South West NET ZERO HUB

Heat Networks in Britain's Ocean City

Mark Burton, February 2025

BURO HAPPOLD

PLYMOUTH CITY COUNCIL

National Marine Aquarium (NMA)

Largest aquarium in the UK

- 4,000 animals
- 400 species
- 7 habitat zones
- Leading seagrass restoration

Heating and Cooling:

- Peak heat: 1,129kW
- Annual heat: 981,113kWh
- Peak cooling: 716kW
- Annual cooling: 916,147kWh

Option 1: Direct Pump Marine Source Heat

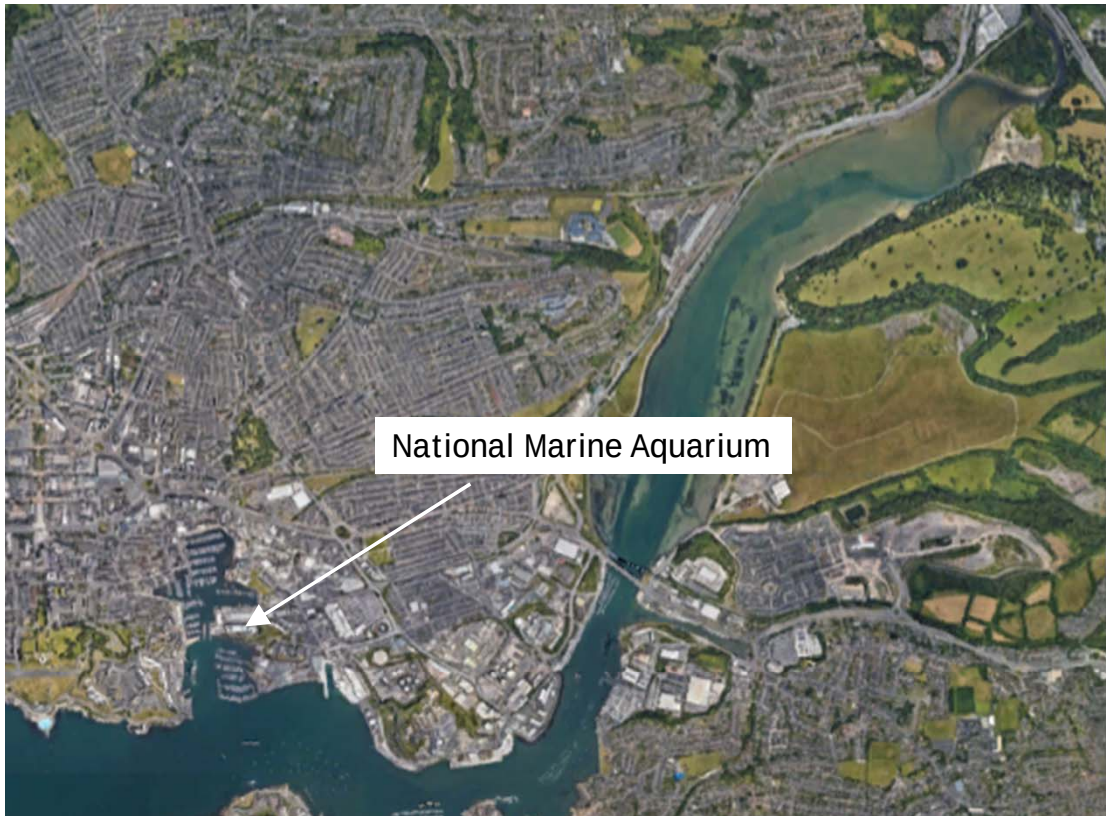
Initial assessment found that there are significant constraints and complexity, including:

- Land ownership, rights and third-party agreements needed
- High level of harbour traffic
- Dredging and risk of ingress
- Environment Agency marine consents
- Presence of protected species
- Depth of water required

Conclusion:

Pumping seawater direct from the harbour as a source of heat is not feasible for the NMA.

