# RBG Batch01c Sam Manners House – DHN Design Note

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| Project | Sam Manners House |
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## 1.0 Introduction

SCMS Associates have been conditioned to prepare a Design Note to demonstrate details of the method of how the proposed/existing centralised or individual air source heat pump systems (ASHP) will facilitate connection to a future offsite District Heating Network (DHN) in support of a new Planning Consent for the residential development on Tuskar Street known as Sam Manners House within the Royal Borough of Greenwich, London for Greenwich Builds.

This Design Note describes the strategies considered in relation to retrofitting each of the Domestic and Non-Domestic typologies for connection to an offsite DHN in the future. Factors such as the type of connection (direct or indirect), pipework routing, intervention required in certain properties and domestic hot water (DHW) production are discussed. The current consented Sam Manners House project consists of the following accommodation types to make up the combined 32no unit scheme across the 3no blocks.

- 8no Town Houses.
- 12no Maisonettes.
- 12no Apartments.

## 2.0 House/Maisonette DHN Connection Strategy

There are three different strategies for connection houses/maisonettes to a district heating main (which we assume will be installed withing the Public Highway) are illustrated in Figure 2-1. These options are:

1. **Individual connection from the Public Highway to the boundary of each property:** This option is the most costly and labour intensive to apply on a mass scale, due to the high excavation costs for each property. Works would include trench excavation, back-filling and re-instatement of surfaces as required, with pipework rising up and entering into the property.

2. **Shared connection from the main district heating branches to multiple properties:** This option, economic feasibility would be higher, given there is only one branch to the road main. There may be possible cross boundary and coordination issues when passing through adjacent properties, driveways and/or front gardens.

3. **Shared connection through the roof of multiple properties:** This option would represent the best engineering solution, given road excavation, pipework length and the number of connections is significantly reduced. In reality however, this option is likely to be particularly challenging due to legal issues regarding covenants and wayleaves (i.e. rights of access specifically for trench excavation, access and maintenance) and coordination of multiple tenants.

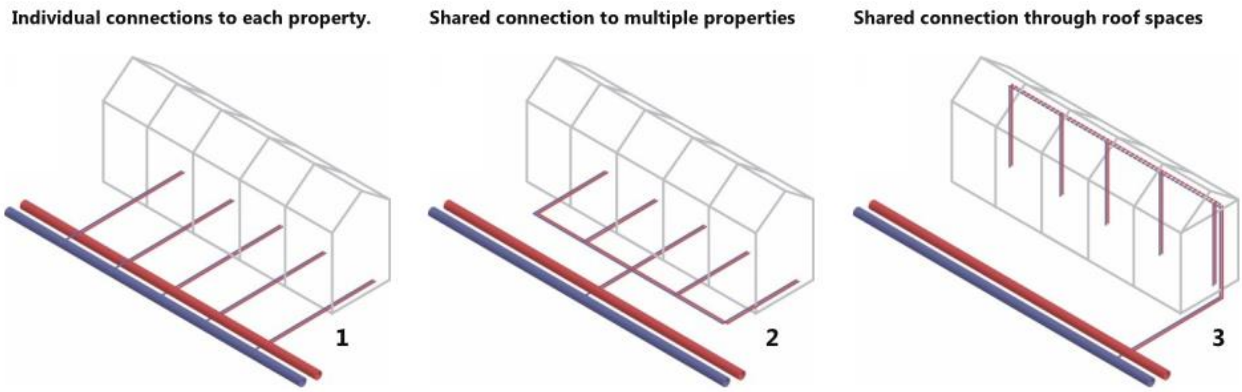



**Figure 2-1** District heating connection strategy to street main (illustration for houses).

For the purposes of this design note, a shared connection to multiple properties has been selected, given the likely standard of ownership across the building stock being held with The Royal Borough of Greenwich and the lack of difficulty envisaged in coordinating and getting agreements for shared connections. It should be noted however that to deliver this at scale an area based approach to promoting and recruiting properties for retrofitting for district heating connections. Broadly this approach could be applied across the majority of typologies, particularly small retail & commercial units.

**Direct vs. indirect district heating connection**

District heating connections can be considered as either direct or indirect based on the hydraulic separation between primary flow and secondary flow within a building. Whilst the flow is continuous for direct systems, indirect heating systems have a heat interface unit (HIU) separating the primary flow from the secondary flow.

