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Tees CCPP Project

The Tees Combined Cycle Power Plant Project

Land at the Wilton International Site, Teesside

Combined Heat and Power Assessment

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Regulation 5(2)(q)

Applicant: Sembcorp Utilities UK
Date: November 2017

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GLOSSARY

Abbreviation	**Description**
BAT	Best Available Technique
CCGT	Combined Cycle Gas Turbine
CCPP	Combined Cycle Power Plant
CHP	Combined Heat and Power
CHP-R	Combined Heat and Power Ready
Co-Gen	Co-Generation
EfW	Energy from Waste
HP	High Pressure
IHP	Intermediate High Pressure
IP	Intermediate Pressure
LP	Low Pressure
MWe	Megawatt Electric
MWth	Megawatt thermal

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1. SUMMARY

1.1 This CHP Assessment has been undertaken in line with the requirements of National Policy Statements NPS EN-1 and EN-2 and the Environment Agency (EA) CHP Ready Guidance, to support the application for a Development Consent Order and meet the Best Available Techniques (BAT) requirements of the CHP Ready Guidance.

1.2 Heat users on the Wilton International Site have been identified, these are currently supplied by other Sembcorp Utilities assets.

1.3 Sembcorp Utilities is actively marketing the Wilton International Site, including the provision of steam supplies.

1.4 The new Power Station will be CHP ready.

1.5 Periodic reviews of the heat load requirements of the Wilton International Site will be carried out.

2. INTRODUCTION

2.1 This document supports SembCorp Utilities DCO application for the construction and operation of a new Combined Cycle Power Plant (CCPP) with a capacity of up to 1700 MWe which will be located at the Wilton Site on the south side of the river Tees. The proposed plant would operate on natural gas and be constructed using advanced gas turbine combine cycle equipment with a net thermal efficiency of ~60%.

2.2 The Environment Agency requires that all applications for Environmental Permits for new installations regulated under the Environmental Permitting (England and Wales) Regulations 2010 demonstrate the use of Best Available Techniques (BAT) for a number of criteria, including energy efficiency.