But it might be possible elsewhere…



Option 1: Direct Pump Marine Source Heat

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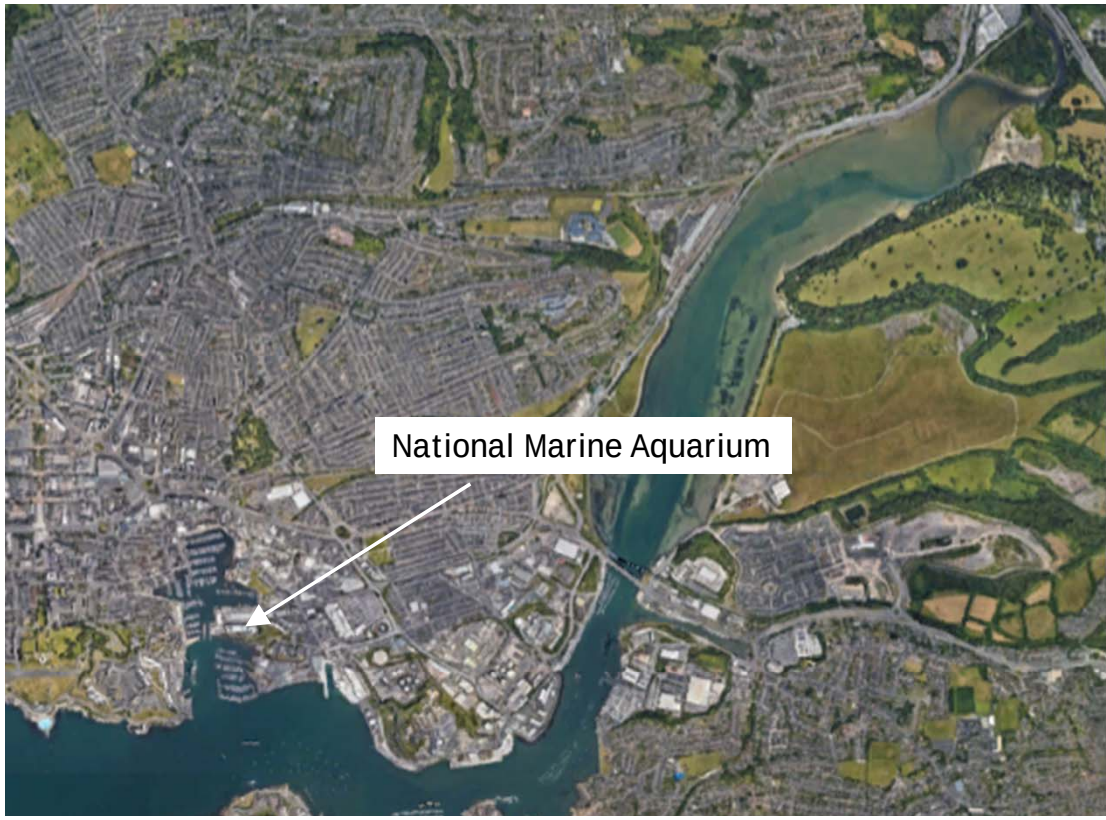
1. What are the other potential sources of heat?