When connecting each house, it has been assumed that an indirect connection to district heating with be the preferred approach. Though direct connections reduce losses in the system and can be considered more economical than the indirect connection, there is increased possibility for cross contamination and leakage. As the indirect connection is also the highest cost this has been assumed throughout.

**Retrofit strategy for houses/maisonettes**

For air source heat pump (ASHP) heated homes, similarly to gas heated homes, existing radiators would be retained and a new HIU would be installed to either; directly replace the air source heat pump (ASHP) along with new mains pipework to the home to provide the heating and hot water. The HIU would provide heating as well as pressurised instantaneous hot water. The air source heat pump (ASHP) would be replaced by an HIU  and then the hot water cylinder would also be removed which would create some additional space within the home. The HIU would be a packaged unit with new secondary pump, control valves and heat meter for billing on the primary side.

Two pipe radiator systems are well suited for conversion to district heating systems with little or no modifications required provided they are fitted with appropriately selected thermostatic radiator valves (TRVs).

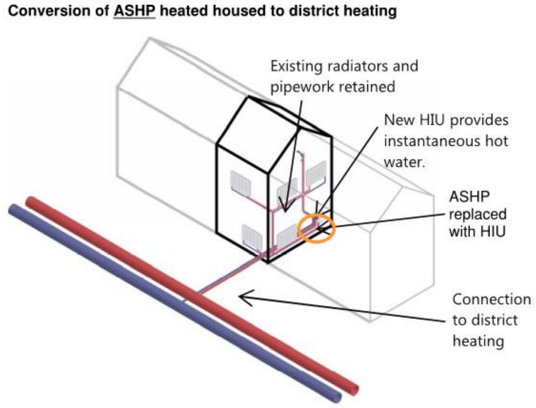



**Figure 2-2** District heating connection strategy for ASHP.

Although it is proposed to remove the domestic hot water cylinder, it is possible to retain existing hot water cylinders should this be preferred by occupants as these cylinders can be converted though care is needed to ensure they deliver a return temperature which is acceptable to the system operator.

The benefit of removing the hot water cylinder in favour of an HIU is the additional space created, the additional flexibility of instantaneous hot water in dwellings with multiple occupants and/or high hot water demand and the role it plays addressing the threat of legionella in networks with lower supply temperatures, below 60°C. An additional benefit of replacing the DHW cylinder with an HIU is that this reduces the return temperature to the district heating network and allows greater capacity within the network, lowering pumping costs and increased efficiency of central plant in some cases.

**District heating pipe sizing in houses/maisonettes**

Figure 3-3 illustrates the assumptions made relating to pipework lengths for the house/maisonette, together with the resulting pipework diameters and insulation thickness calculation. As shown, a 5m length of 32mm diameter pre-insulated district heating pipework is required externally. A further 5m of steel pipework of 32mm diameter with insulation has then been assumed running internally within the property to the HIU.

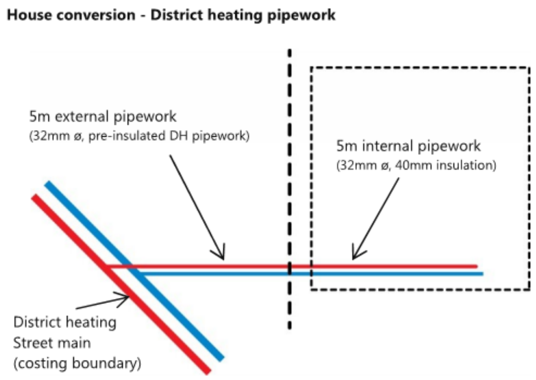



**Figure 2-3** Pipework length and thickness assumptions for house/maisonette typologies.

## 3.0 Apartment Blocks DHN Connection Strategy

As set out within the planning consent the architecture being considered is a low rise purpose built low rise standalone blocks, each with a central core, the second is a low rise converted apartment, typically in coreless blocks or where duplexes may reside.

For low rise blocks with central cores, of which Sam Manners is, the building has greater space to run district heating pipework internally over the type without a core. As such, the connection strategy for this building type (left image of Figure 3-1), shows pipework running internally and through corridors to each apartment. Individual HIUs would then be added to each apartment, with similar provisions as described previously for conversion of air source heat pump (ASHP) systems.

