/m. Only clustered loads that were equal or greater to 0.5 GWh were carried forward for analysis. The clusters and heat loads used are shown in Figure 10-2**.**

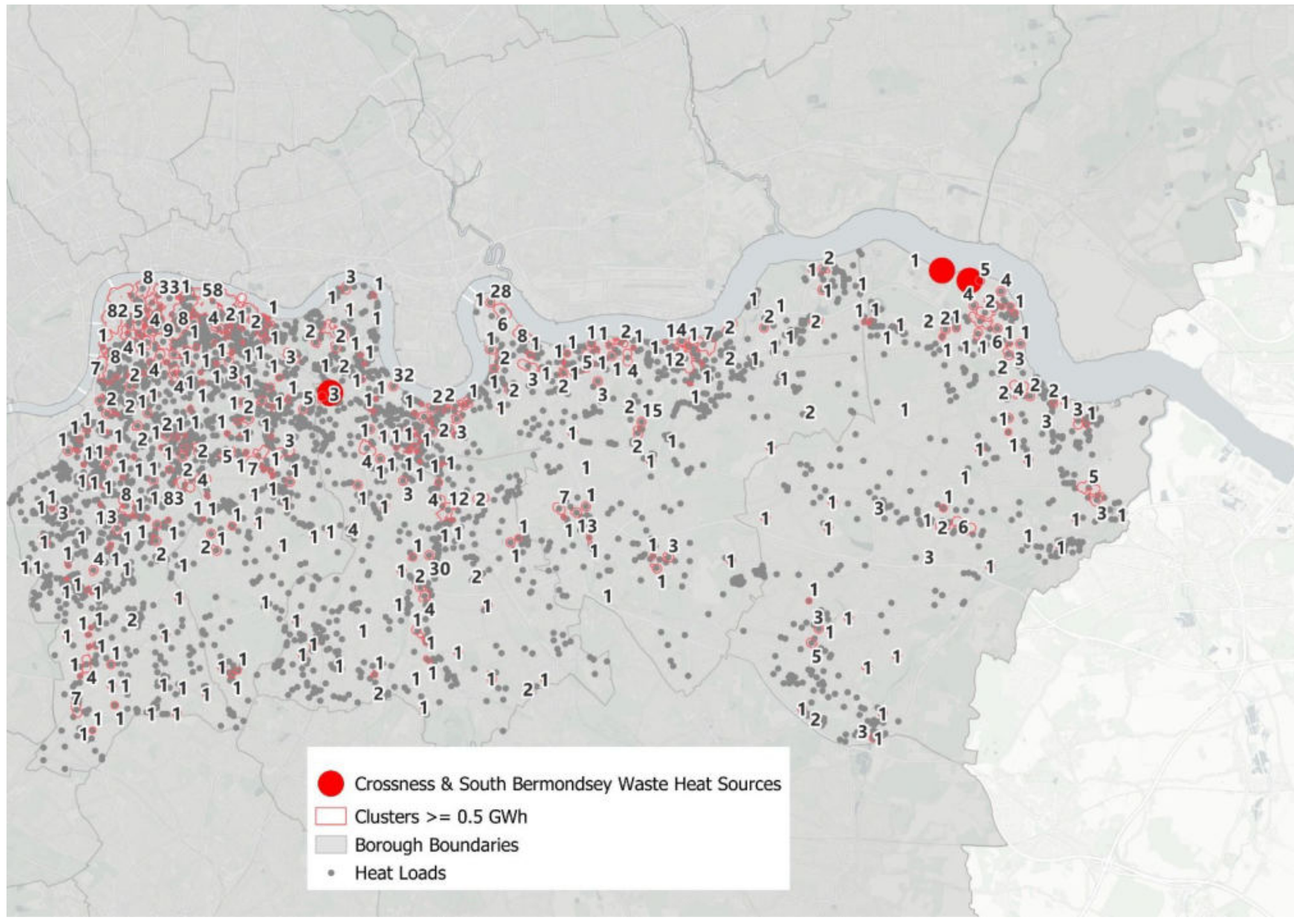


Figure 10-2 Crossness & South Bermondsey Area with potential Heat Loads and Clusters over 0.5 GWh

Modelling has been carried out to identify potential networks to interconnect these clusters with the final network built up of only pipework with a linear density of **8+ MWh/yr/m**. The resulting network is shown in Figure 10-3.

There is a significant number of proposed networks (identified from the London Heat Map and shown in purple), several of these are already planned to utilise two of the waste heat sources modelled in this strategic area. These sources are:

- **Cory Riverside Heat Network**, which utilises the Riverside Energy from Waste Facility. Vattenfall are currently partners with Cory to bring this heat to the area. A planned network extending into Greenwich has been identified.
- **SELCHP Future Heat Network** which will utilise the SELCHP heat from waste facility with ~7km of new piping. This is being brought forward by Southwark and Veolia. A planned network extending into the North Lewisham area is also planned.

These networks are on a local level but in combination with the two other waste heat sources in the area, the three waste sources could stretch to serve a wider area. This strategic area has been modelled to serve a wider region, and in combination with these heat networks have the potential to be a large sub-regional district heat network which also extends to the northern areas of Southwark and into Lambeth. The heat load of this potential network is **~943 GWh/yr** using less than 50% of the current waste heat estimates from the London Heat Map.

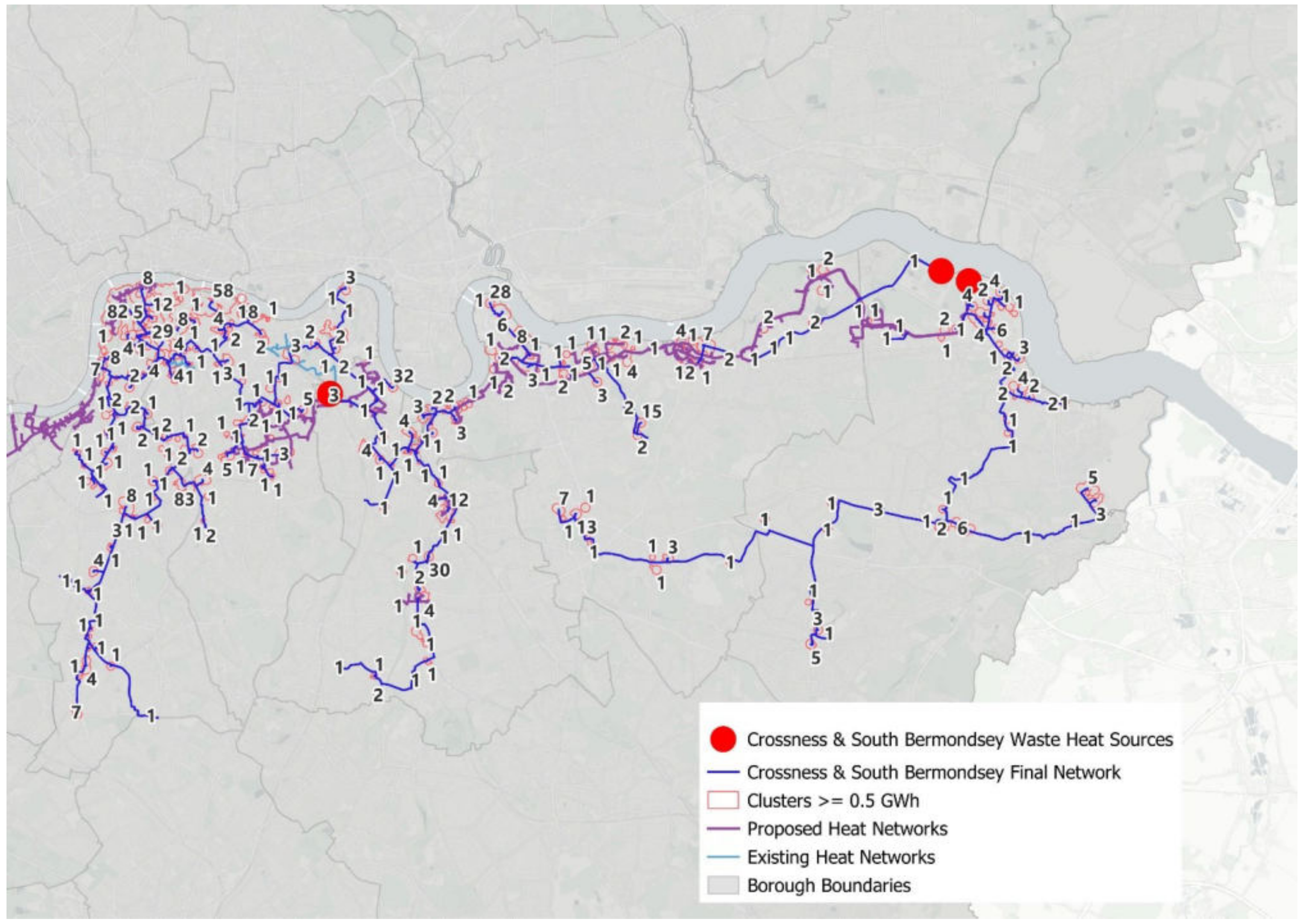


Figure 10-3 Final Network based off linear density and existing/proposed networks

A map showing existing heat networks in the area, the initial Steiner Tree outputs, explicit results of the linear heat density assessment, and alignment of the final network with the GLA's Potential DHN Project Areas can be found in Appendix F.

10.3 Connection Opportunities

The proposed network will be a multi-borough heat network that will reach all the main heat clusters. It will cover the London Boroughs of Bromley, Greenwich, Southwark and Lewisham. Looking at the 20 largest loads to be connected gives an understanding of the main stakeholders that will need to be involved in the potential network.

Table 10—2 indicates that all of them have linear densities of 8+ MWh/yr/m indicating that the pipelines connecting these have a greater opportunity for inclusion in an overall network. Figure 10-4 shows the geographical location of the Top 20 loads in the Crossness & South Bermondsey Area.

Table 10—2 20 Largest Heat Loads in the Potential Crossness & South Bermondsey Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included in Network
1	Kings College Hospital	Lambeth	Hospital	77400	38400	8+	Included
2	Convoys Wharf	Lewisham	Mixed-Use Development	32400	16100	8+	Included
3	University Hospital, Lewisham	Lewisham	Hospital	29600	14700	8+	Included
4	The O2	Greenwich	Entertainment Venue	26700	13300	8+	Included
5	Shell Centre	Lambeth	Office Building	24600	12200	Proposed Network	Included
6	Millwall Football Club	Lewisham	Sports Stadium	24200	12000	8+	Included
7	Queen Elizabeth Hospital	Greenwich	Hospital	14500	7200	8+	Included
8	Harmsworth Quays	Southwark	Office and Commercial Complex	10100	5000	Proposed Network	Included
9	Southbank Centre	Lambeth	Cultural Centre	9300	4600	Proposed Network	Included
10	Palestra House (TFL, Arriva Rail Offices)	Southwark	Office Building	8900	4500	8+	Included
11	Kidbrooke Village	Greenwich	Residential Development	7900	3900	8+	Included
12	Guy's Hospital	Southwark	Hospital	7900	3900	8+	Included
13	London Bridge Hospital	Southwark	Hospital	7100	3600	8+	Included
14	Metropolitan Police Forensic Science Laboratory	Lambeth	Police Facility	6900	3500	8+	Included
15	St. Thomas' Hospital	Lambeth	Hospital	6800	3400	Proposed Network	Included
16	Ocado Customer Fulfilment Centre	Bexley	Distribution Centre	6400	3200	8+	Included
17	Phase 6 Kidbrooke Village	Greenwich	Residential Development	5900	2900	8+	Included
18	Waterloo Station	Lambeth	Transportation Hub	5700	2900	8+	Included
19	Tate Modern	Southwark	Cultural Centre	5100	2600	8+	Included
20	Streatham Ice & Leisure Centre	Lambeth	Leisure Centre	4700	2400	8+	Included

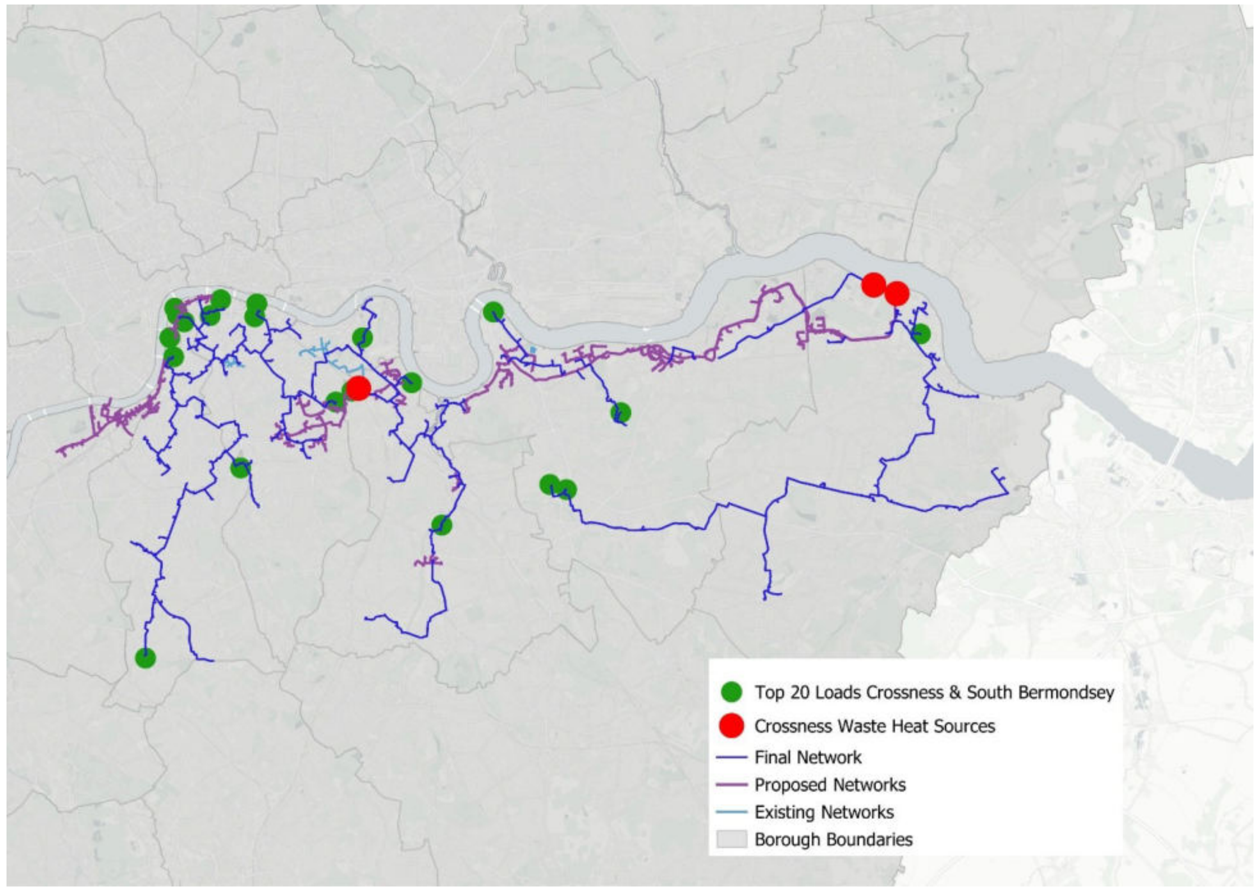


Figure 10-4 Final Network with Top Loads

10.3.1 High Social Housing Areas and NHS Trust Sites

Figure 10-5 shows the LSOA areas where there are high densities of social housing. The darkest areas indicate the densest areas of social housing (rented from local authority or other) in each LLSO Area (LSOA) across the Crossness & South Bermondsey Strategic Area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the heat network to these areas could support the decarbonisation of social housing as well as the major non-domestic loads in the area that were identified within the Top 20 loads. This figure indicates that there are also several NHS Trust sites located close to the proposed heat network route and this shows the potential for the heat network to support the NHS in decarbonising these sites