2. What are the other key sites in a potential local network?



Sutton Harbour Cluster

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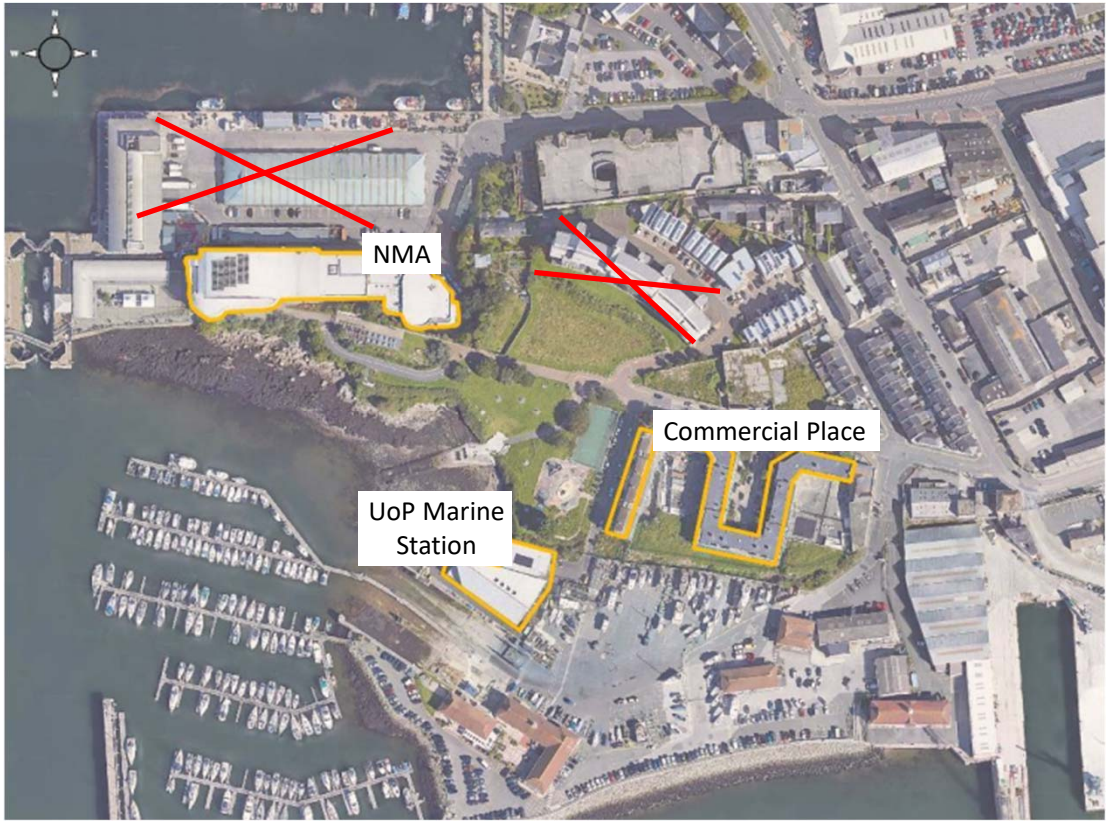
Connection	Typology	Heating	Cooling
National Marine Aquarium (NMA)	Aquarium	1,129 kW peak 981 MWh/year	716 kW peak 916 MWh/year
Plymouth Community Homes (PCH) 'Commercial Place'	Residential apartments	426 kW peak 773 MWh/year	None
University of Plymouth (UoP) Marine Station	University building	66 kW peak 81 MWh/year	None

Other sites	Typology	Comments
Sutton Harbour Fish Market	Wholesale food market	Temporarily closed during the project. Plans to operation. Potential source of significant waste heat.
Queen Anne's Quay	Residential apartments	Privately owned. Did not engage in the project.

Priority Heat Sources:

- Open loop ground source heat
- Advanced Zoning Programme heat network connection