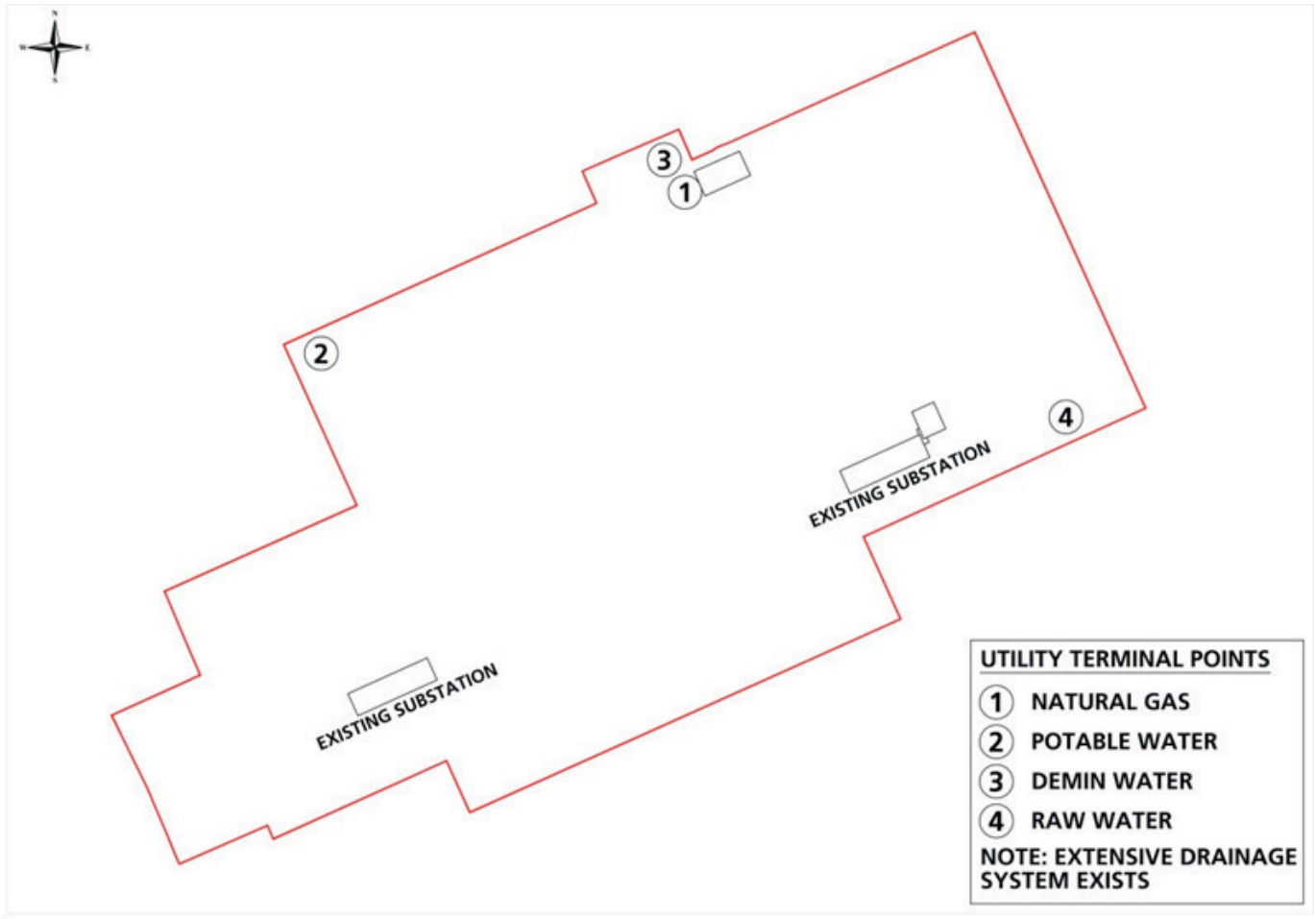
2.3 One of the principal ways in which energy efficiency can be improved is through the use of Combined Heat and Power (CHP), sometimes referred to as Co-Generation (Co-Gen). The document has accordingly been prepared in order to demonstrate that Combined Heat and Power (CHP) conditions can be achieved in respect of the proposed development.

2.4 Tees CCPP will be located to the immediate south west of the Wilton International Site, a 2,000 acre site which is home to a wide variety of energy intensive manufacturing facilities (such as chemical, petrochemical, biofuel, polymer and recycling) that use heat and power in their processes.

2.5 Wilton International site is owned and operated by Sembcorp. The site has extensive utilities infrastructure and established CHP generation equipment comprised of efficient gas and steam turbines integrated with biomass and Energy from Waste assets. These currently provide site customers with efficient low carbon power and heat.

2.6 The Tees CCPP site was also formally the site of Teesside Power Station (TPS). TPS was an 1875MW Combined Cycle Gas Turbine (CCGT) facility with capabilities to supply heat and power into the Wilton International site utilities, supplying supplementary steam and power to Wilton for many years until it was recently de-commissioned. Much of the electrical infrastructure for supplying power directly to the Wilton site remains in place and will be reused by Tees CCPP. Steam and water utilities and pipeline/service corridors also remain and will be reused. The existing substations and utility connection points are shown in the below figure.

Figure 1 Existing Connections to Utilities



3. IDENTIFICATION OF POTENTIAL HEAT LOADS

3.1 It is often recognised that opportunities for the supply of heat do not always exist from the outset (i.e. when a plant is first consented, constructed and commissioned). In this case very real opportunities for CHP/Co-Gen exist from the outset.

3.2 Tees CCPP will consist of up to 2 Combined Cycle Gas Turbine modules (CCGT modules) capable of generating up to 2 x 850MWe. Each CCGT module includes a steam turbine which will be specified to be capable of supplying both power and heat in the form of steam.

3.3 Power of up to 250MWe will be able to be supplied if necessary to the Wilton site via existing arrangements that are a legacy of TPS. Heat in the form of steam extracted from Tees CCPP will also be possible, up to 750MWth (subject to the final scale of Tees CCPP and detailed design of the steam turbines) that could clearly be used in processes on the Wilton site as and when demand for this materialises.