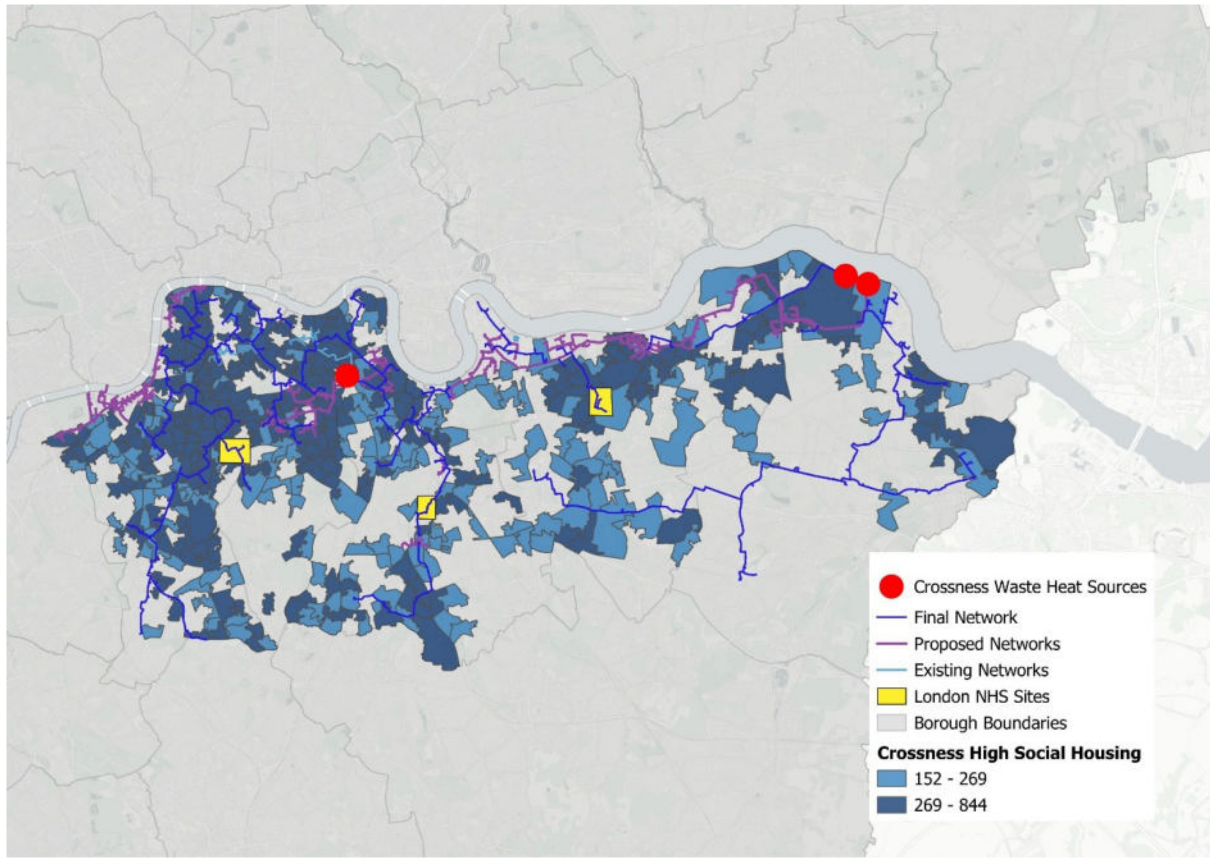


Figure 10-5 Areas of high LSOA Social Housing Density and NHS Trust Site Locations

10.4 Potential Scale of Investment

The amount of pipework required for this network is ~**119 km**. There are 3 heat sources used in this strategic area that are high grade heat source the associated cost estimate is based off the recovered heat costs whereas the fourth heat source is low grade and costed based off the water source heat pump costs. Table 10—3 shows the estimated costs which total circa **£676m**.

Table 10—3 CAPEX

	Unit	Unit Cost	Total Cost
Pipework and Civils	119 km	3,000 £/m	357 m
Recovered Heat	120 MW	£0.75m/MW	90 m
Water Source Heat Pump	78 MW	£1m/MW	78 m
Plant and Energy Centre	119 km	£1m/km	119 m
		Total	**£644m**

10.5 Carbon Results

Carbon reduction realised by connecting to proposed clusters to the final network for Crossness & South Bermondsey, calculated as set out in the methodology (3.7), are presented in Table 10—4 below. These carbon results are over a 40 year lifetime.

Table 10—4 Carbon Results Summary

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
10,507,239	20,3000	10,304,000	98%

10.6 Key Next Steps

London Boroughs: Bromley, Greenwich, Lewisham and Southwark.

- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area heat network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.
- Establish whether networks which are planned to be installed soon have sufficient capacity to future proof for the wider strategic growth of the network.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.
- Engage with Veolia and Cory/Vattenfall to communicate the potential, understand their current planned expansions and heat availability and discuss ways to move a network forward.

Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.
- A feasibility study focussing on serving the areas North East of SELCHP would be recommended as expansion beyond Old Kent Road has not been investigated to our understanding.

11 Strategic Area G: Old Oak and Park Royal Development (OPDC) Strategic Area

11.1 Waste Heat Sources and Heat Loads

The Old Oak and Park Royal Development (OPDC) Strategic Area is located in West London, in the London Boroughs of Brent, Ealing and Hammersmith & Fulham. There is a significant number of waste heat sources in the form of data centres that could provide heat to these boroughs and beyond. Phase 1 of a local network utilising several of these data centres for heat is currently out for procurement of a delivery partner for the first phase – this study looks at a theoretical wider growth in this area.

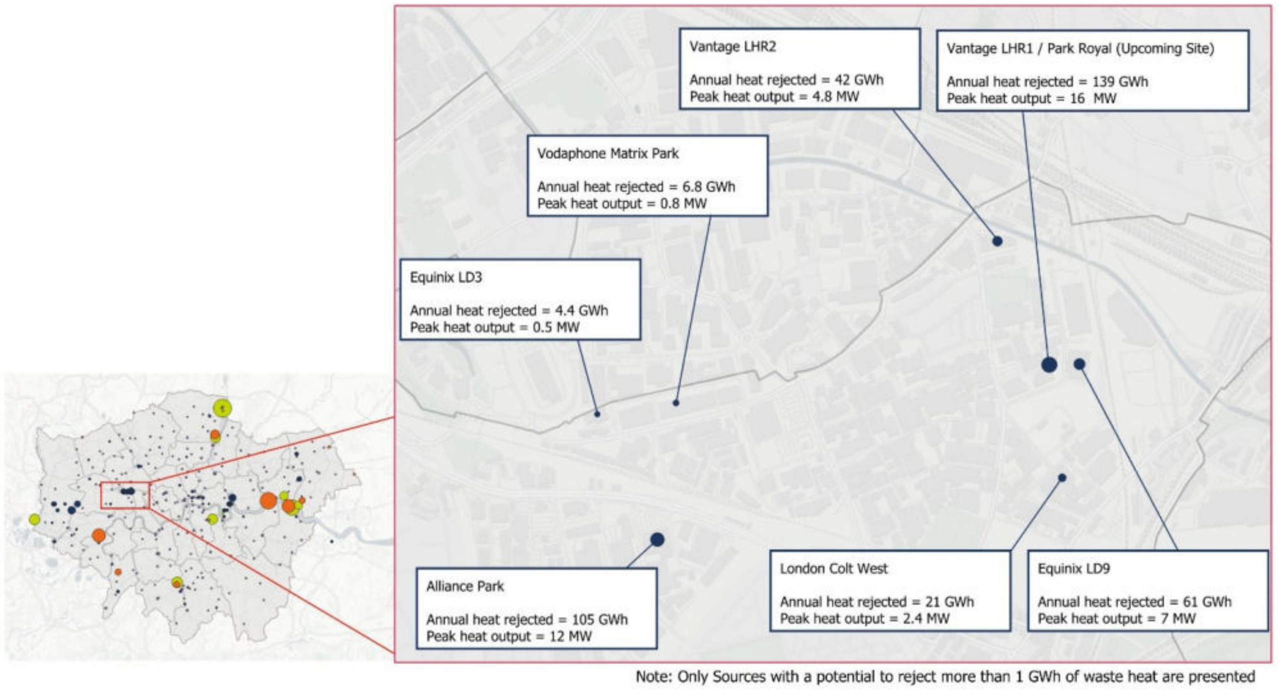


Figure 11-1 Waste heat sources in the OPDC Strategic Area

Several sources were used to estimate the annual heat availability and peak heat output from the data centres. The data presented in Table 11—1 should be further verified. OPDC are already developing a heat network in this area and the heat sources, estimated heat availability and any additional heat sources in the area will need verifying as part of any future work to understand the full expansion opportunity to neighbouring boroughs, including to extend further to the south of this strategic area into the boroughs of Hammersmith & Fulham, Kensington & Chelsea and Westminster.

Table 11—1 OPDC Main Heat Sources

Heat Source	Type	Annual Heat Rejected (GWh/yr)	Peak Heat Output (MW)
Equinix LD3	Data Centre	4.4	0.5
Equinix LD9	Data Centre	61	7
Vantage LHR2	Data Centre	42	4.8
Vantage LHR1 / Park Royal (Upcoming Site)	Data Centre	139	16
Alliance Park	Data Centre	105	12
London Colt West	Data Centre	21	2.4
Vodaphone Matrix Park	Data Centre	6.8	0.8
	Total	**379.2**	**43.5**

11.2 Potential Connections and Network

A longlist of heat loads has been identified which have been shortlisted into clusters of heat load equal or greater than 0.5GWh. These clusters have been incorporated into the analysis ensuring that the total is less than the annual heat rejected from the chosen heat sources for the strategic area. The clusters and heat loads used, and their geographic location are shown in Figure 11-2.

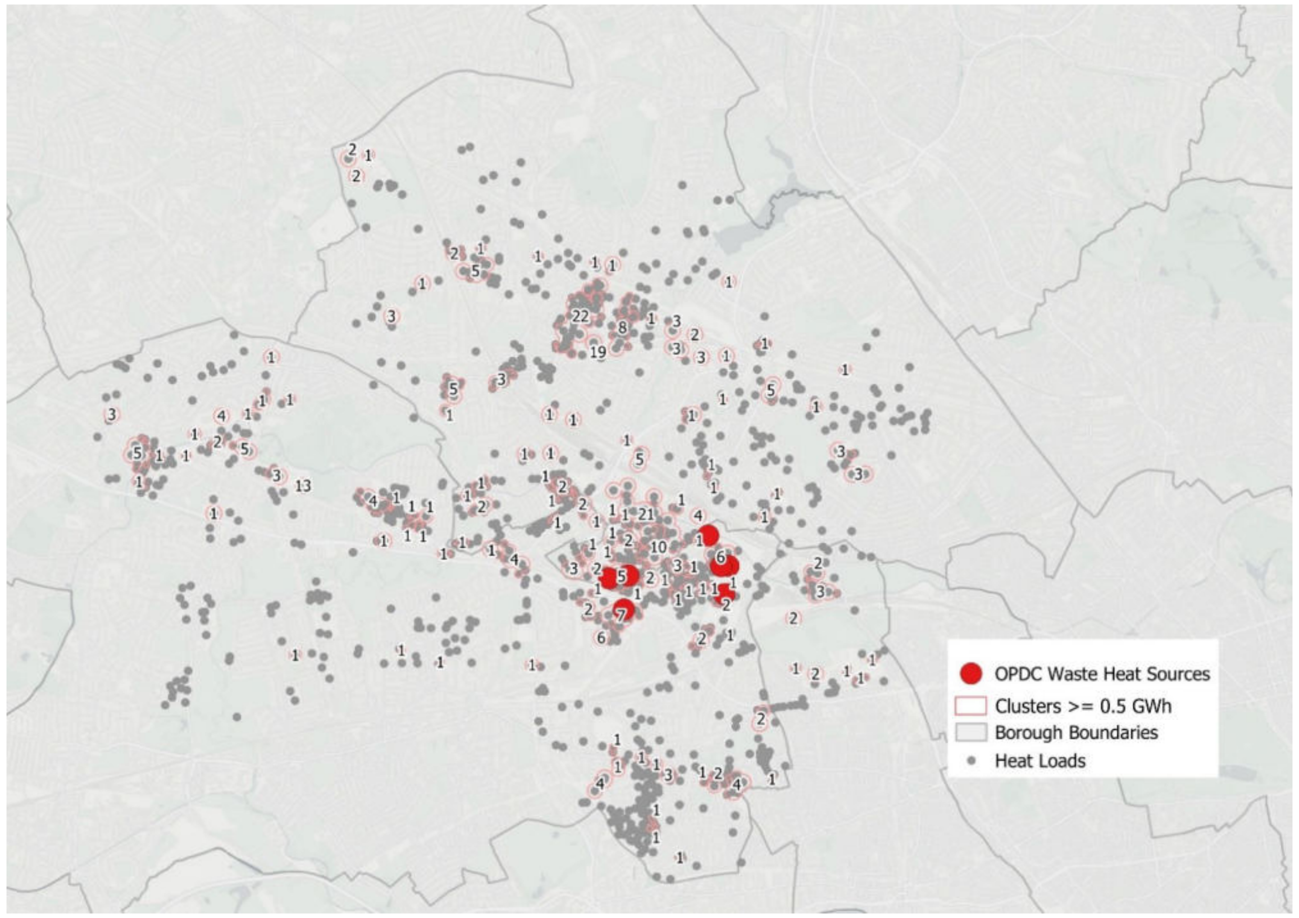


Figure 11-2 OPDC Area with potential Heat Loads and Clusters over 1 GWh

The shortest route to connect clusters and heat sources has been identified using the Steiner tree methodology. The final network identified prioritises only pipework with a linear density of **8+ MWh/yr/m**. Where there was any existing or proposed heat networks in the immediate area, these were manually combined with the resulting network from the processing tool.

The final output showing the network between connected clusters and waste heat sources, as well as existing and proposed networks is presented in Figure 11-3. The network has the potential to cover areas of London Boroughs of Ealing, Brent and Hammersmith & Fulham – potentially linking with other strategic waste heat networks identified in this study. The heat load of this potential network is **~ 276 GWh/yr.** This does not utilise the estimated full potential of the waste heat in the area and therefore may have potential to extend further into Hammersmith & Fulham, Kensington & Chelsea and Westminster.

A map showing existing heat networks in the area, the initial Steiner Tree outputs, explicit results of the linear heat density assessment, and alignment of the final network with the GLA's Potential DHN Project Areas can be found in Appendix G.

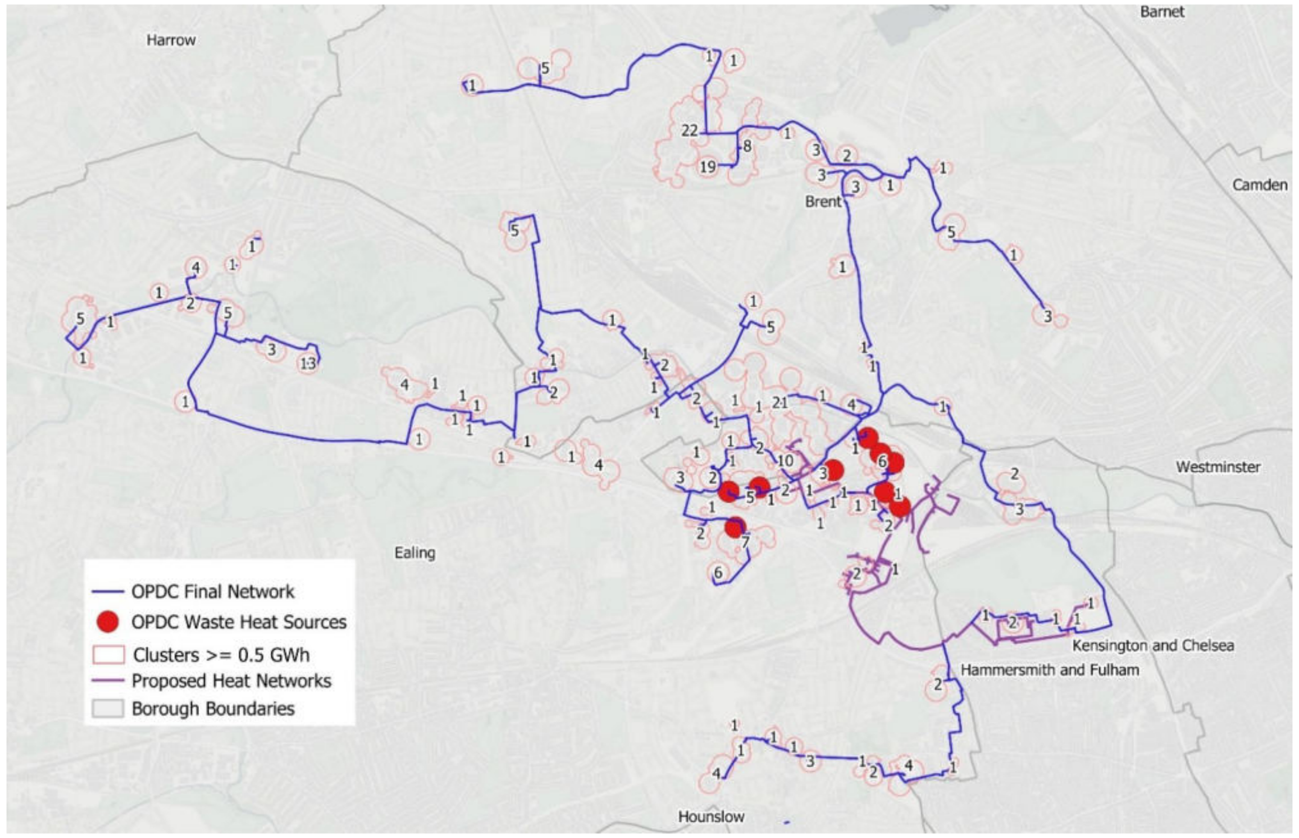


Figure 11-3 Final Network based off linear density and existing/proposed networks

11.3 Connection Opportunities

The proposed network will be a multi-borough heat network that will reach all the main heat clusters. It will cover the London Boroughs of Brent, Ealing and Hammersmith & Fulham. Looking at the 20 largest loads to be connected gives an understanding of the main stakeholders that will need to be involved in the potential network. Table 11—2 shows that 17 of the 20 have linear densities of 8+ MWh/yr/m indicating that the pipelines connecting these have greater opportunity for inclusion in an overall network. Figure 11-4 shows the geographical location of the Top 20 loads across the OPDC area.