Where apartments are served via central source heat pumps (ASHP) either via a direct monobloc connection to the hot water cylinder or VRF network to individual Hydro units within each apartment, the Hydro and domestic hot water cylinder would be replaced with a new HIU in each apartment, providing heat to the existing radiator network, as well as instantaneous hot water.

Although it is proposed to remove the domestic hot water cylinder, it is possible to retain existing hot water cylinders should this be preferred by occupants as these cylinders can be converted though care is needed to ensure they deliver a return temperature which is acceptable to the system operator.

The benefit of removing the hot water cylinder in favour of an HIU is the additional space created, the additional flexibility of instantaneous hot water in dwellings with multiple occupants and/or high hot water demand and the role it plays addressing the threat of legionella in networks with lower supply temperatures, below 60°C. An additional benefit of replacing the DHW cylinder with an HIU is that this reduces the return temperature to the district heating network and allows greater capacity within the network, lowering pumping costs and increased efficiency of central plant in some cases.

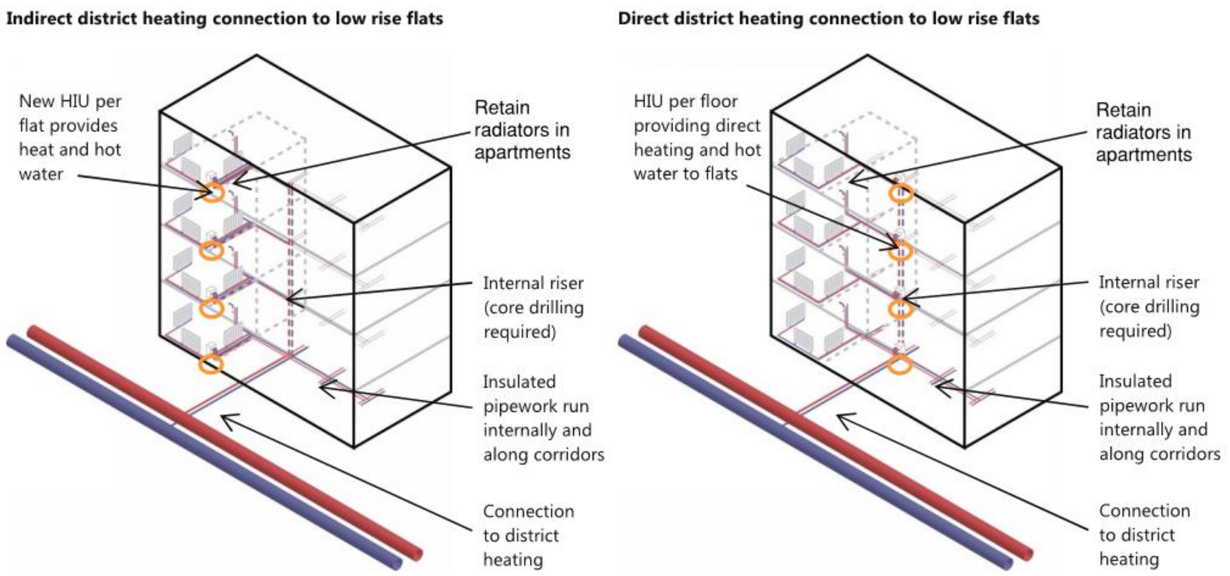



**Figure 3-1** District heating connection strategy with indirect (left) and direct (right) connection into blocks with cores

Figure 3-2 illustrates an alternative connection strategy, which would also be the strategy for coreless apartments served via central air source heat pumps (ASHP) similarly to those served via has appliances respectively. As shown, due to a lack of internal riser space, it is proposed for this option to run insulated pipework up the façade externally, with penetrations per level entering into floor plates serving two adjacent apartments at a time (to reduce pipework length). Pipework can be boxed in where aesthetics or planning conditions require this.