3.4 Sembcorp Utilities UK is a major industrial energy, utilities and services provider to process industry companies based with a strong belief and track record of adopting CHP and EfW where viable. The construction of Tees CCPP with CHP/Co-Gen capabilities will enable Sembcorp to attract new energy intensive manufacturing customers to the Wilton site.

3.5 While the intent is clear, the question of heat supply from the outset is an unknown. Historically, over the last three years there has been an average hourly heat supply of just under 150MWth from the plants on Wilton International Site. This represents about 200t/h of steam supply at a variety of pressures.

3.6 Demand can be extremely variable due to customer process requirements where the total heat load is made up of four different grades of steam which are used on plants on Wilton International Site, as shown in the below table.

Table 3.1 Different grades of steam

Grade of steam	Abbreviation	Pressure (barg)	Temperature (deg C)
High Pressure	HP	98	324
Intermediate High Pressure	IHP	58	311
Intermediate Pressure	IP	17	305
Low Pressure	LP	1.4	127

3.7 Demand in MWth at each different grade of steam are shown Table 3.2.

Table 3.2 Demand of different grades of steam

	HP	IHP	IP	LP
2014	20	15	96	19
2015	18	14	43	18
2016	26	13	87	11
Q1 2017	24	13	120	15
Average	22	14	87	16