Table 11—2 Top 20 Largest Heat Loads in the Potential Beddington Network

	High Demand Load	Borough	Typology	Heat Demand (MWh/yr)	Peak Demand (kW)	Pipe Linear Density	Included in Network
1	Titan Studios	Brent	Film Studio	18700	9300	8+	Included
2	London North West Depot (Parcelforce, Royal Mail)	Ealing	Distribution Centre	13000	6500	8+	Included
3	Royal Mail Greenford Mail Centre	Brent	Mail Sorting Centre	8800	4400	8+	Included
4	Northolt Leisure Centre	Ealing	Leisure Centre	6200	3100	2-4	Not Included
5	Wilesden Magistrates' Court	Brent	Courthouse	3800	1900	8+	Included
6	Vale Farm Sports Centre	Ealing	Sports Centre	3700	1900	2-4	Not Included
7	Brent Civic Centre & Wembley Library	Brent	Civic Centre/Library	3600	1800	8+	Included
8	Wembley Police Station	Ealing	Police Station	3300	1600	8+	Included
9	Princess Royal Distribution Centre	Brent	Distribution Centre	3000	1500	8+	Included
10	HMP Wormwood Scrubs	Brent	Prison	2900	1500	8+	Included
11	Hitachi Depot	Brent	Depot	2900	1400	2-4	Not Included
12	Wincaton	Brent	Distribution Centre	2900	1400	8+	Included
13	Sainsburys Greenford Distribution Centre	Brent	Distribution Centre	2700	1400	8+	Included
14	IKEA	Brent	Retail Store	2700	1400	8+	Included
15	Amazon	Ealing	E-commerce Warehouse	2700	1300	8+	Included
16	Premier Park (GXO Logistics)	Brent	Logistics Park	2600	1300	8+	Included
17	Central Middlesex Hospital	Brent	Hospital	2500	1300	8+	Included
18	Wembley Stadium	Hammersmith and Fulham	Stadium	2500	1200	8+	Included
19	Premier Park (Bestway, Map Trading)	Ealing	Logistics Park	2400	1200	8+	Included
20	McVities	Hammersmith and Fulham	Manufacturing Plant	2300	1200	8+	Included

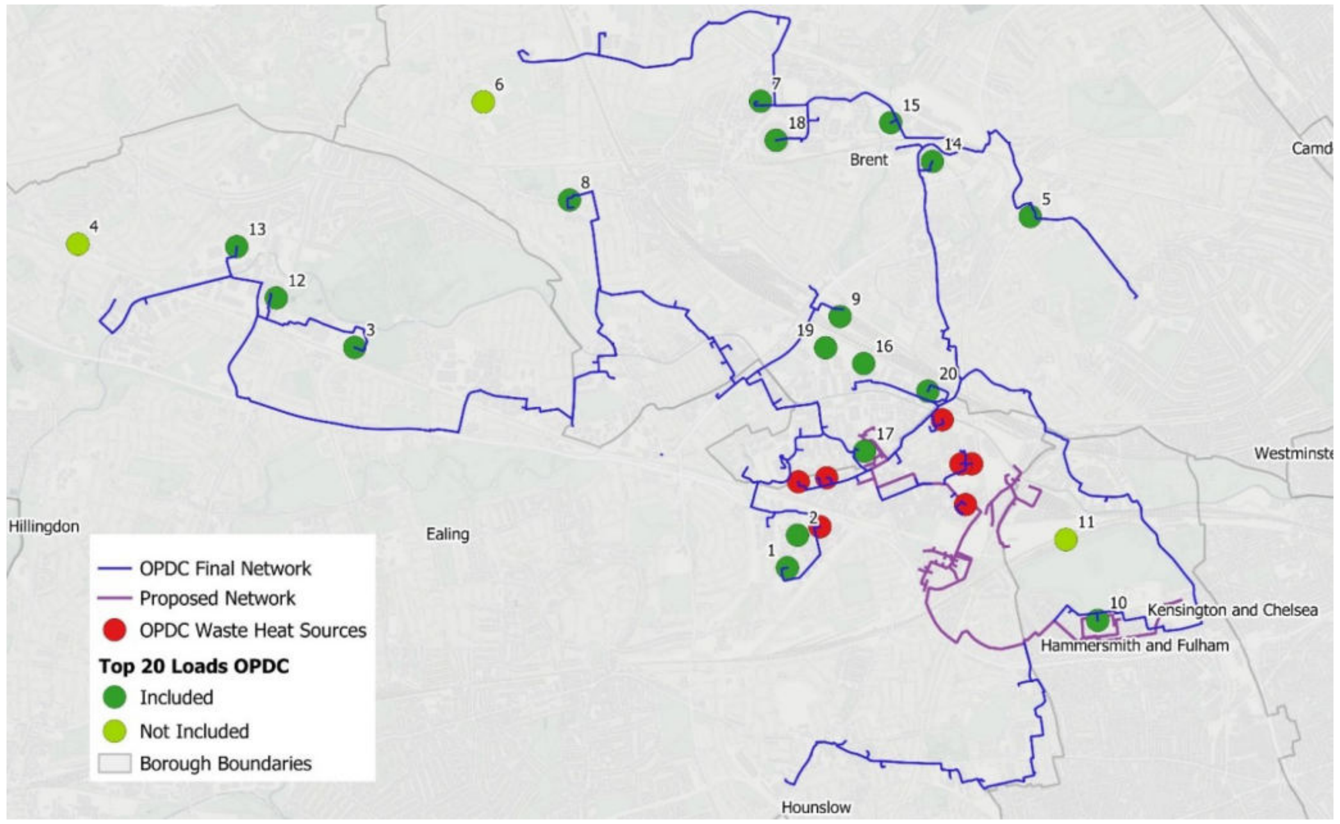


Figure 11-4 Final Network with Top Loads

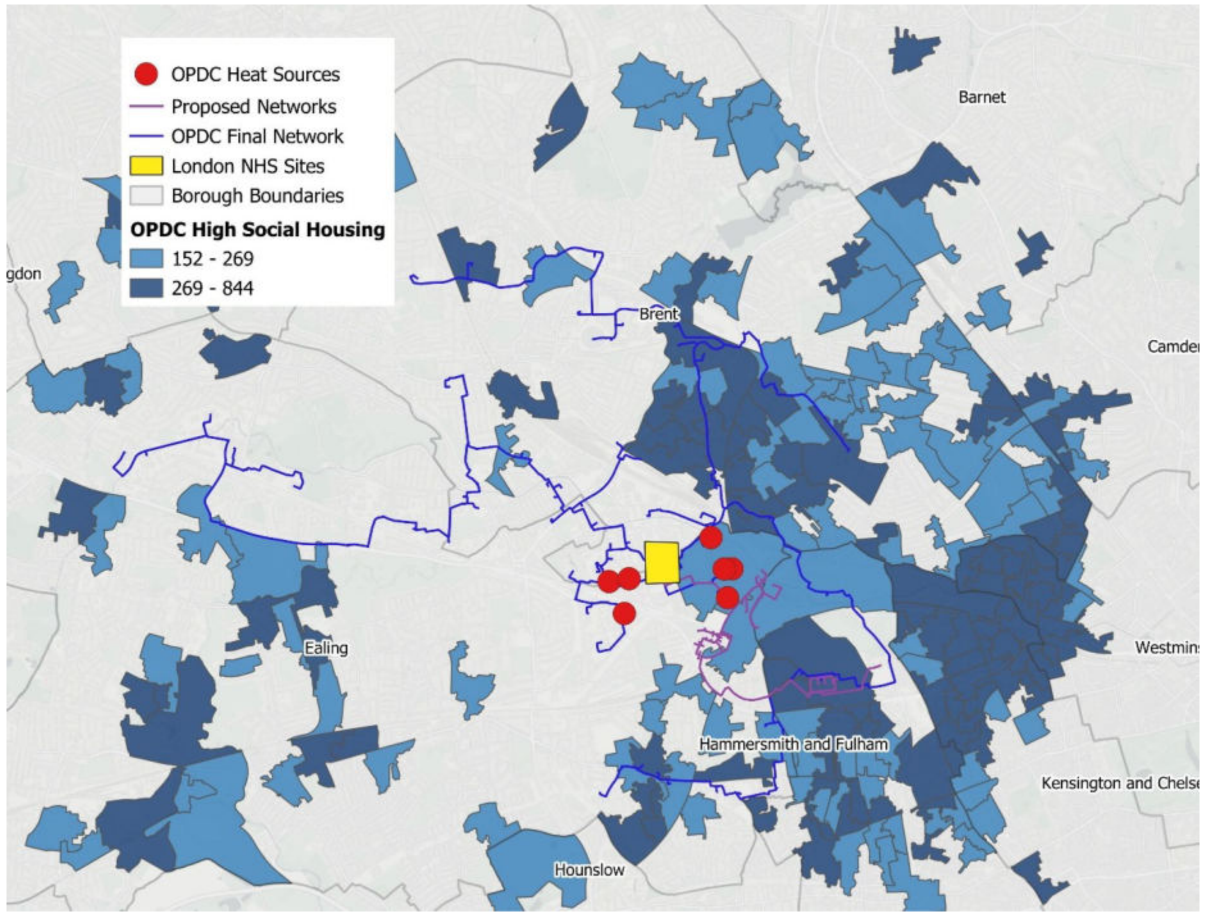


Figure 11-5 Areas of High LSOA Social Housing Density and NHS Trust Site Locations

11.3.1 High Social Housing Areas and NHS Trust Sites

Figure 11-5 shows the LSOA areas where there are high densities of social housing. The darkest areas indicate the densest areas of social housing (rented from local authority or other) in each LSOA across the OPDC area. This data is from the 2021 ward and LSOA estimates (London Datastore).

This shows a general correlation with the proposed network routing which indicates that building out the heat network into these areas support the decarbonisation of social housing as well as the major non-domestic loads identified within the Top 20 loads. This figure indicates that there are also several NHS Trust sites located close to the proposed heat network route and this shows the potential for the heat network to support the NHS decarbonising these sites.

11.4 Potential Scale of Investment

Overall this network gives a total pipework of required of **~48km.** Depending on the type of waste heat, the costs associated depend on whether they are high or low grade heat. In the OPDC area, only data centres have been used as waste heat sources, which are all classified as low grade heat and costed as water-source heat pumps. The total capex is estimated at **£236m**.

Table 11—3 CAPEX

	Unit	Unit Cost	Total Cost
Pipework and Civils	48 km	3,000 £/m	£144m
Water Source Heat Pump	43.5 MW	£1m/MW	£43.5m
Plant and Energy Centre	48 km	£1m/km	£48m
		Total	**£236m**

11.5 Carbon Results

Carbon reduction realised by connecting to proposed clusters to the final network for OPDC area, calculated as set out in the methodology (3.7), are presented in Table 11—4. These carbon results are over a 40 year lifetime.

Table 11—4 Carbon Results Methodology

Counterfactual carbon emissions (tCO2)	Proposed solution carbon emissions (tCO2)	Carbon emissions reduction (tCO2)	Percentage reduction
3,075,000	78,000	2,997,000	97%

11.6 Key Next Steps

London Boroughs: Brent, Ealing and Hammersmith & Fulham

- Communicate the opportunity to relevant boroughs that could benefit from this Strategic Area heat network to establish their interest for developing a partnership and undertaking a more detailed feasibility study, as well as understanding any other local elements that can contribute to network opportunities.

Major Heat Loads/connections:

- Using local knowledge verify the major heat loads listed, add additional information and contacts and update with any other major heat loads.

Waste Heat Sources:

- Using local knowledge verify the major heat sources listed, add additional information and contacts and update with any other known major heat loads.

Further development work and partnership building:

- Where interest exists develop the partnership between interested London Boroughs and spec out a more detailed feasibility study develop the project proposal and engage with major heat loads and the important heat sources.

12 Conclusion

This study was commissioned to assess and visualise the opportunity that the diverse range of large-scale waste heat sources provide for developing strategic multi-borough low carbon heat networks that can contribute to decarbonising London's heat supply and support our pursuit of Net Zero. The value of strategic multi-borough district heat networks is that they benefit from the economies of scale that make heat networks such a viable and competitive infrastructure for not only supplying affordable, low carbon heat to homes and businesses but also providing flexibility, balancing and accelerated decarbonisation of the electricity network.

This work wasn't instigated by emerging Heat Network Regulation and Zoning but it certainly will provide intelligence and insight into the opportunities that exist for multi-borough district heat networks in London and support and inform our work around heat network zoning. This work will also feed into the sub-regional LAEPs providing intelligence around the opportunity for developing heat networks to support the decarbonisation of heat and instigate discussions between relevant London Boroughs both within and between sub-regional LAEPs.

This study analysed seven Strategic Areas, all served by significant volumes of waste heat and the potential that provides for the development of strategic multi-borough district heat networks to supply existing and new heat demands. It concludes that there is a significant quantity of waste heat available from a relatively few large waste heat sources across London and they provide a good opportunity to develop out a number of strategic multi-borough district heat networks.

Currently, there are very few examples in London of existing or planned multi-borough district heat networks. Stakeholder engagement with relevant boroughs thinking about these type of heat networks highlighted that there are a number of challenges to the development of such networks, this includes areas such as network ownership, operational structure, and heat sales pricing.

To overcome the technical, political, and financial challenges that are highlighted above requires a partnership approach to be developed for developing multi-borough district heat networks that tackle these issues and create solutions that are acceptable to all the parties.