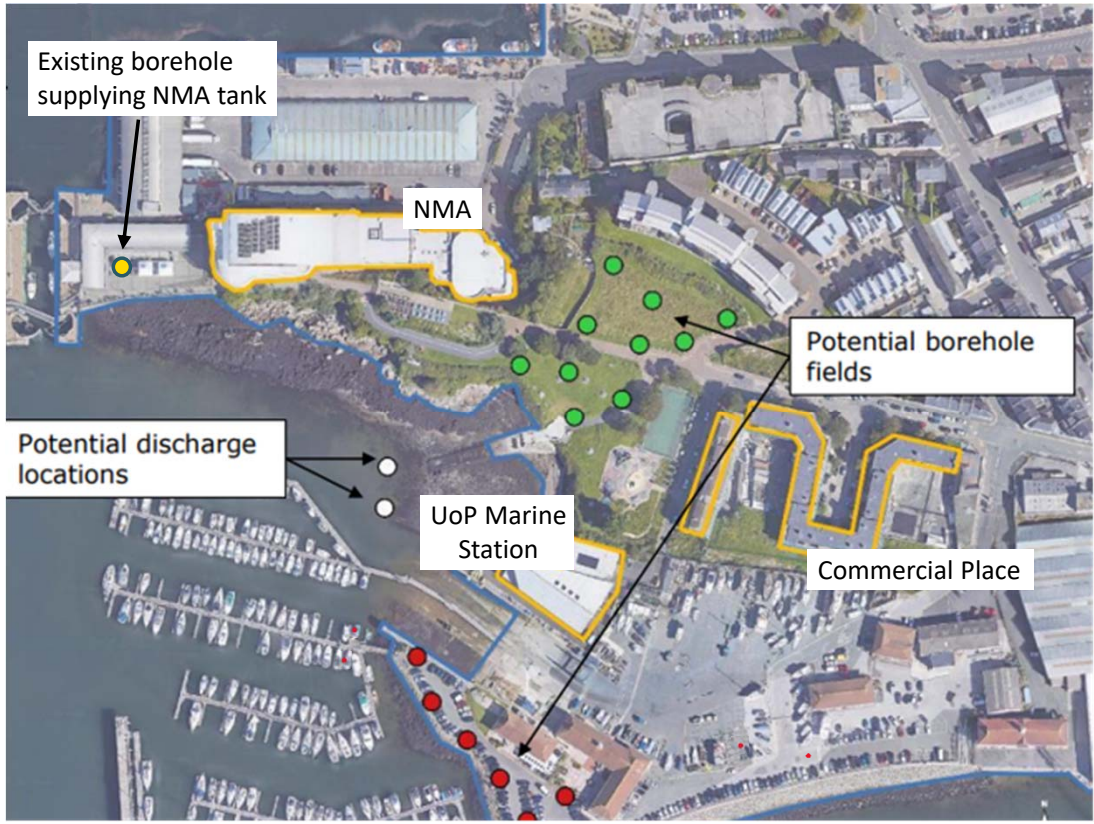
Option 2: Open Loop Ground Source Heat

Good evidence to support the potential yields from boreholes in the area:

- Required geology (shallow limestone)
- Tidal variation confirms high permeability and strong hydraulic connection to the sea
- NMA abstraction borehole flowrates indicate conservative yield in similar boreholes
- 6-7 productive boreholes required to meet heat demand of the cluster

Constraint: The further inland the borehole, the higher the risk that it will not be productive.

Key risk: Environment Agency not accepting the abstraction rate and/or the discharge location, so early engagement with the EA would be a crucial next step.