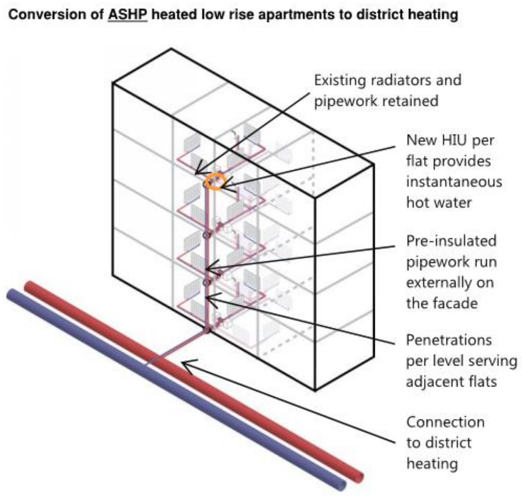



**Figure 3-2** District heating connection strategy for low rise blocks (coreless).

It should be noted that in order to mitigate any risk of overheating in corridors the pipework should be insulated to a standard in excess of BS 5422 and provision for ventilation should be ensured.

The right hand image in Figure 5-2 shows an alternative conversion approach for retrofitting low rise flats and is shown for information. Here, instead of each apartment having its own HIU and indirect connection, there is an HIU per floor with a direct connection to each apartment. This would reduced investment and maintenance costs however it could introduce some ownership complexity.

**District heating pipe sizing in low rise blocks**

The right hand diagram in Figure 3-3 shows the proposed strategy for Sam Manners House, which is a low rise block with a central core, considered to have four floors (two floors of apartments in Block A and one floor of apartments in Block B) with a max 4 apartments per floor (I.e. 12 apartments in total). Here a larger 65mm diameter, and longer 10m pre-insulated district heating pipework from the street main has been assumed. This pipework then runs internally within a 65mm riser (plus 40mm insulation), reducing to 50mm riser (40mm insulation) serving the final floor. On each floor 15m of pipework has been assumed for a main branch per floor. A length of 5m of pipework has then been assumed running internally to each apartment to the HIU.

The left hand diagram in Figure 3-3 illustrates the pipework design considerations for low rise blocks without a central core (façade mounted alternative pipework option). Here, the building is considered to have four floors in Block A and three in Block B, with district heating pipework serving two properties per floor (i.e. 8 apartments in total Block A). A 5m length 50mm diameter pre-insulated district heating pipe from the building towards the street main has been assumed.

Running externally, a riser of 50mm diameter steel pipework, plus 40mm insulation is included, reducing down to 40mm diameter serving the top floor apartments. Branching inside the apartments and further pipework to the HIU has also to be provided.