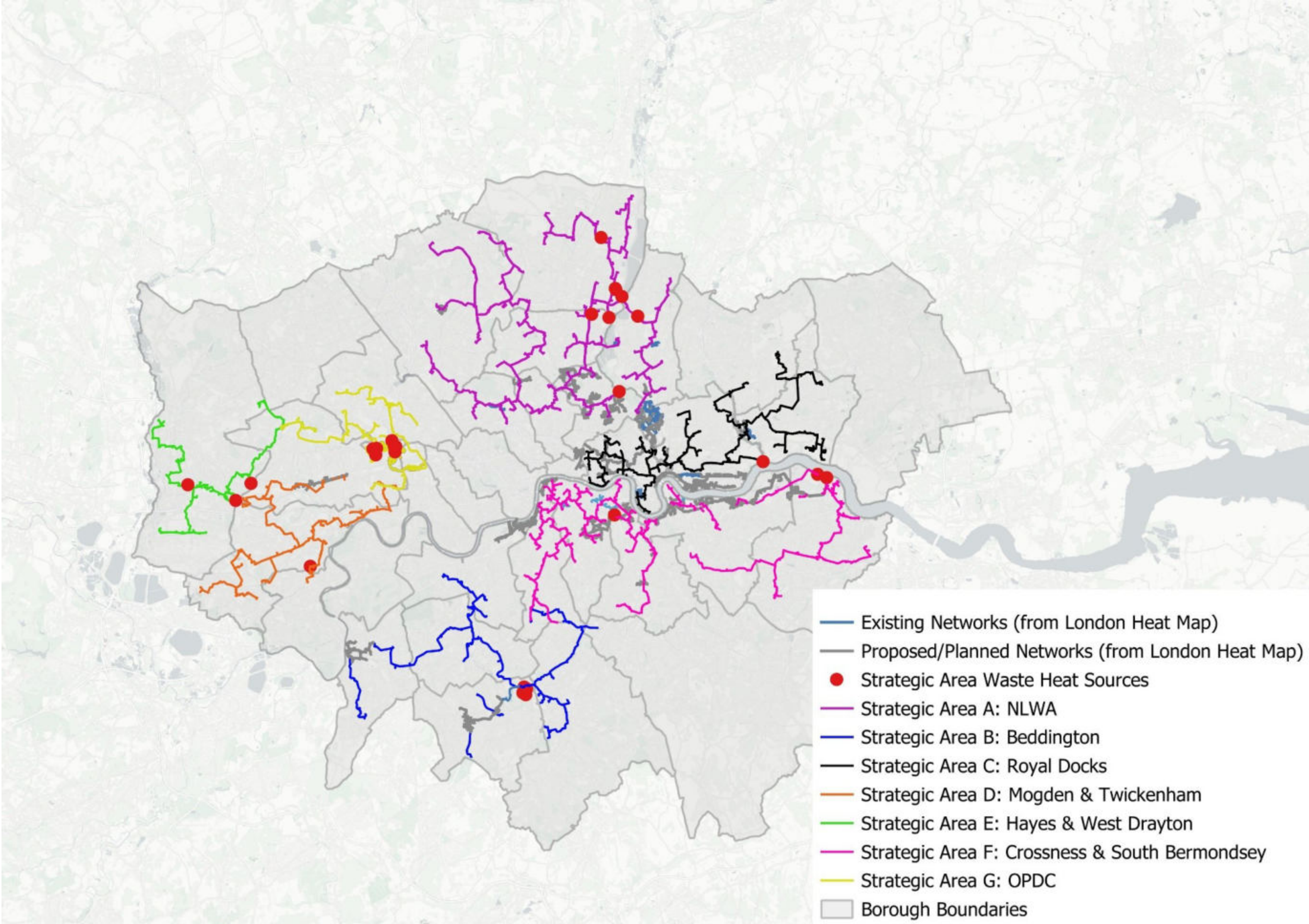


Figure 12-1 Map showing all Strategic Area Networks

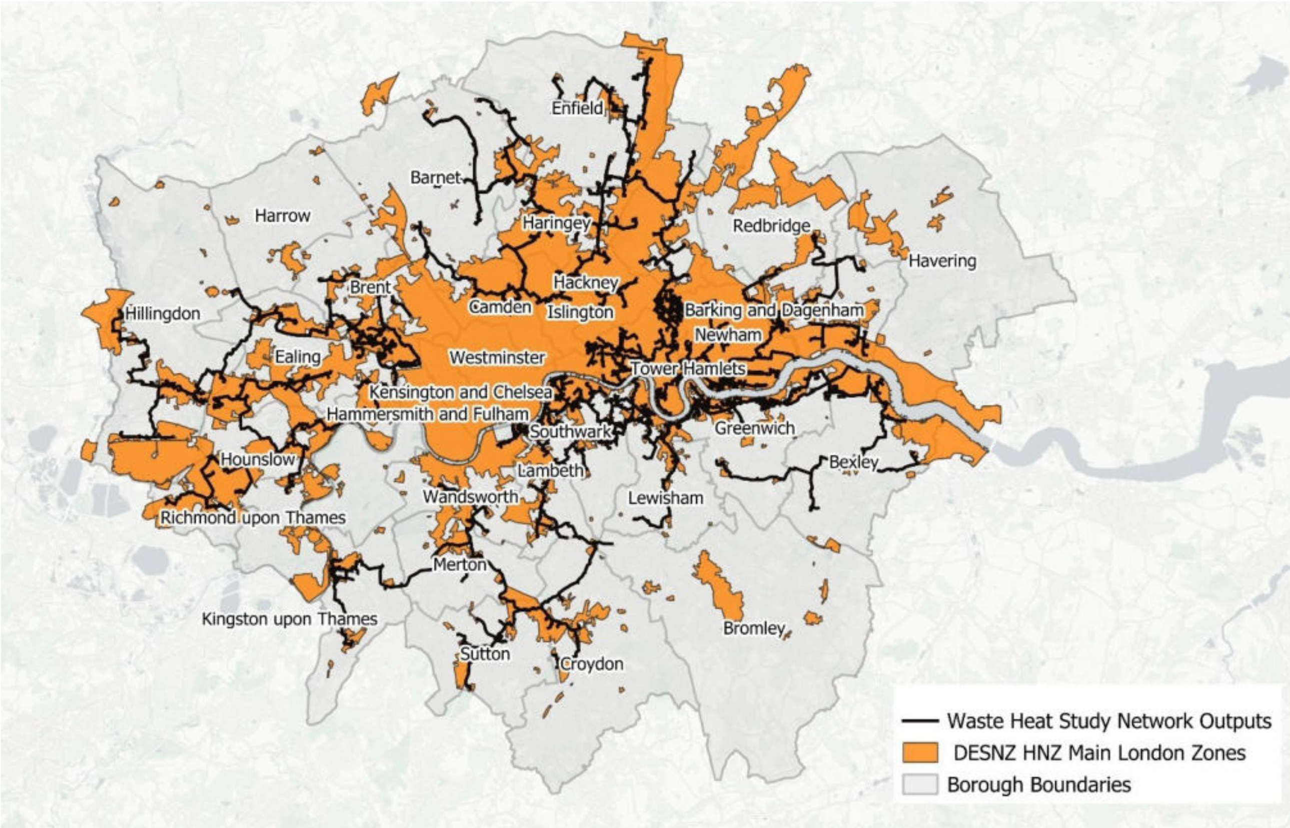
This is a significant departure from the current development model which is largely happening at an individual borough level and led, in most cases, by the relevant London Borough. This is often constraining the ambition and size of London's district heat networks and with the introduction of heat network zoning in 2025, there is real opportunity for London Government – the GLA, London Councils and London Boroughs - to coordinate and develop these strategic opportunities.

Data used in the analysis of these seven Strategic Areas is based on estimates from a variety of sources which are published in the London Heat Map – further validation of this data is recommended as the level of project detail is developed, for example through the sub-regional LAEP process. More detailed techno-economic modelling was only carried out on the NLWA Strategic Area, as that was funded by DESNZ through the North London Heat Network Study, and therefore additional detailed techno-economic modelling work will be needed to help understand and demonstrate the viability of these potential multi-borough district heat networks.

As set out in the 'Key Next Steps' at the end of each Strategic Area section of this report it is suggested that the initial next steps should be the integration of this study into the sub-regional LAEP process and then the resulting engagement of the relevant London Boroughs in each of the Strategic Areas and their respective sub-regional LAEPs. The initial purpose being to present the findings and the opportunity and discuss the level of interest in supporting a multi-borough district heat network and then, if there is interest, how best to develop the opportunity.

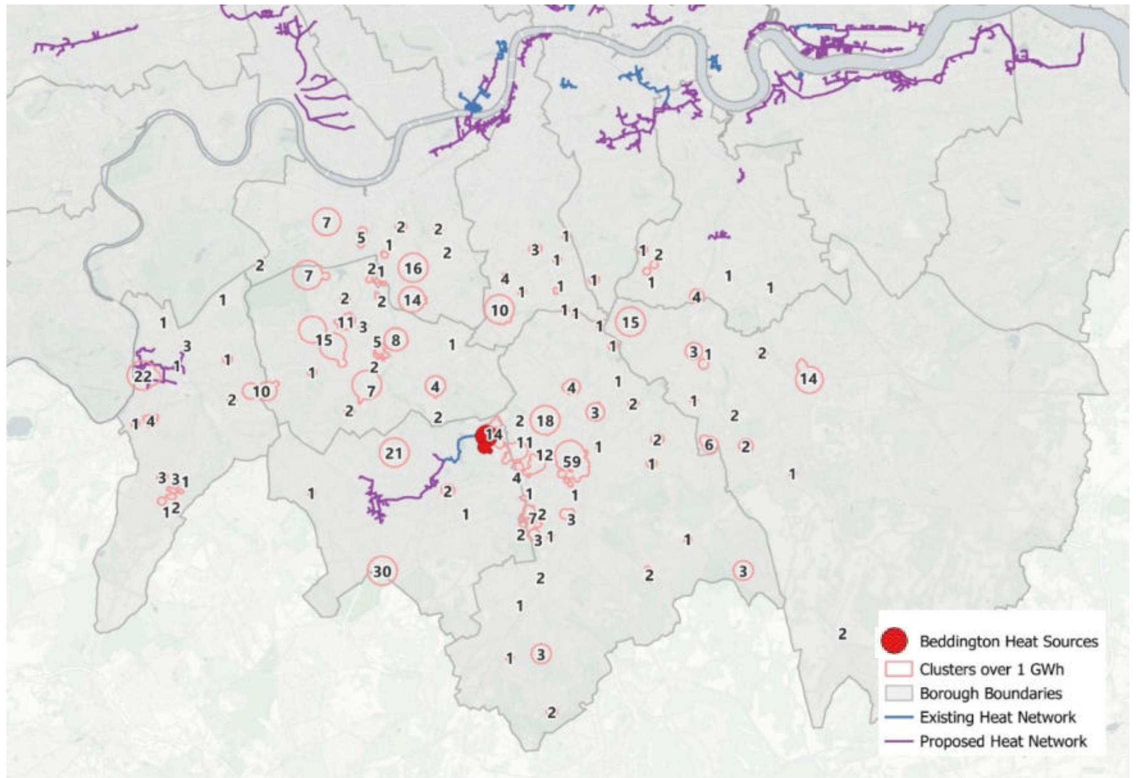
Appendix A National Zoning Model Comparison

A comparison between Heat Network Zones from the first run of the National Zoning Model shows good alignment when compared to the strategic area networks proposed in this study. In most areas, the strategic networks serve clusters that are within Heat Network Zones, with limited scenarios where this is not the case and this is an example of how our local knowledge and heat studies will play an important role in the local zone refinement process which will then lead to zone designation. The fact that the Heat Network Zones and these strategic heat networks show such good alignment having been drawn-up using different methodologies suggests a good level of confidence that the strategic heat network opportunities identified make good use of the waste heat resource across London. It should be noted that subsequent versions of the National Zoning Model have been run as the model has been evolved, however these are currently not publicly available for comparison.