3.8 The table below shows the capacity of the existing Sembcorp assets.

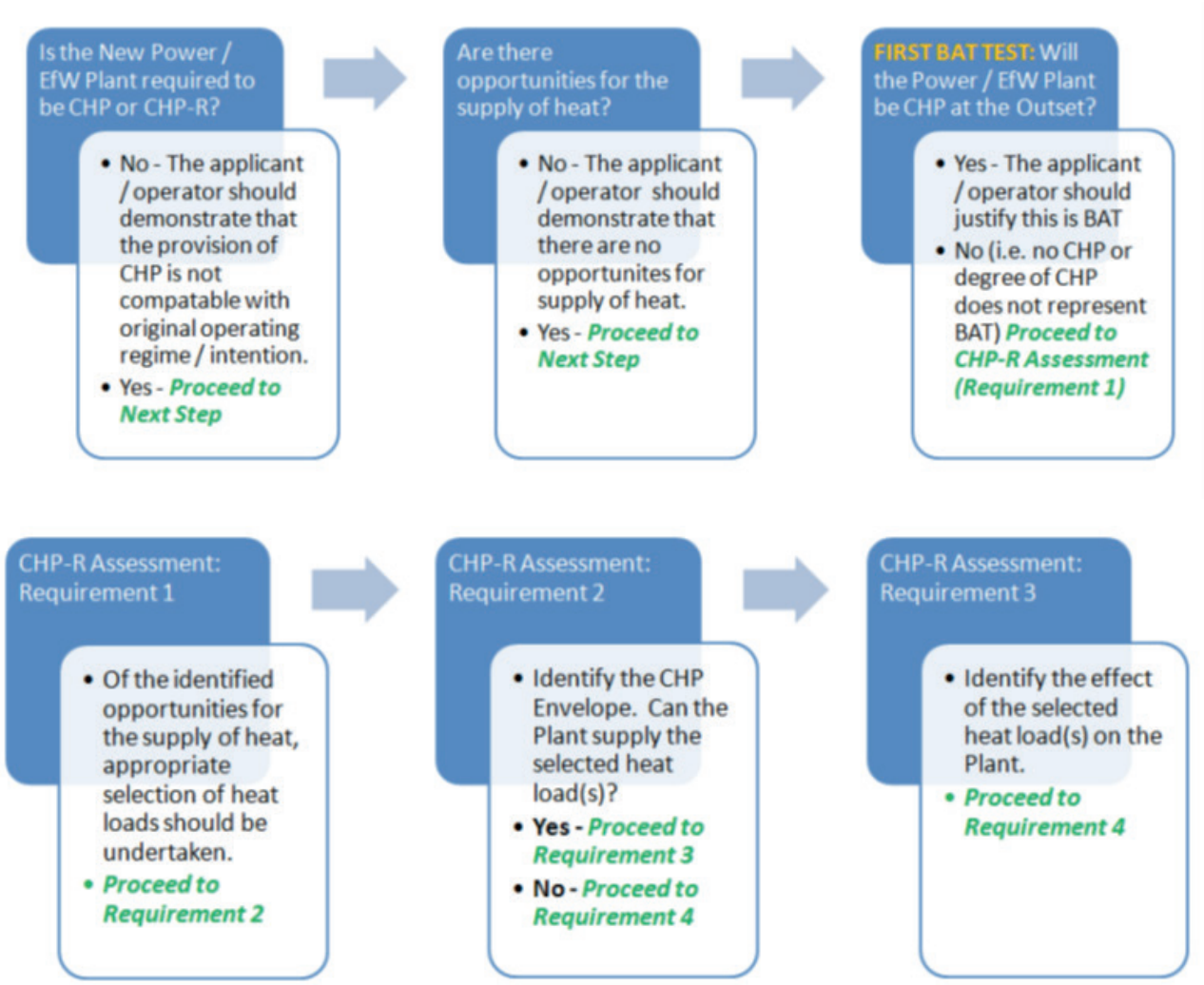
Table 3.3 Capacity of existing assets

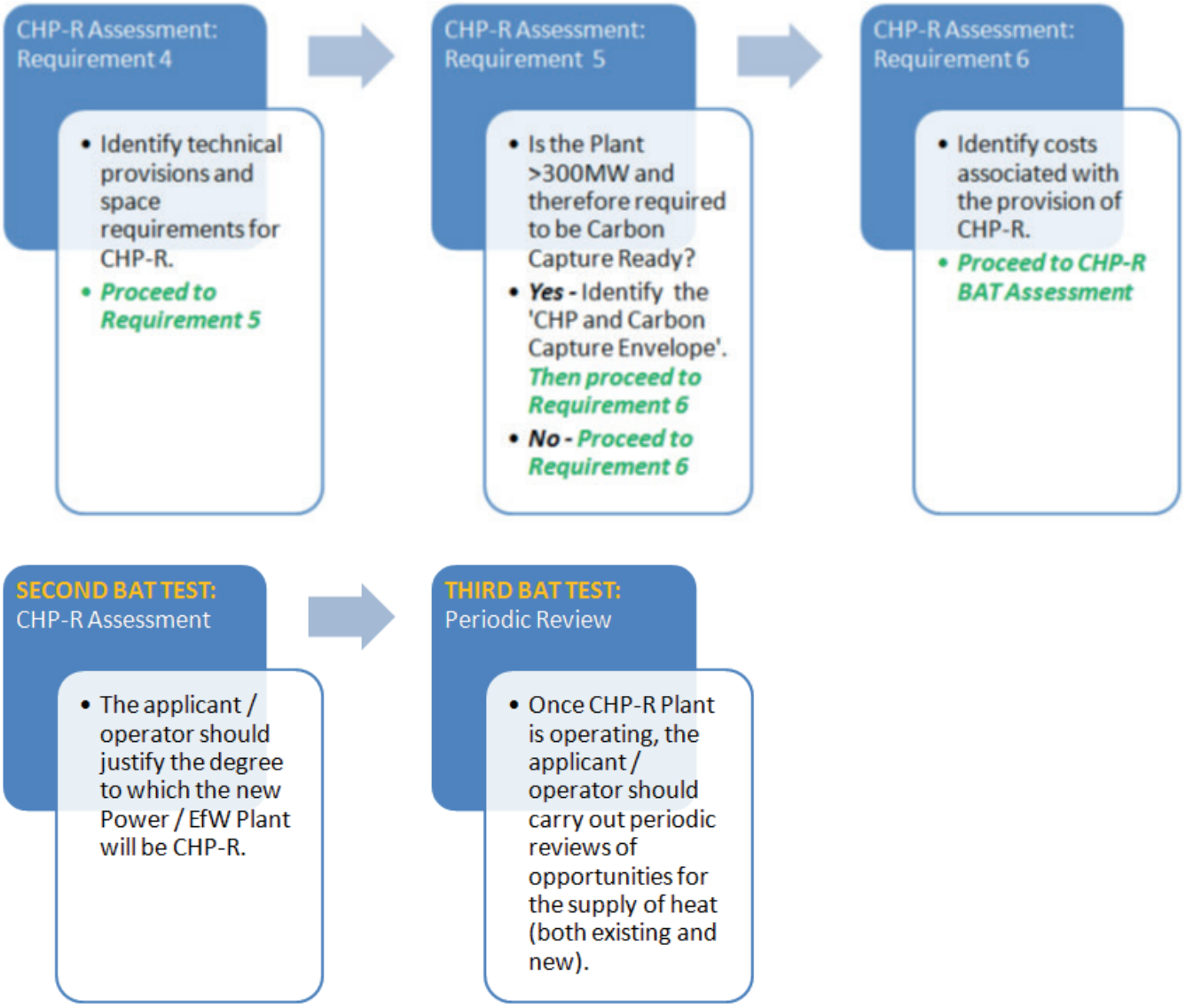
Existing Sembcorp Assets	Maximum Heat Export (MWth)
GT1/ST11 Gas Fired CHP Plant	116
GT2 Gas Fired CHP Plant	132
Package Boilers	100
Wilton 10 Biomass CHP Plant	12
Wilton 11 EfW CHP Plant	132
TOTAL	**492**