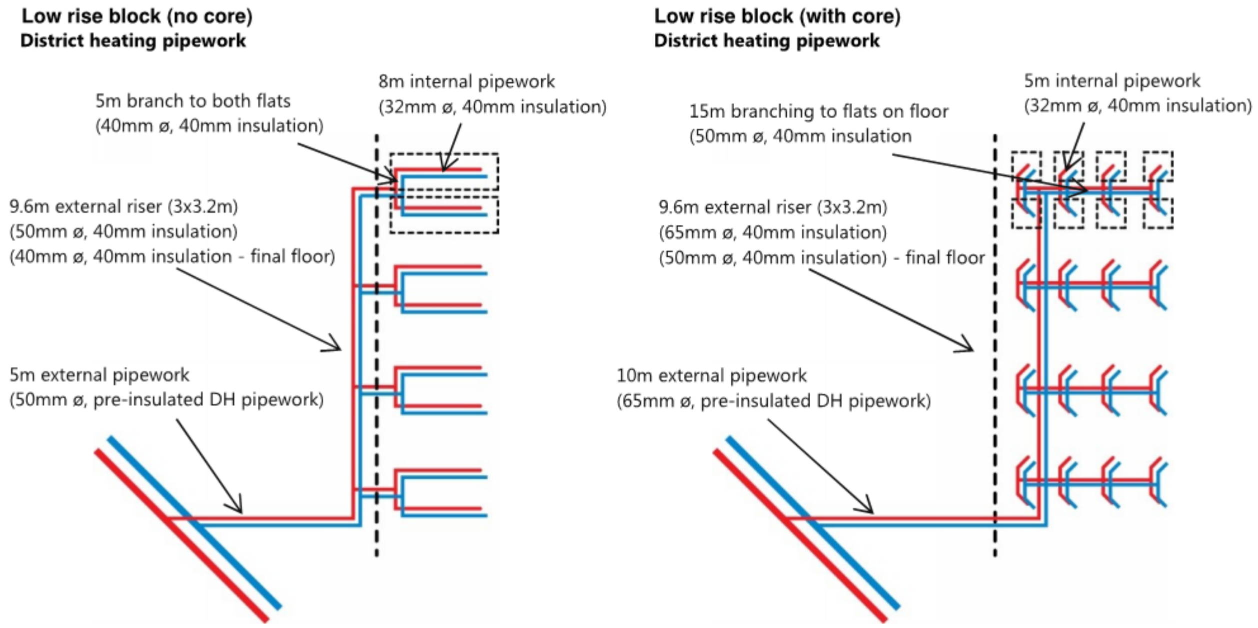



**Figure 3-3** Pipework length and thickness assumptions for low rise blocks (coreless on left; core on right).

To inform the pipework sizes assumptions for the future for the Sam Manners blocks, diversity calculations were applied to pipework thickness serving each floor, based on the Danish Standard DS 439[1]. The diversity calculations used for heating and hot water are given in Equation 1 and 2 below. This standard is appropriate for multiple dwellings where occupants of each dwelling have lifestyles that are independent of each other. Figure 3-4 illustrates these diversity levels in graphical format, showing that heating diversity factors becomes lower than DHW the higher the number of dwellings.

**Equation 1** Heat demand diversity calculation.

$$Fq = 0.62 + (0.38/n) \qquad (1)$$

*Where*

*Fq = Diversification factor for heat demand*

*N = Number of dwellings*

**Equation 2** Hot water demand diversity calculation.

$$Fh = (1.19n + 18.8\sqrt{n} + 17.6) / (37.598n) \qquad (2)$$

*Where*

*Fh = Diversification factor for hot water demand*

*N = Number of dwellings*

[1] Dansk Standard DS 439, 2009, Norm for vandinstallationer, https://webshop.ds.dk/da-dk/standards/ds-4392009

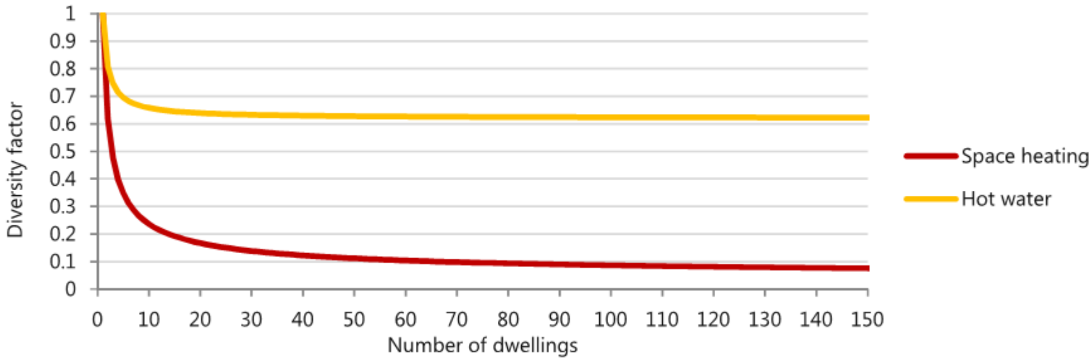



**Figure 2-4** Diversity factors for heating and hot water (graph drawn based upon diversity factors in DS 439).

## 4.0 Future Connection Provision

Based on the pipe sizing calculation within section 3.0, and due to the constraints of the volumetric construction of the apartment blocks on Sam Manners House, the strategy to facilitate connection to a current market or higher efficiency offsite heating and/or private wire network, is to provide full installed pre-insulated below ground grade external pipework to a safeguard position at the edge of the site into the block risers within the core.

**Figure 4-1** Future provision route to risers in cores of Block A & Block B.

A spare 100mmØ twin walled rigid-cable duct will also be installed from each riser to the site edge to allow the future installation of any cabling, wiring or future private wire network.

**Pipework Specification**

The pre-insulated pipework within the external below ground trenches to the risers, which will be installed as part of the development groundworks, shall be the Uponor Ecoflex Thermo Single, complete with PE-Xa with EVOH, SDR11 pipework encased in PE-X foam insulation, surrounded by a HDPE jacket.