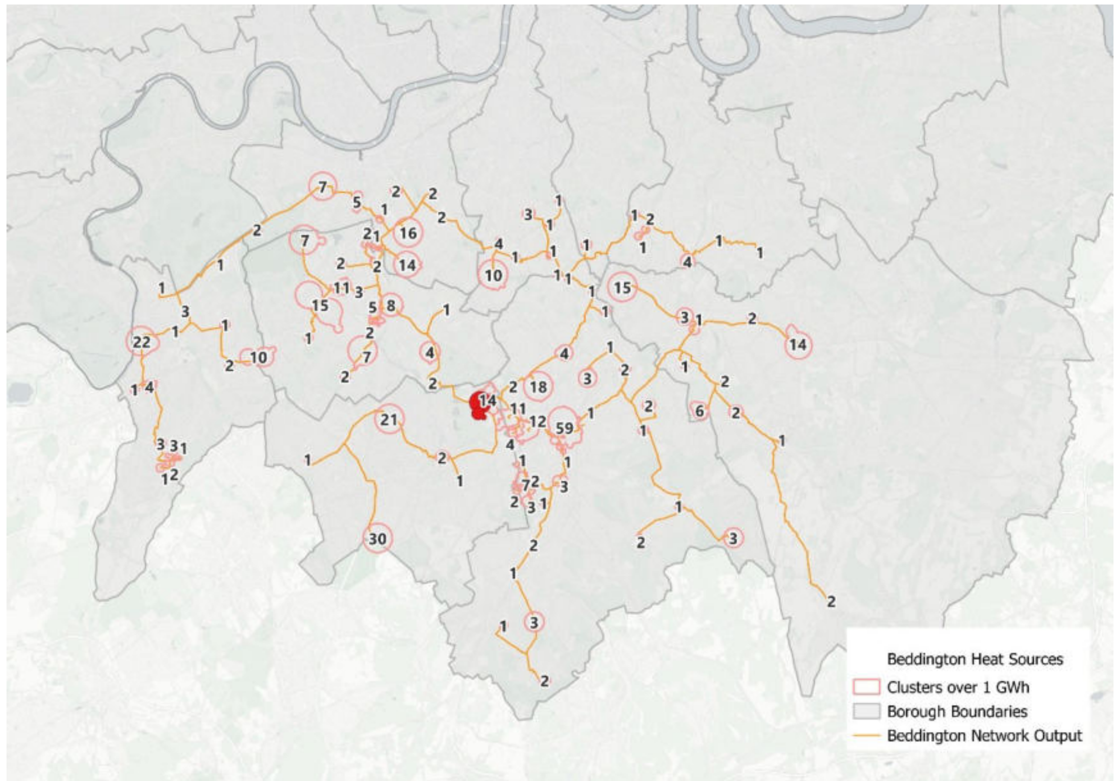


Appendix B Strategic Area B: Beddington

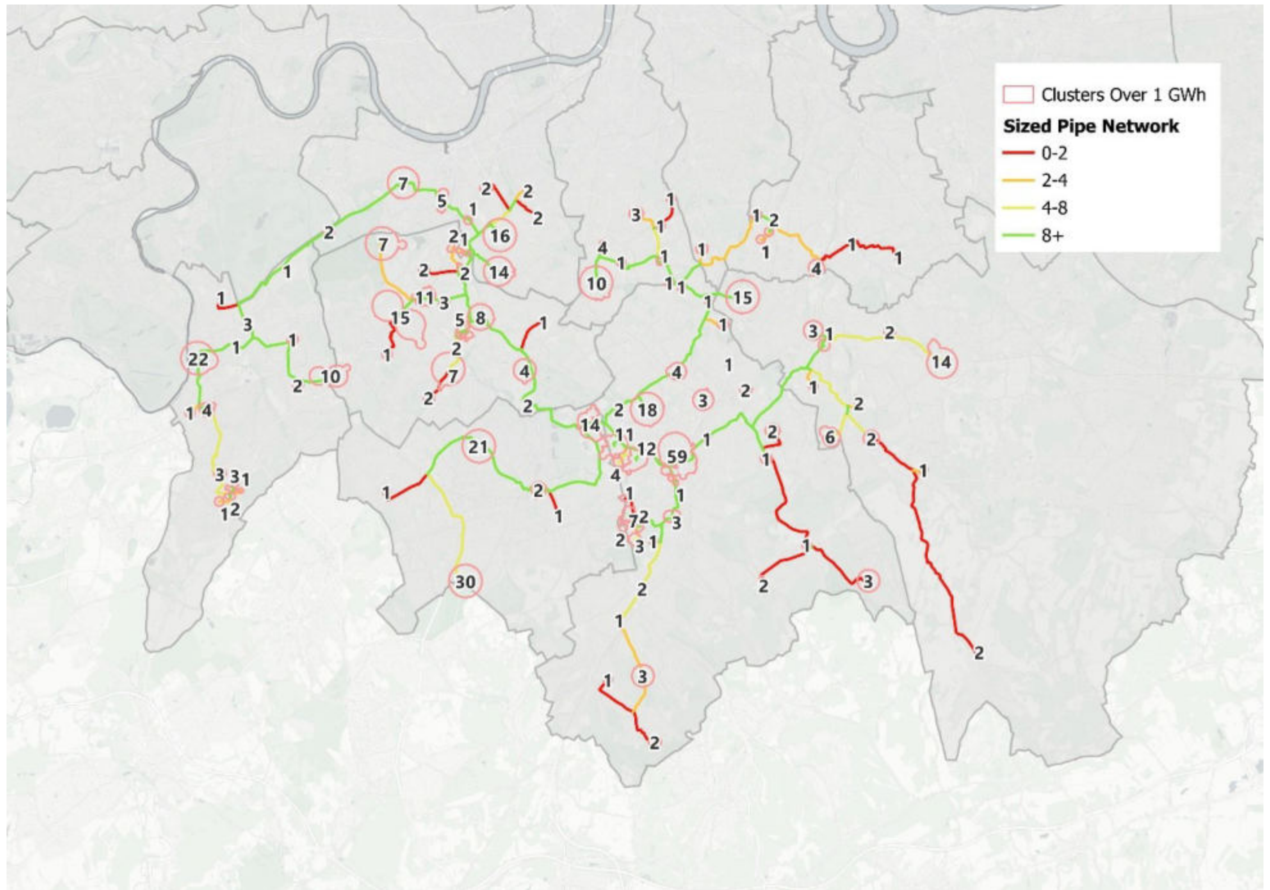
B.1 Existing and proposed networks



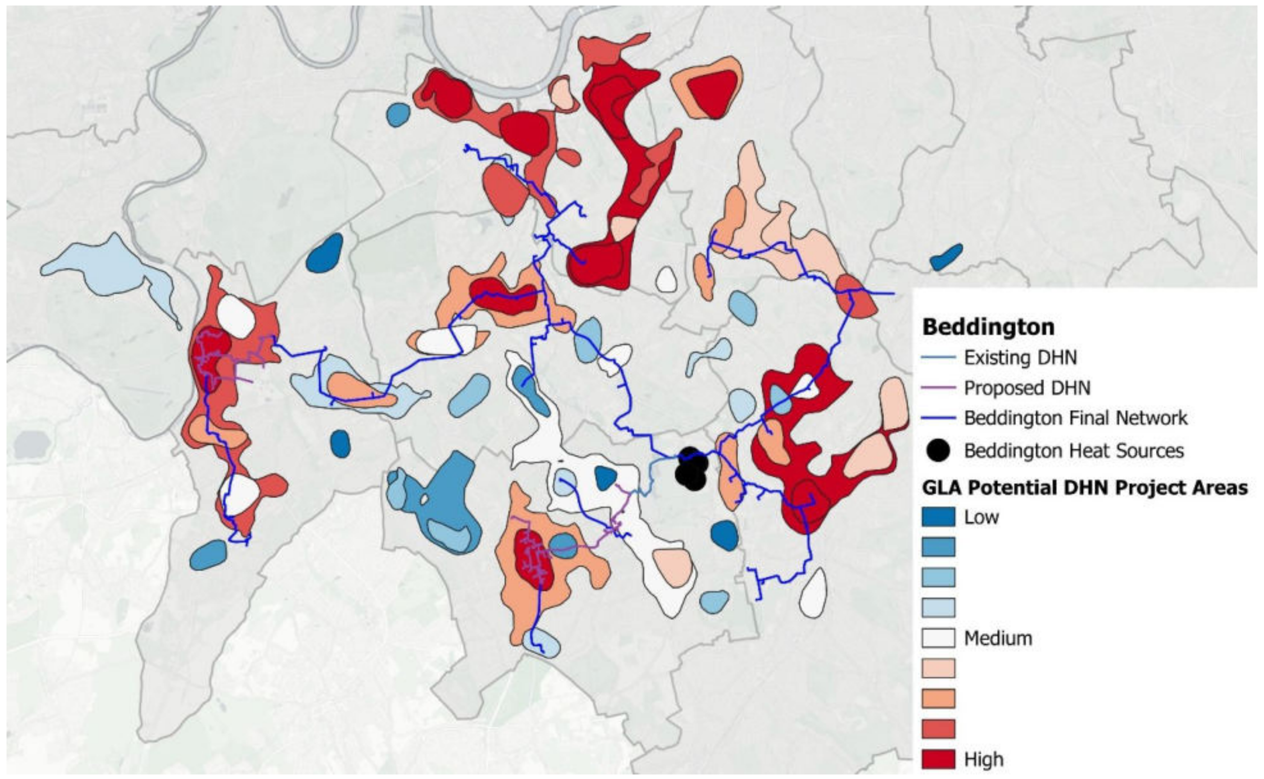
B.2 Initial Steiner Output



B.3 Linear heat density

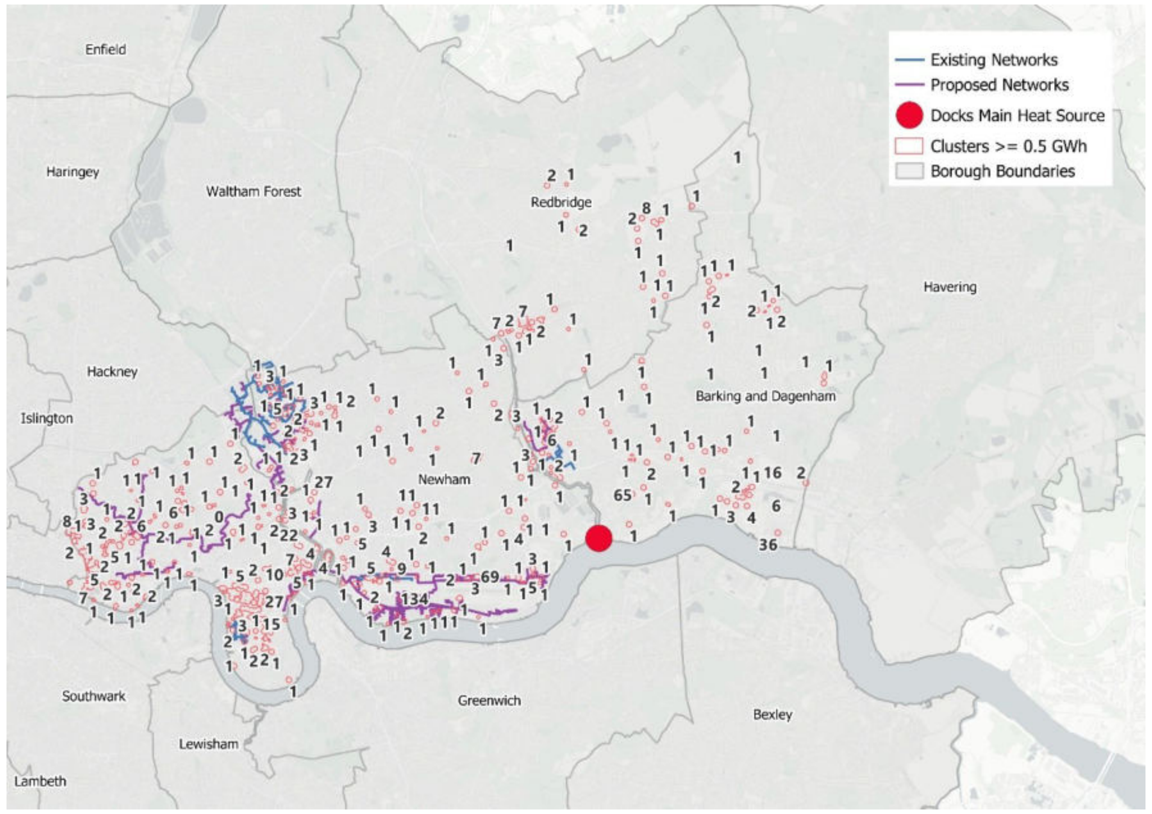


B.4 GLA Potential DHN project areas

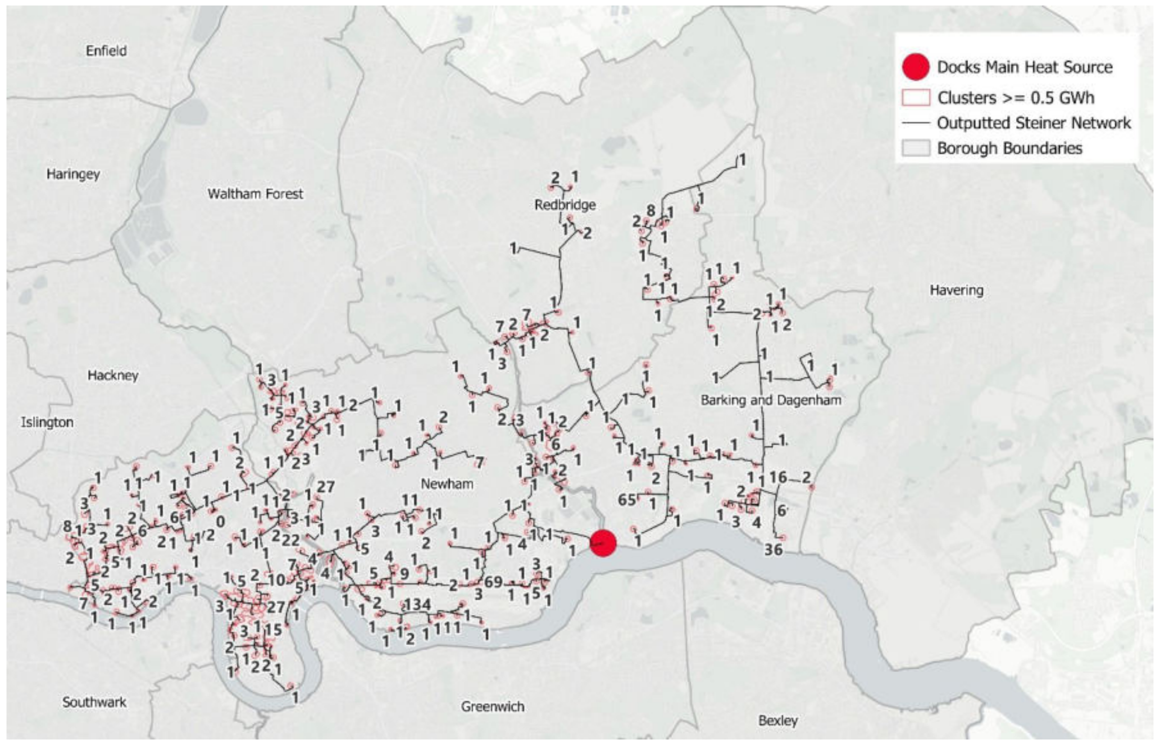


Appendix C Strategic Area C: Royal Docks

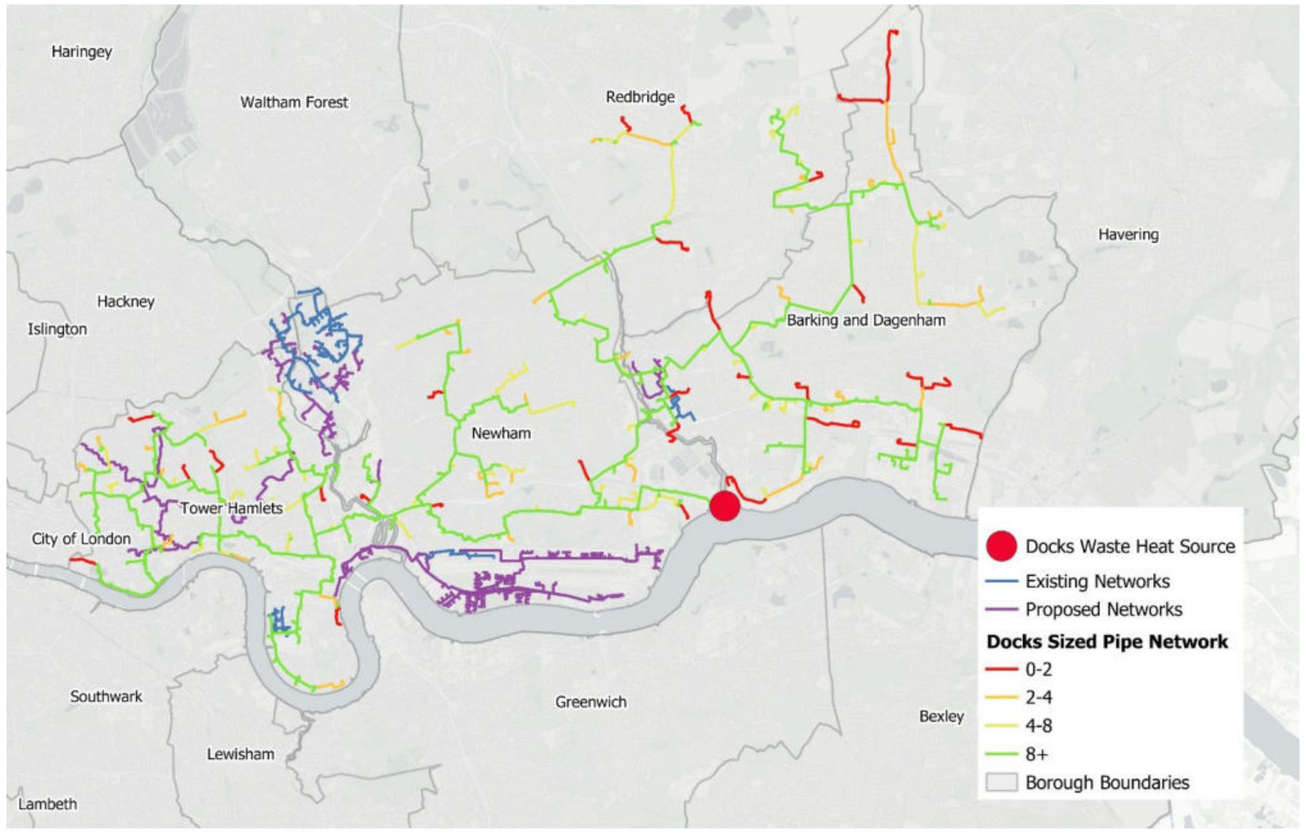
C.1 Existing and proposed networks



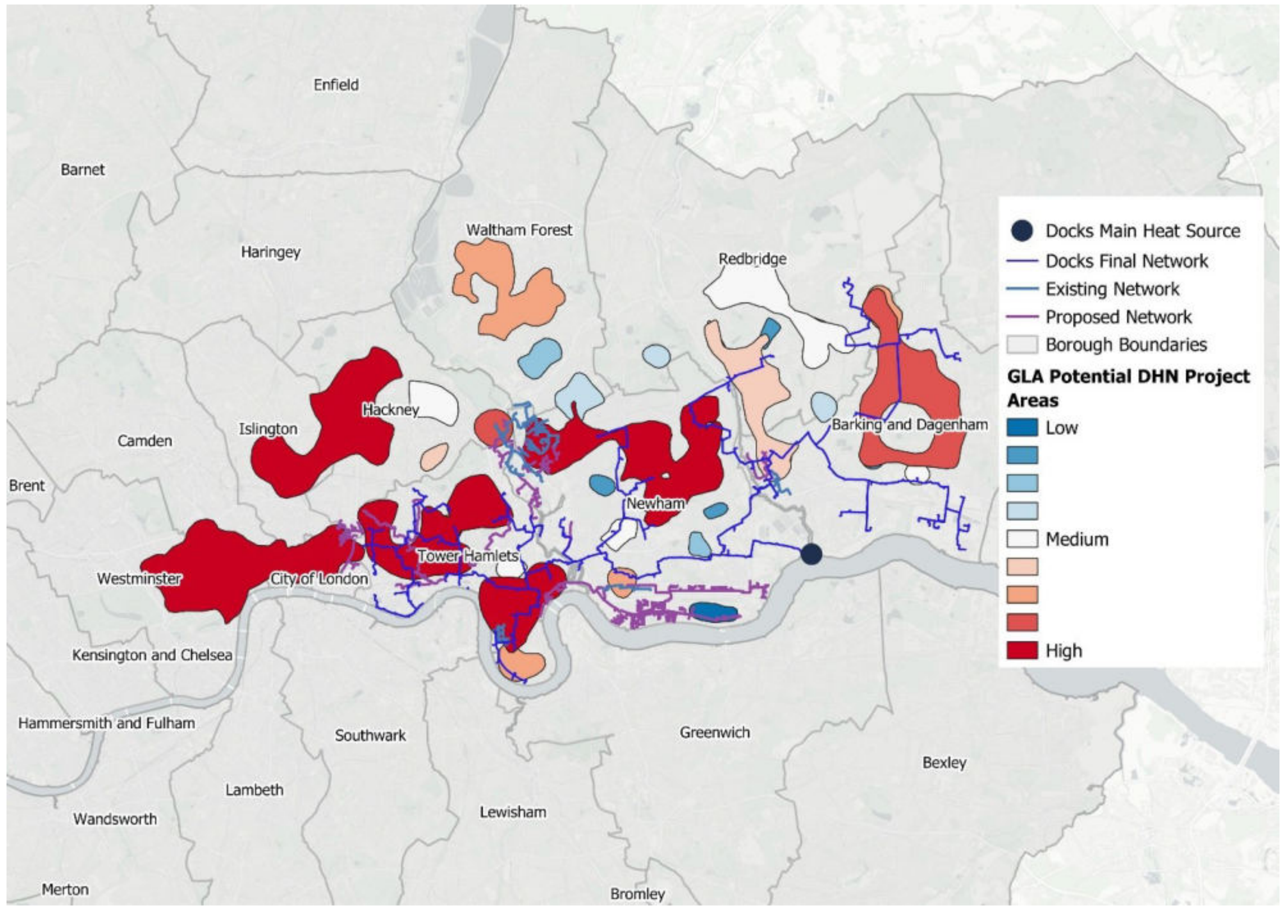
C.2 Initial Steiner Output