4. BAT ASSESSMENT TESTS

4.1 With respect to the use of CHP, there are three BAT tests which should be applied. These are as follows:

Figure 2: Bat assessment process FOR CHP and CHP-R




CHP-R Assessment: Requirement 4
• Identify technical provisions and space requirements for CHP-R.
• Proceed to Requirement 5
CHP-R Assessment: Requirement 5
• Is the Plant >300MW and therefore required to be Carbon Capture Ready?
• Yes - Identify the 'CHP and Carbon Capture Envelope'. Then proceed to Requirement 6
• No - Proceed to Requirement 6
CHP-R Assessment: Requirement 6
• Identify costs associated with the provision of CHP-R.
• Proceed to CHP-R BAT Assessment
SECOND BAT TEST: CHP-R Assessment
• The applicant / operator should justify the degree to which the new Power / EfW Plant will be CHP-R.
THIRD BAT TEST: Periodic Review
• Once CHP-R Plant is operating, the applicant / operator should carry out periodic reviews of opportunities for the supply of heat (both existing and new).

5. FIRST BAT TEST: WILL THE POWER/EFW PLANT BE CHP AT THE OUTSET?

5.1 It can be seen from the current heat load requirements of Wilton International Site, outlined in Table 3.2, that these can be met by the capacity of the assets already in operation on Wilton International Site. Discounting the package boilers, CHP assets can provide more than twice the average demand. Demand does however vary and reliability and availability must be considered.

5.2 Sembcorp is actively marketing the Wilton site and in the medium term will attract other companies to set up at Wilton. There is also a proposed South Tees District Heating Scheme by local councils: Redcar and Cleveland and Middlesbrough. This scheme is at an early stage and is currently completing its feasibility assessment. Sembcorp have already expressed interest in supporting the scheme and would welcome the opportunity to discuss the scheme further with the local councils.

First BAT Test: Are there opportunities for the supply of heat?

Conclusion: There are currently no immediate opportunities for the supply of heat but growth of business in the medium to long term will require new steam raising capacity.

6. SECOND BAT TEST – TO WHAT DEGREE WILL THE NEW POWER PLANT BE CHP READY?

6.1 This project will be capable of supplying steam at a number of different grades, but will require new customers with heat load demand which is viable and commercial agreements in place to supply.