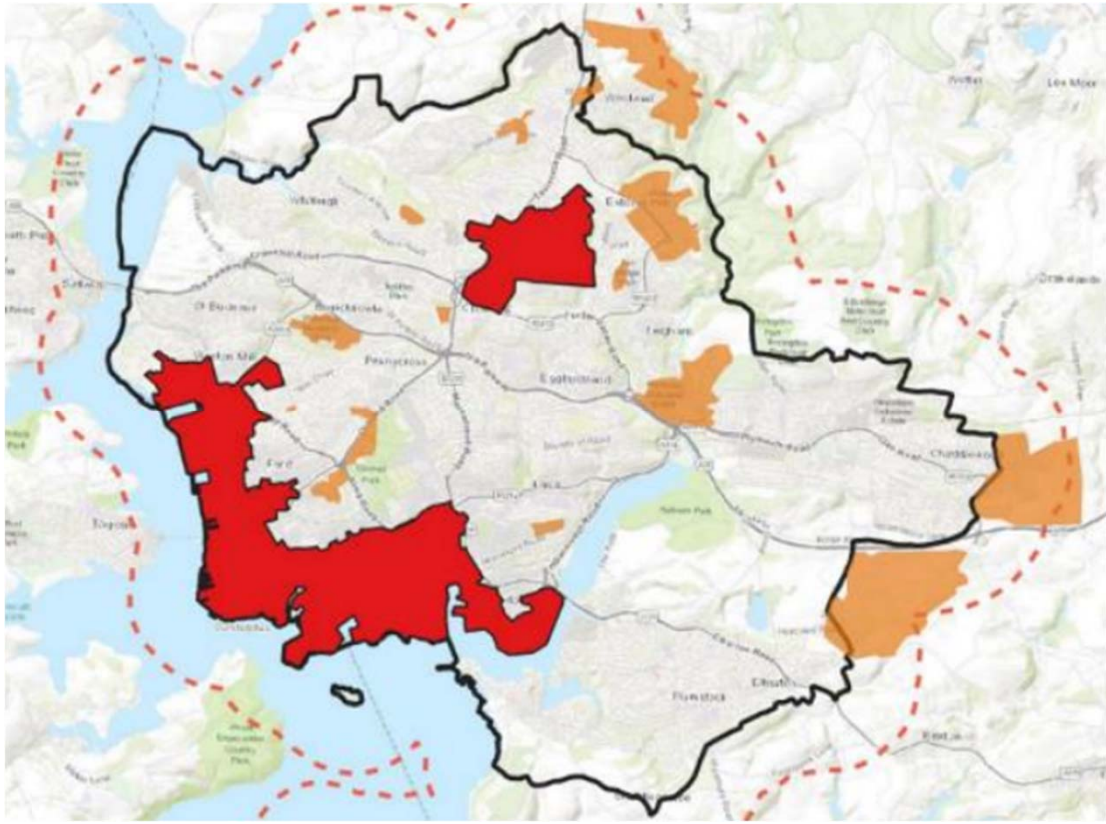


Option 3: Advanced Zoning Programme

Heat Network Zoning Pilot Programme identified 17 potential zones with 2 strategic priorities

Priority Waterfront Zone:

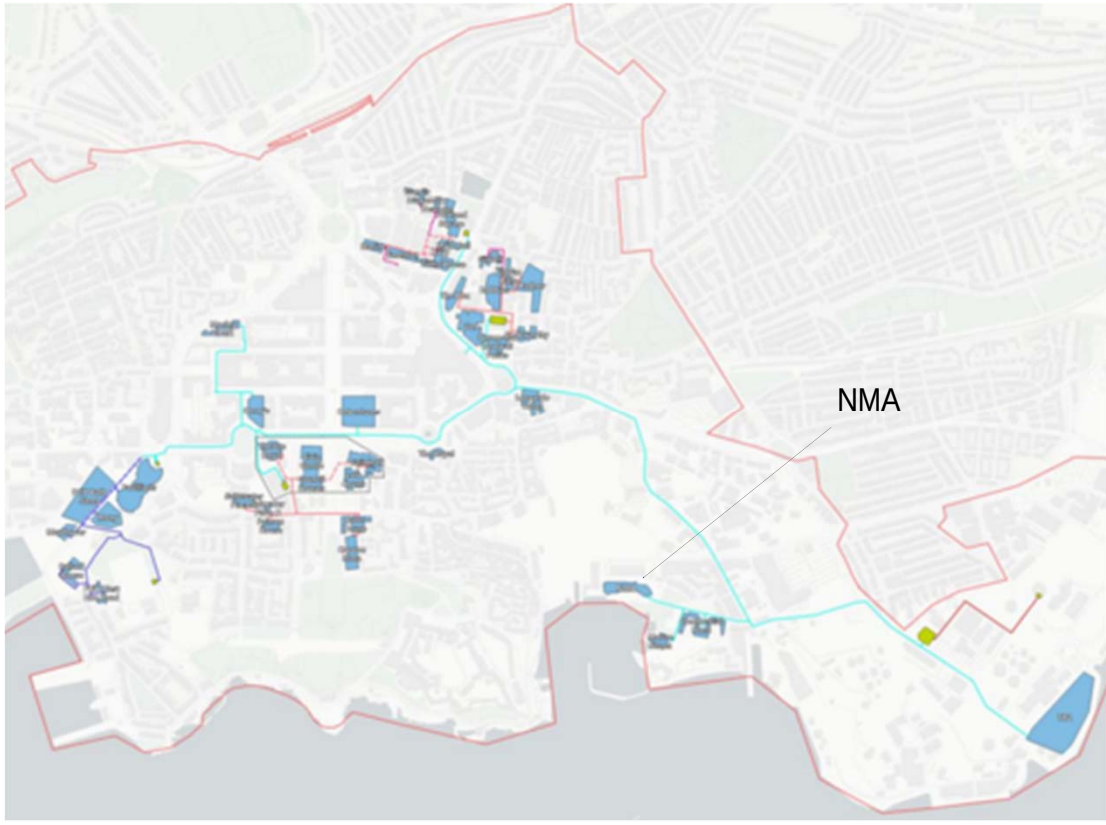
- Full build-out cost of around £300 million
- Estimated savings of 26,000 tCO2e per year
- Small number of stakeholders that each have significant property
- Based principally around two large waste heat sources: the South West Water treatment plant, and the MVV Energy from Waste plant
- Plymouth selected by DESNZ to accelerate heat network delivery as part of the Advanced Zoning Programme