C.3 Linear Heat Density

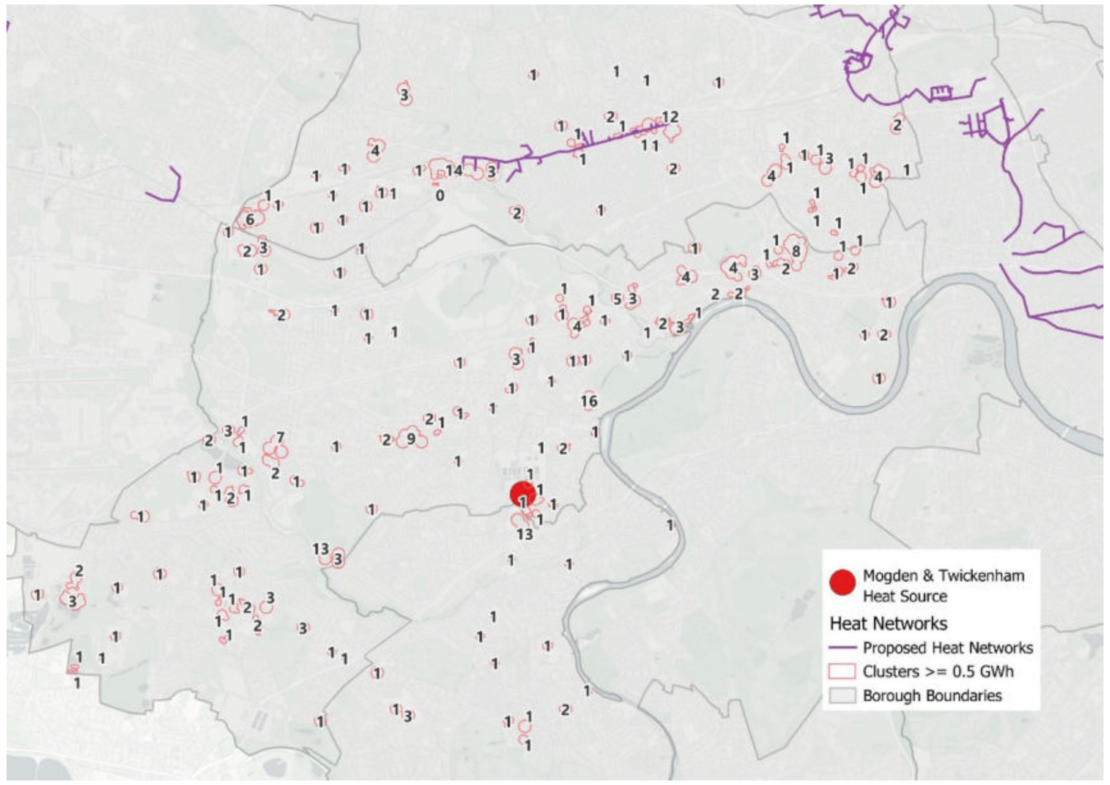


C.4 GLA Potential DHN project areas

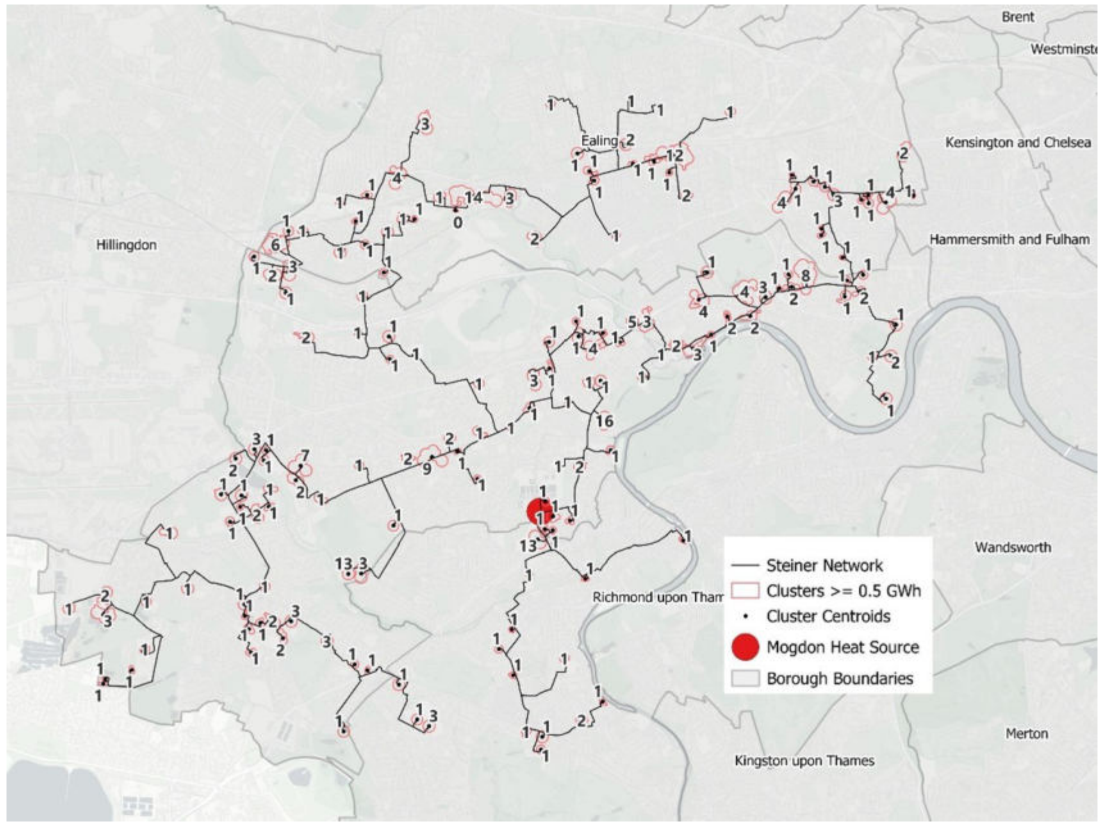


Appendix D Strategic Area D: Mogden & Twickenham

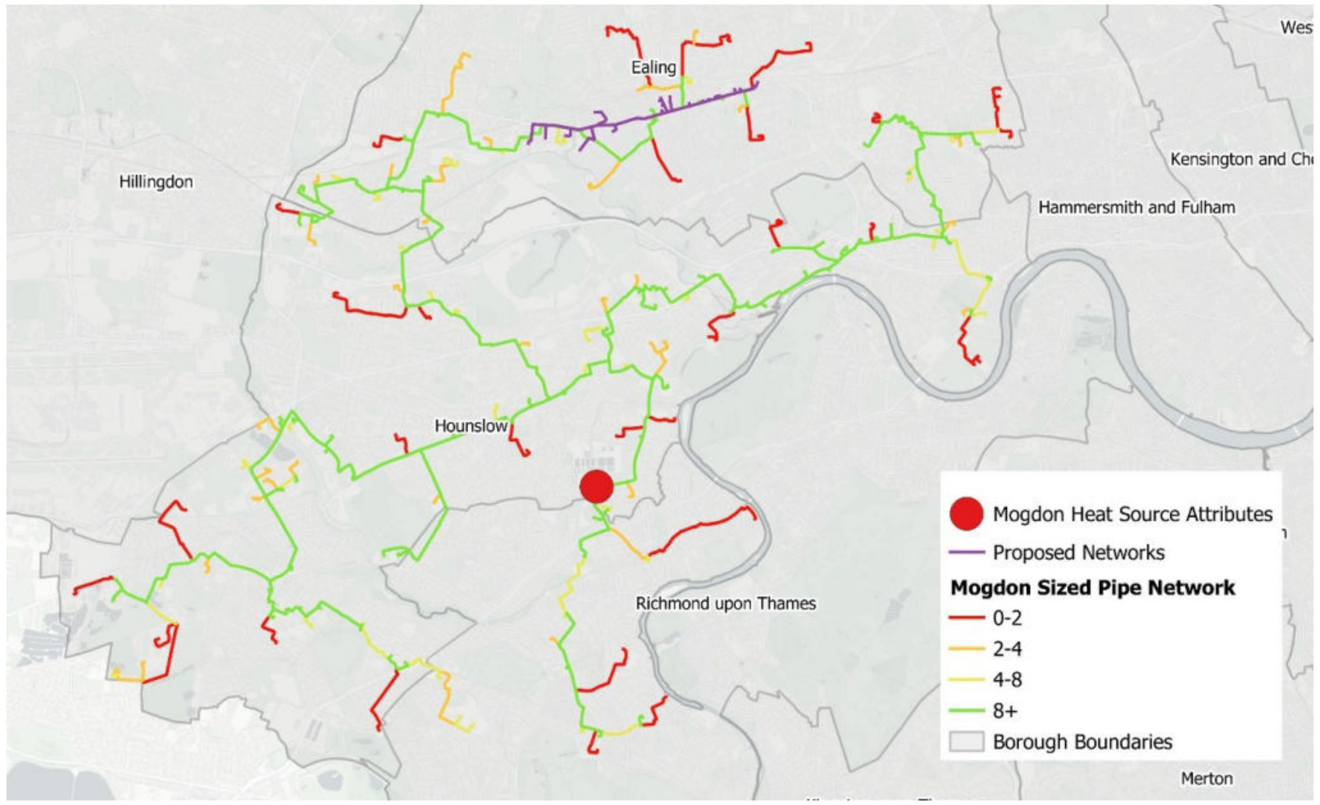
D.1 Existing and proposed networks



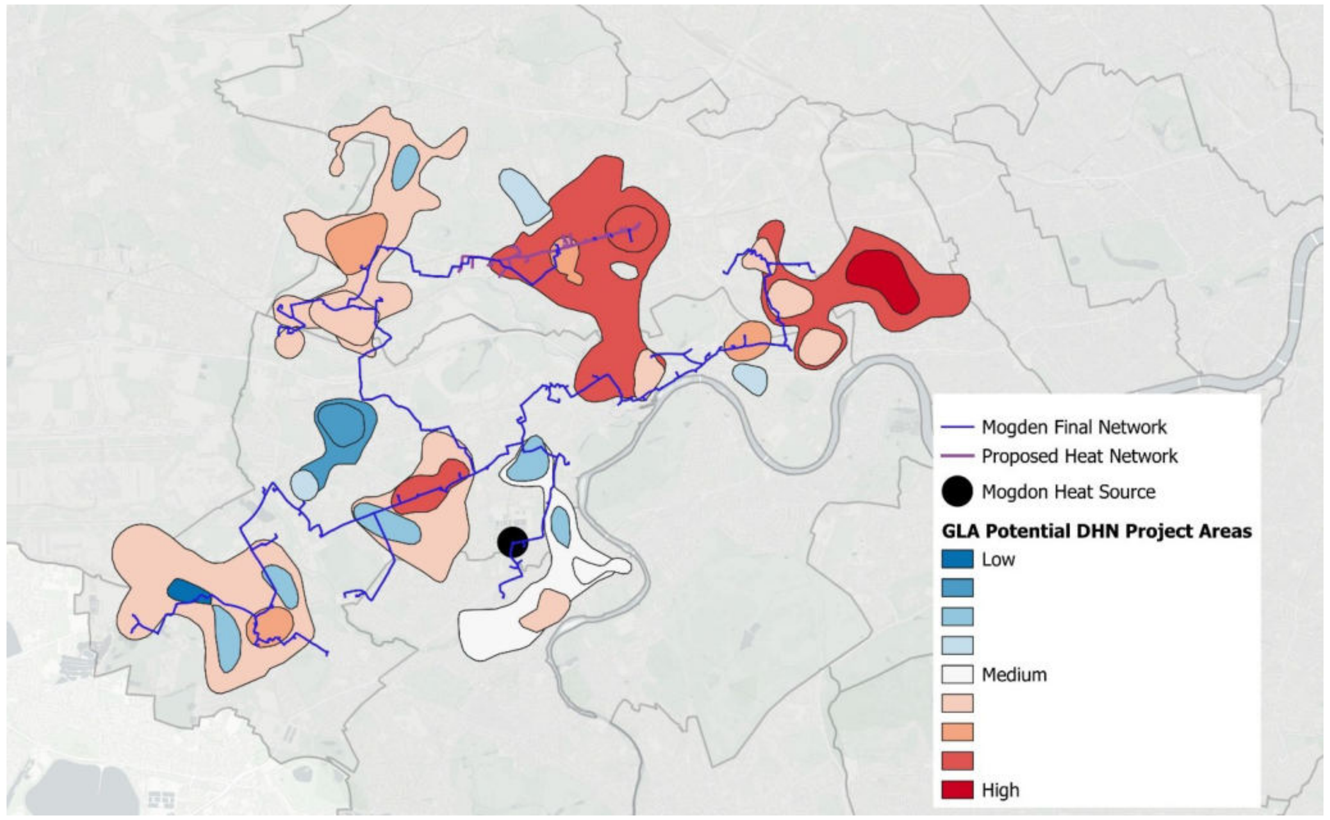
D.2 Initial Steiner Output



D.3 Linear heat density

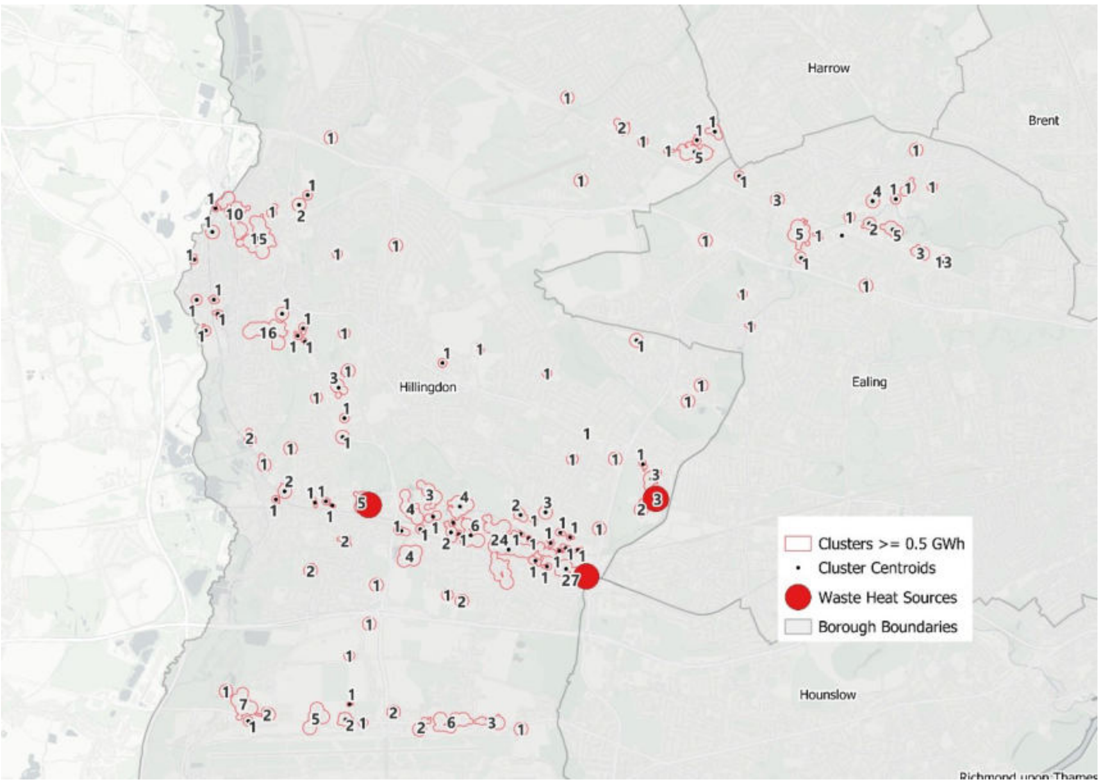


D.4 GLA Potential DHN project areas

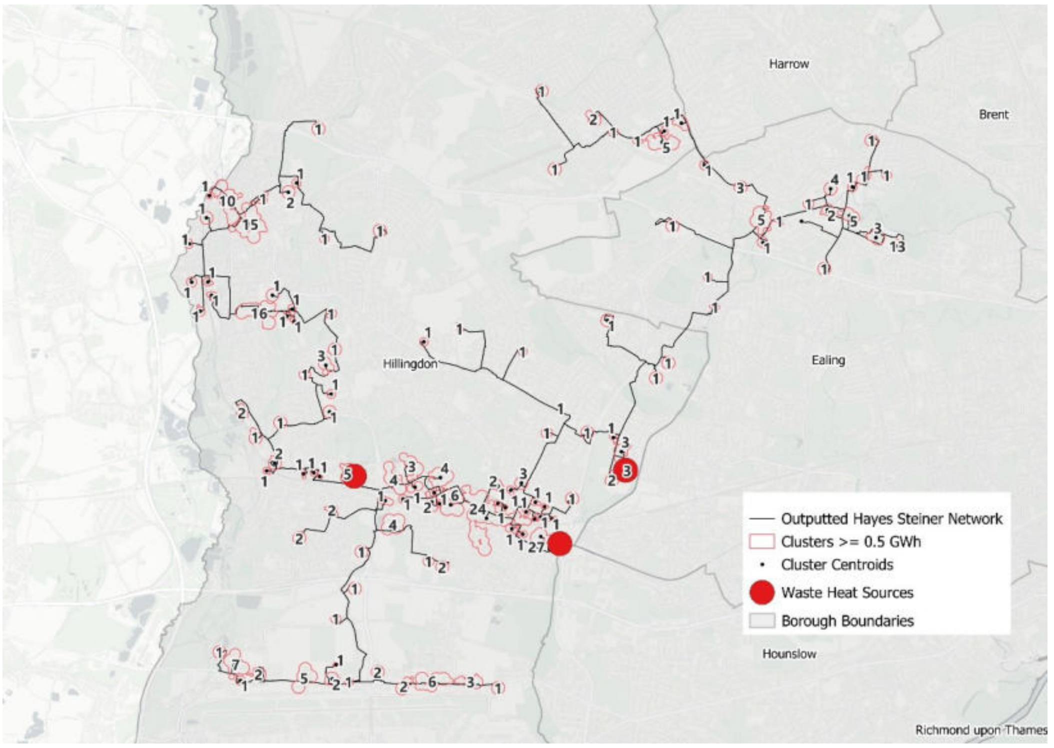


Appendix E Strategic Area E: Hayes & West Drayton

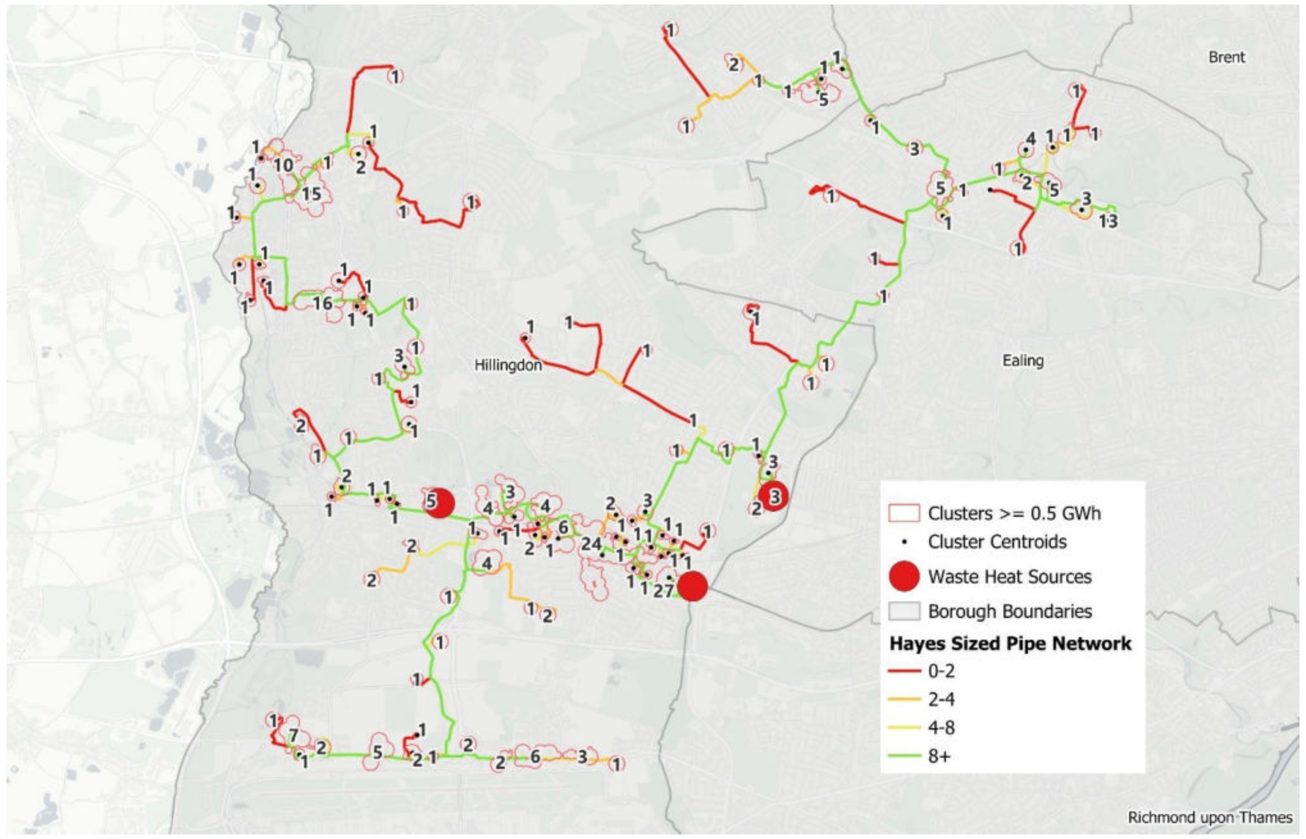