**Uponor Thermo Single**

95 °C

6 bar

25-125mm

Main application
- Heating water

Other applications
- Waste water
- Chemicals

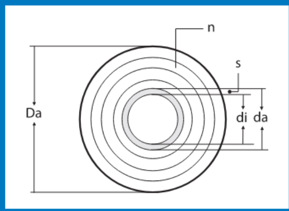
Medium pipe
- PE-Xa with EVOH, SDR 11

Option
- Heating cable

Insulating material
- PE-X foam

Material jacket pipe
- HDPE

Note:
The tried-and-tested solution for heating water distribution in local heating networks and for individual building tie-ins.




| Old Code | Order Code | Medium pipe da / di / s [mm] | n | Jacket pipe Da [mm] | Weight [kg/m] | Delivery lengths [m] | Bending radius [m] | Insulation thickness [mm] |
|---|---|---|---|---|---|---|---|---|
| 500002 | 1018109 | 25 / 20.4 / 2.3 | 4 | 140 | 1.10 | 200 | 0.25 | 45 |
| 500003 | 1018110 | 32 / 26.2 / 2.9 | 3 | 140 | 1.20 | 200 | 0.30 | 42 |
| 500004 | 1018111 | 40 / 32.6 / 3.7 | 4 | 175 | 2.20 | 200 | 0.35 | 55 |
| 500005 | 1018112 | 50 / 40.8 / 4.6 | 4 | 175 | 2.43 | 200 | 0.45 | 50 |
| 500006 | 1018113 | 63 / 51.4 / 5.8 | 3 | 175 | 2.73 | 200 | 0.55 | 43 |
| 500007 | 1018114 | 75 / 61.4 / 6.8 | 3 | 200 | 3.74 | 100 | 0.80 | 49 |
| 500008 | 1018115 | 90 / 73.6 / 8.2 | 3 | 200 | 4.20 | 100 | 1.10 | 39 |
| 500009 | 1018116 | 110 / 90.0 / 10.0 | 3 | 200 | 5.24 | 100 | 1.20 | 30 |
| - | 1083868 | 125 / 102.2 / 11.4 | 3 | 250 | 7.30 | 80 | 1.40 | 45 |

**Figure 4-2** Pre-insulated pipework specification.

Both ends of the pipework will be capped and sealed to maintain the integrity of the pipework. Future jointing to Uponor Ecoflex pipework shall be via Uponor approved Wipex fittings, specifically designed for connecting cross-linked polyethylene pipes, produced by or approved by Uponor, for hot and cold water in domestic and district heating installations.