Option 3: Advanced Zoning Programme

Phase 1 Zonal Delivery Area:

- Interconnect three existing and planned heat networks in the city centre to the South West Water treatment plant, with enough waste heat for the whole scheme
- A low-temperature ambient “spine” connecting direct to buildings or secondary energy centres as appropriate, and accepting waste heat from cooling systems
- 100% commercially owned network, with the tender for a commercial partner due to open in April and including the provision of community benefits
- £44 million CAPEX, leading to 4,500 tCO2e savings
- Initial connections in 2028, and Phase 1 complete in 2032



Techno-Economic Comparison

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Option 2: Open Loop Ground Source

- Initial modelling indicates low profitability
- Low revenue from heat sales, due to the relatively small total annual demand

To achieve 10% IRR needs a grant of £2,467,760 (63% of CAPEX).

Unfunded Results

- IRR: N/A
- NPV: -£2,331,000

Grant Funded Results (10% IRR)

- NPV: £137,000

Next steps:
Engagement with the environment agency to mitigate key risk.

Option 3: AZP Connection

- Initial modelling indicates profitability with and without grant funding
- Conservative result including of additional AZP network costs

To achieve 10% IRR, needs a grant of £1,124,066 (36% of CAPEX).

Unfunded Results

- IRR: N/A
- NPV: £813,000

Grant Funded Results (10% IRR)

- NPV: £1,937,000

Next steps:
Include report and recommendation in the AZP tender.
Detailed engagement with cluster connections and landowners.

PREFERRED OPTION

NMA Stand-Alone Option

- 100% redundancy is a requirement
- End of life equipment poses a critical business risk
- Designed and costed a stand-alone system replacement.
- Enabling works required with stand-alone replacement or AZP connection.
- CAPEX of £2 million with no immediate source of funding

Questions remain about whether an AZP connection will be possible and commercially viable for the NMA.

Next steps:

Continue dual approach. Engage with PCC and AZP commercial partner,

Search for funding to progress enabling works and end of life replacement.

Project outcomes and learning

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1. Heat networks are complex projects

- We've gained some valuable knowledge and identified some clear ways forward
- These projects take a long time, and usually longer than you expect
- There's still a lot more to do and questions still to answer

2. Stakeholder involvement is crucial

- There are many stakeholders involved with different issues and working to different timescales
- All principle stakeholders in the project say that more and better stakeholder engagement is what they would change if doing the project again

Conclusion: The Net Zero Hubs are well placed to play the crucial roles of stakeholder and project management over long project durations.

Thank you

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