E.1 Existing and proposed networks



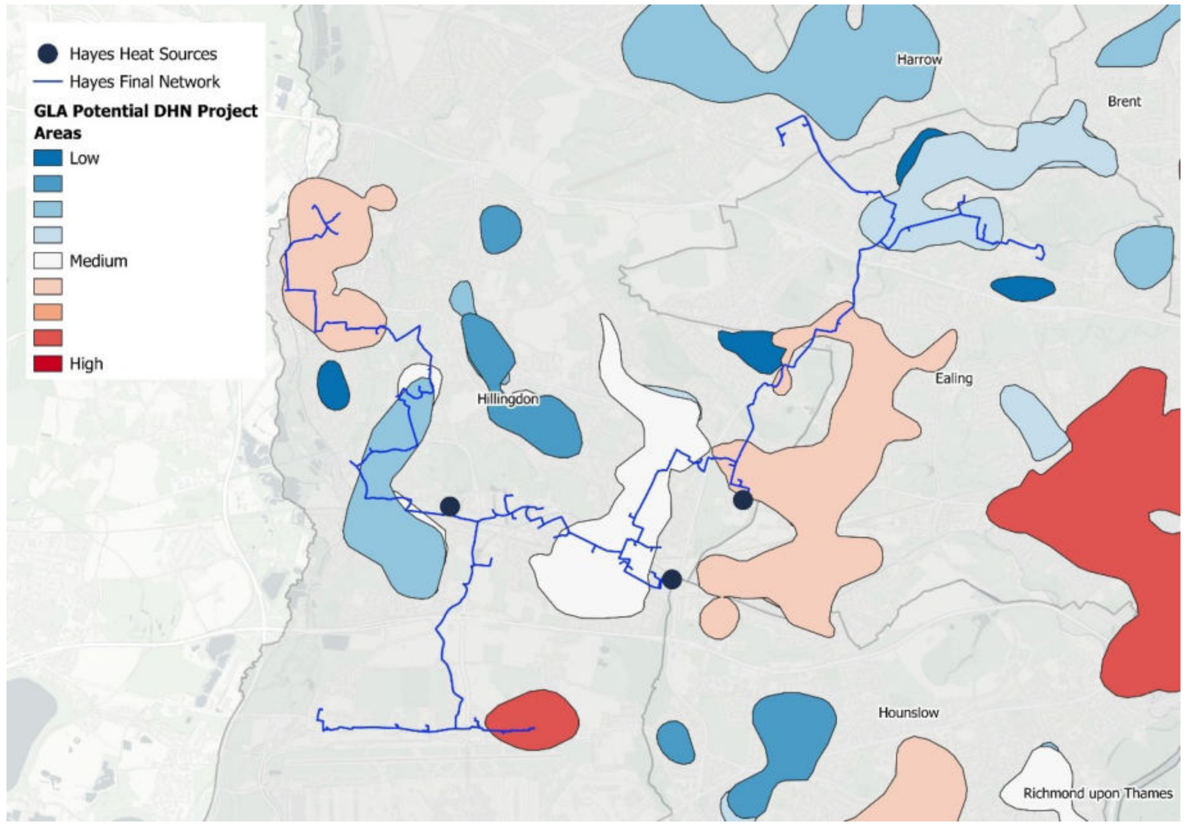
E.2 Initial Steiner Output



E.3 Linear heat density

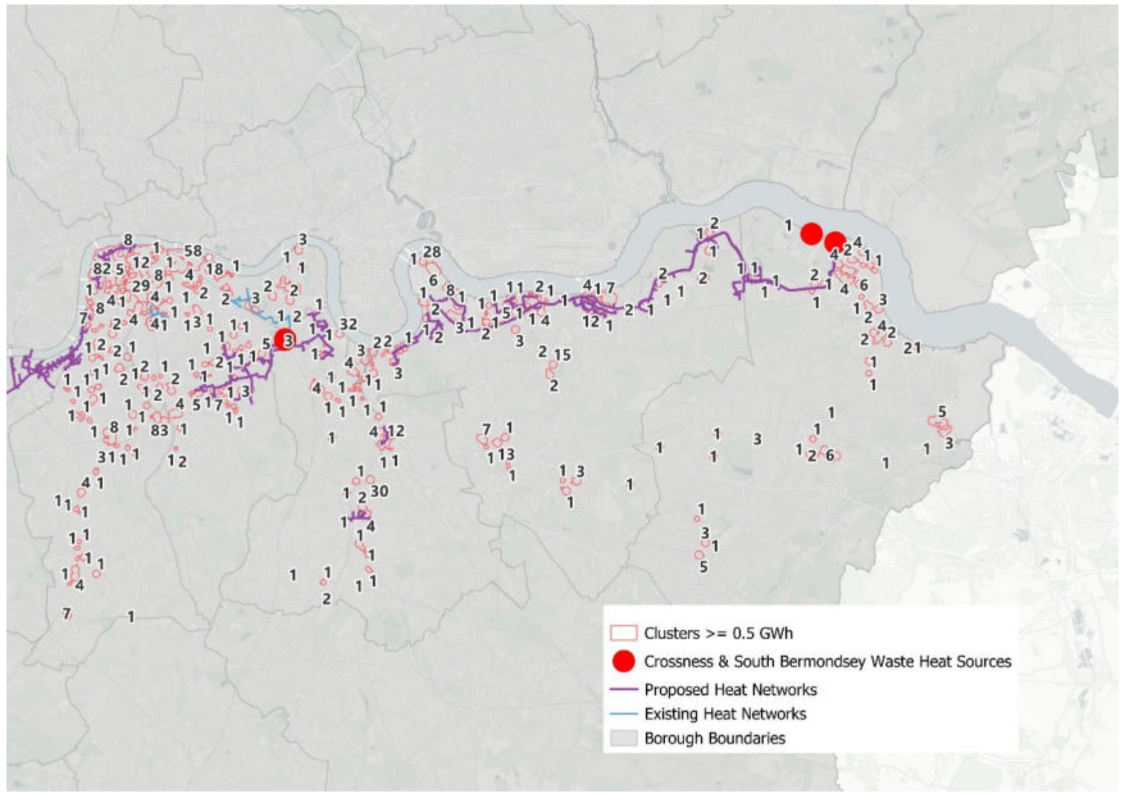


E.4 GLA Potential DHN project areas

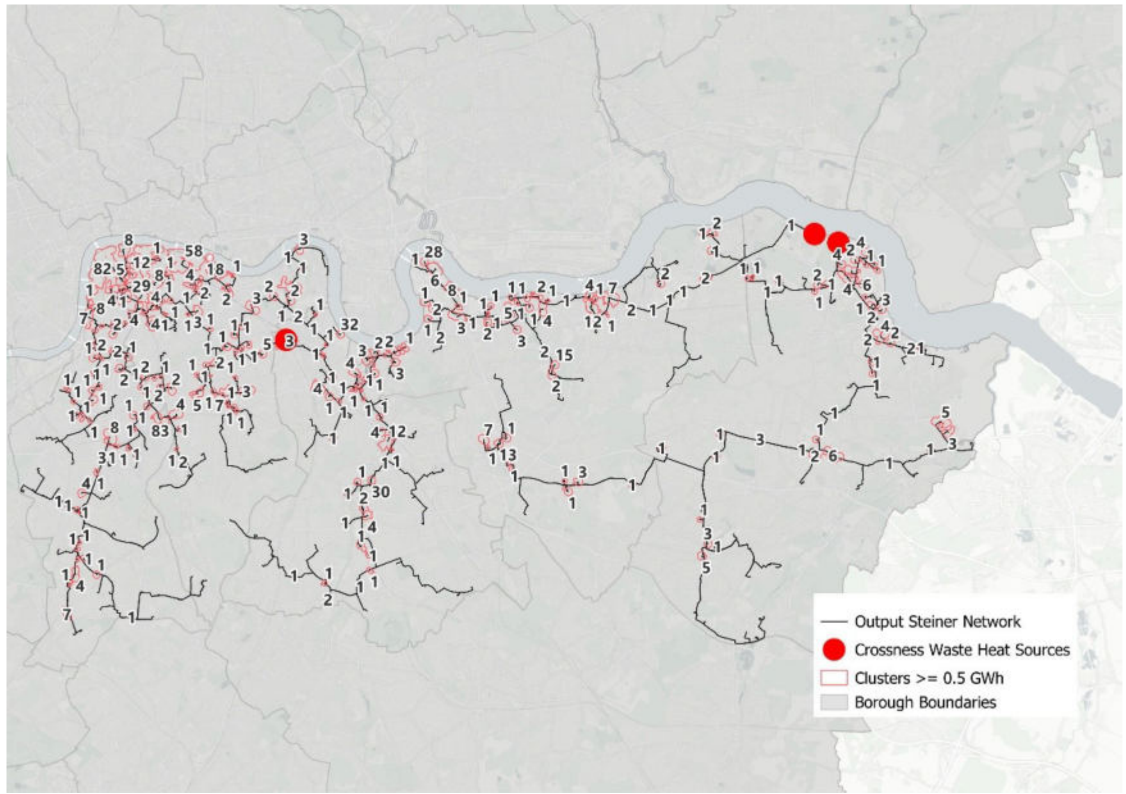


Appendix F Strategic Area F: Crossness & South Bermondsey

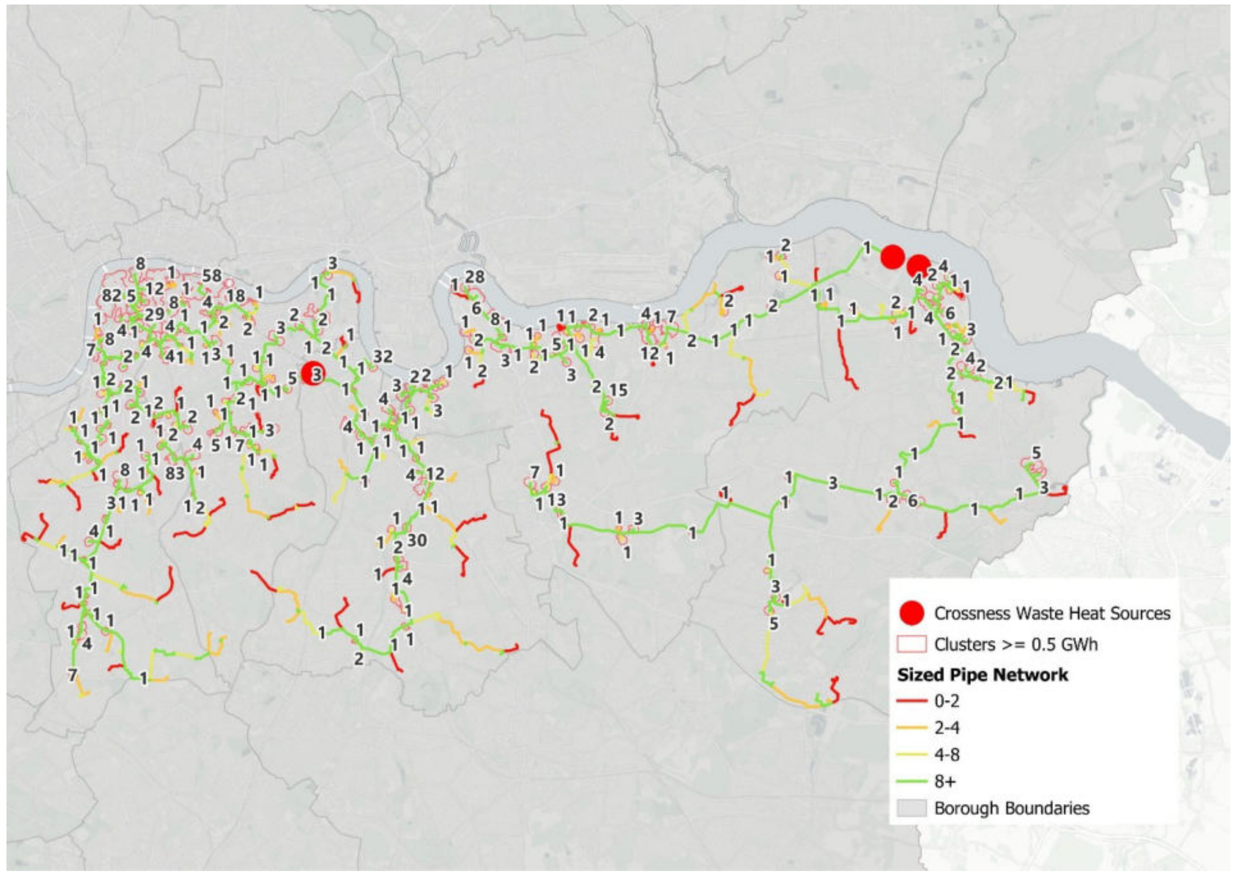
F.1 Existing and proposed networks



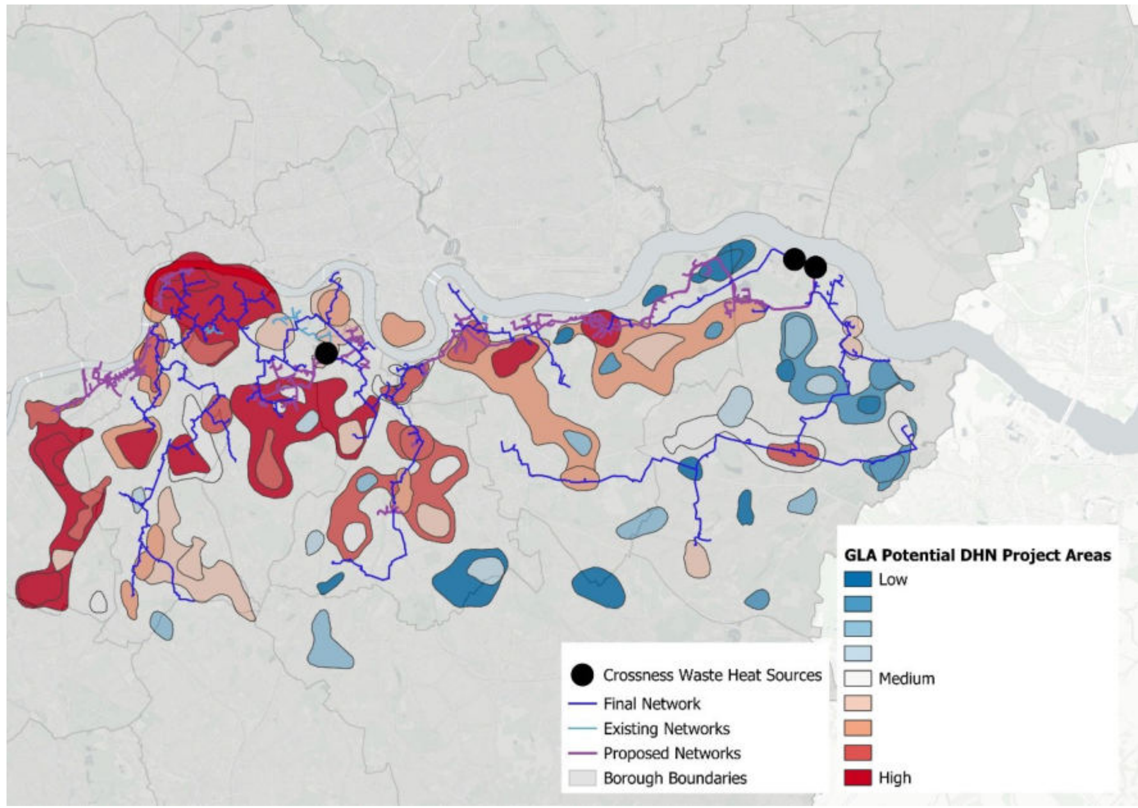
F.2 Initial Steiner Output



F.3 Linear Heat Density

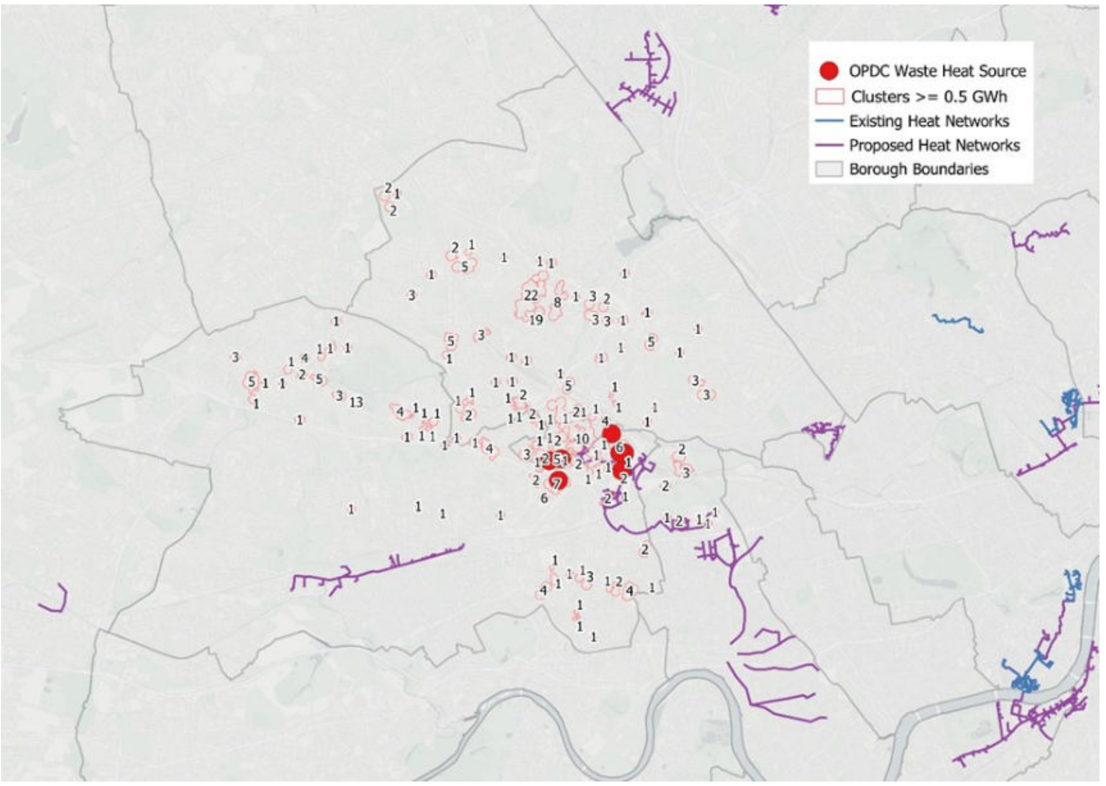


F.4 GLA Potential DHN project areas

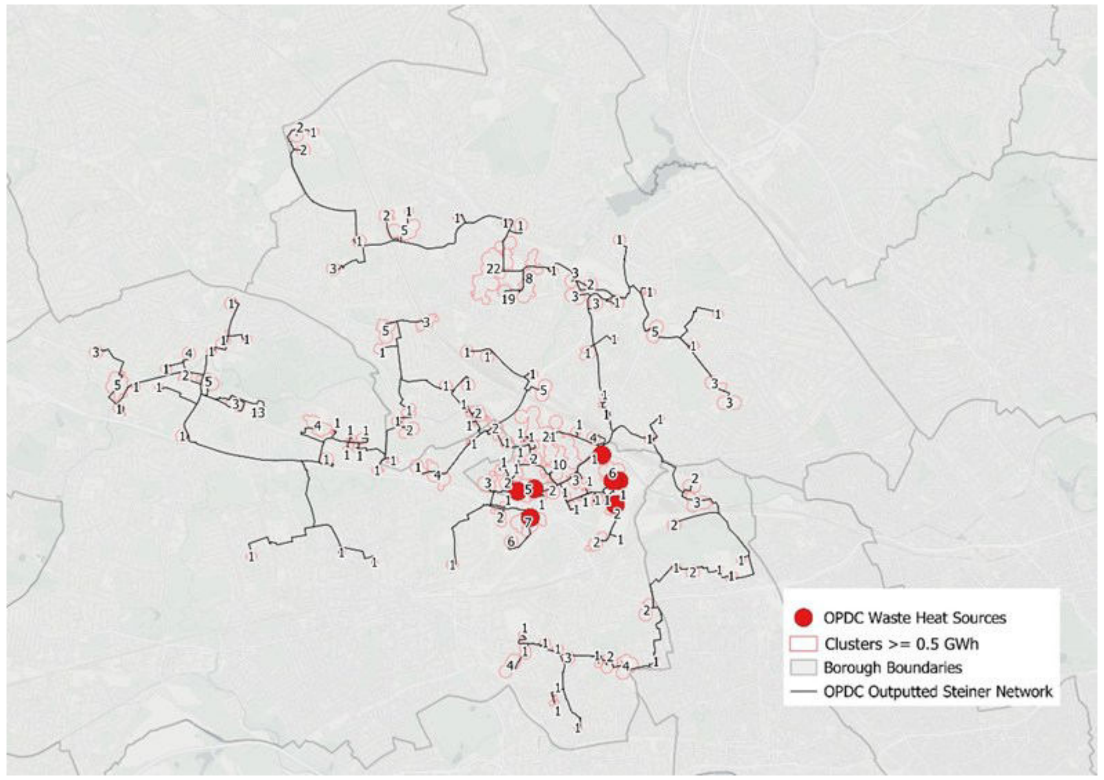