5.0 Groundworks Provision

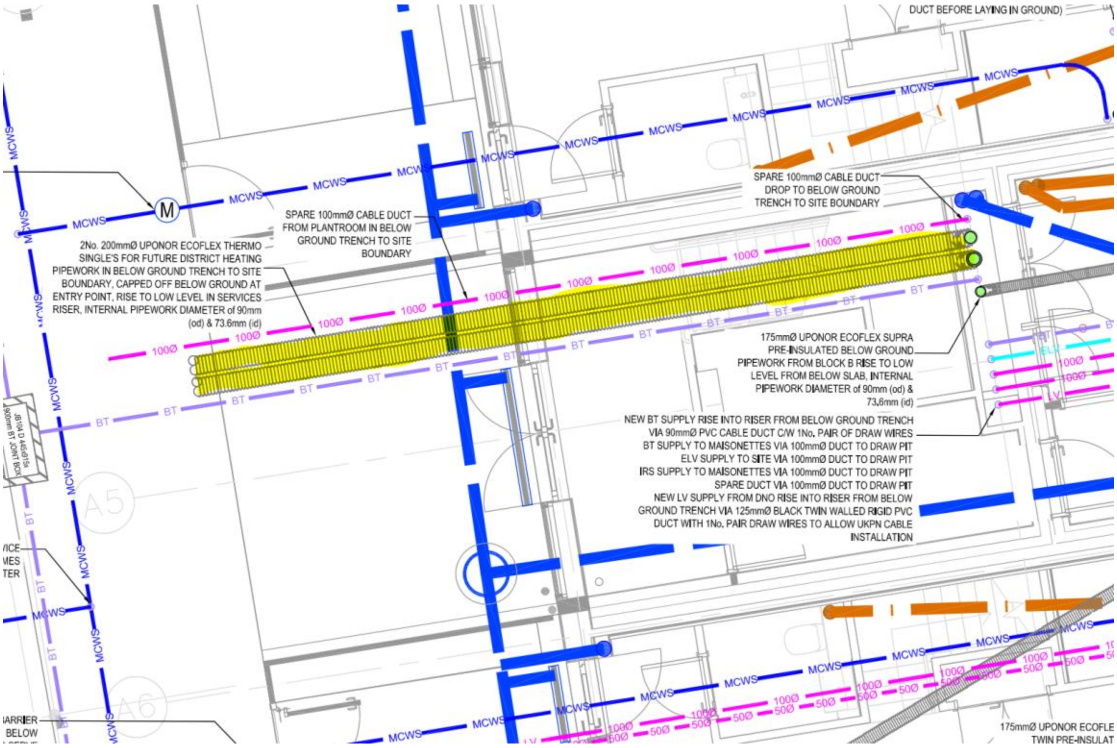



**Figure 5-1** Pre-insulated pipework and cable duct to Block A.

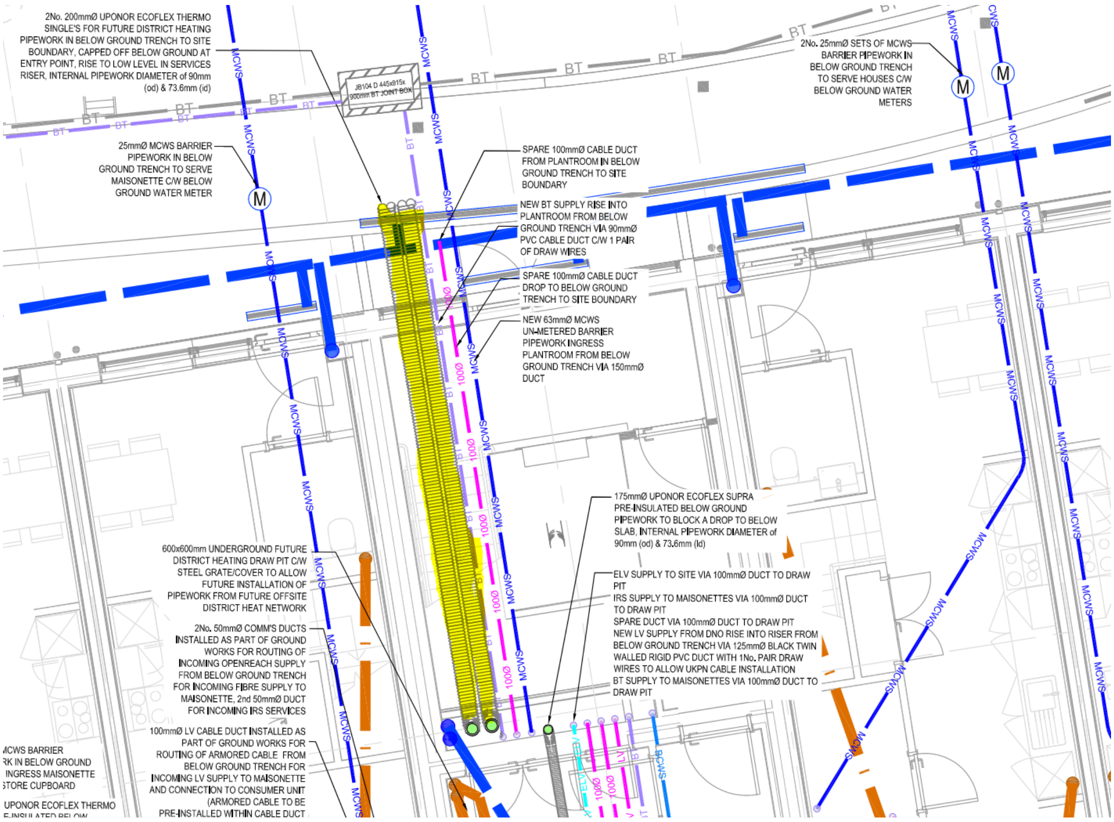



**Figure 5-2** Pre-insulated pipework and cable duct to Block B.