Appendix G Strategic Area G: OPDC

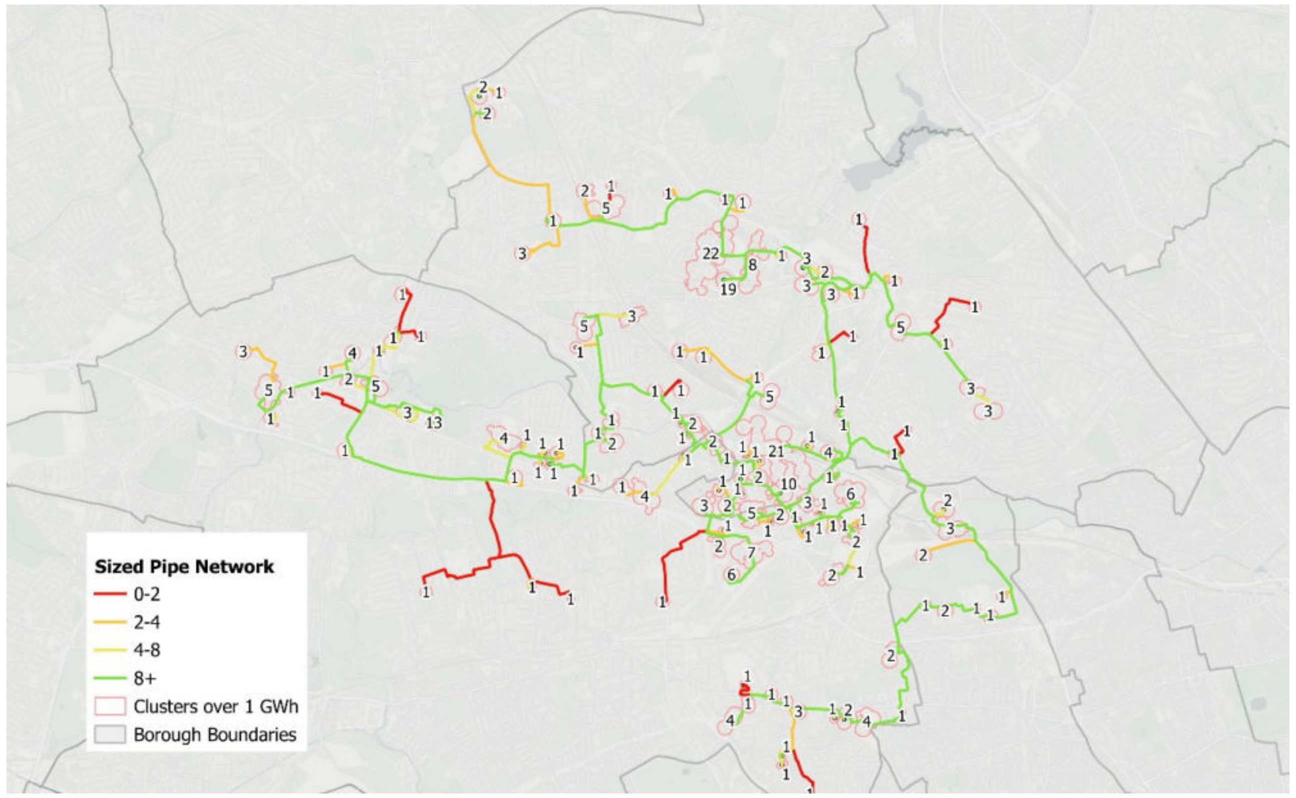
G.1 Existing and proposed networks



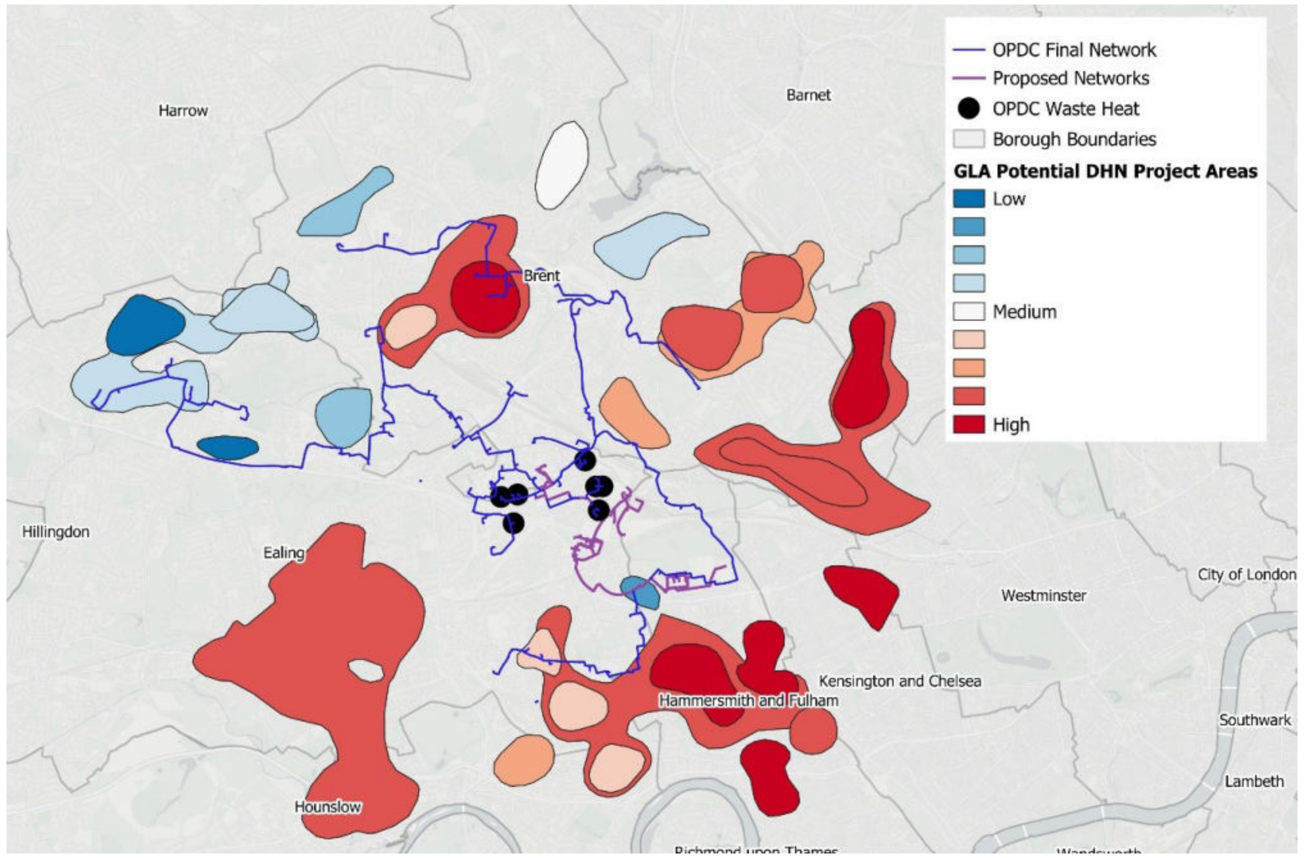
G.2 Initial Steiner Output



G.3 Linear Heat Density



G.4 GLA Potential DHN project areas



Issy Cassidy, Dan Croft, Annalisa Guidolin, Ellie Farmer, Bill Wilson
Buro Happold
Level 5-8, The Featherstone Building
66 City Road
London, EC1Y 2AL
UK

T: +44 (0)207 927 9700
F: +44 (0)870 787 4145
Email: Bill.Wilson@BuroHappold.com

CORY

DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk

corygroup.co.uk