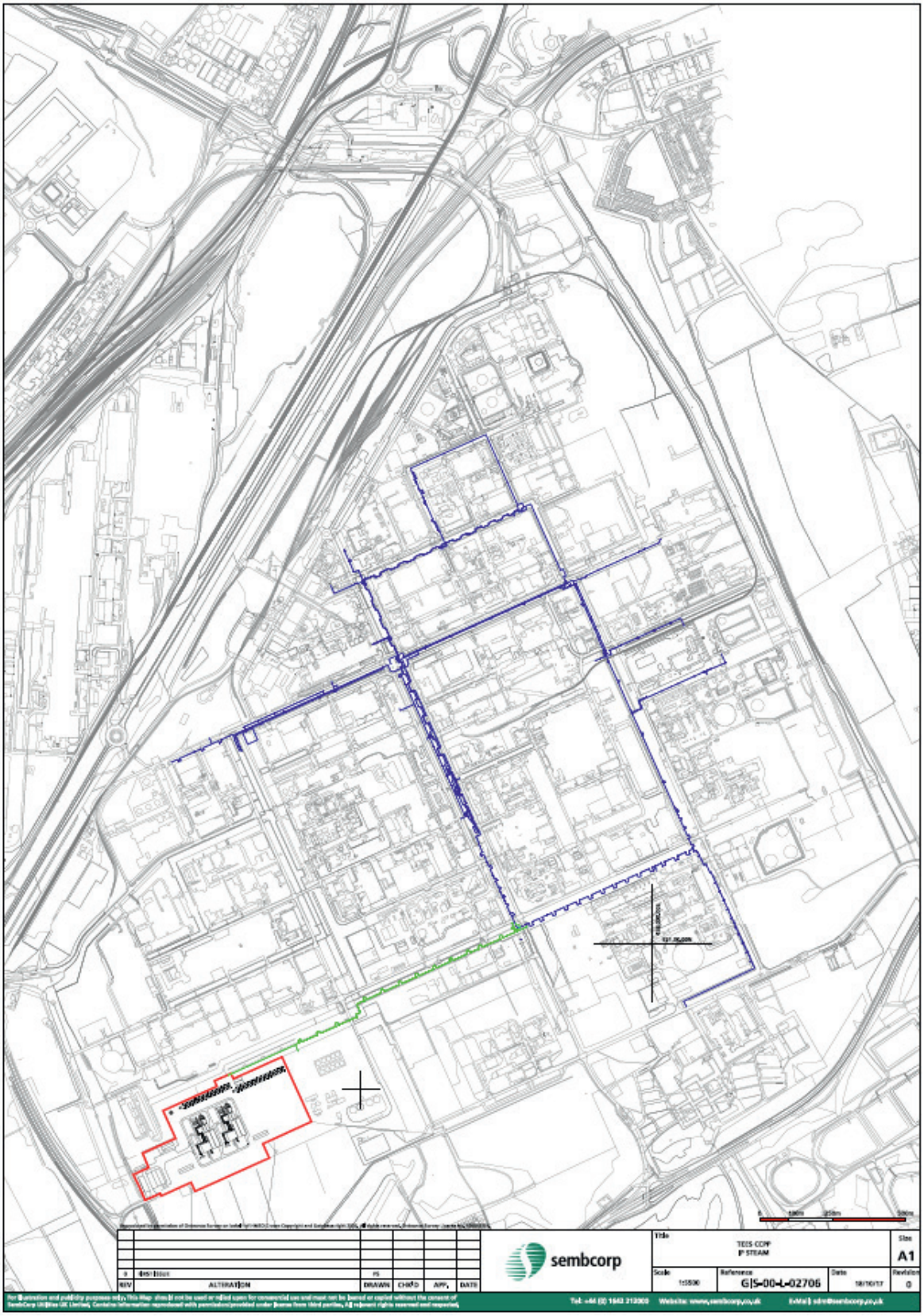
6.2 Prior to EPC (Engineering Procurement Construction) contract execution, it would be decided what specific grades of steam the project would be capable of supplying.

6.3 Modifications to the proposed new power plant will be minimal to allow the power plant to supply steam, this is likely to be achieved by the implementation of extraction systems, valves and controls. The prospect of more significant change being required to the steam turbine and steam raising equipment is a possibility but this will not be a barrier to implementation of CHP and will be examined in more detail during EPC negotiations.

6.4 While new steam pipelines may be required to be installed between the project site and Wilton International, it should be noted that there is an existing steam pipeline and corridor in place as a legacy of TPS.

6.5 This pipeline is still in position and serviceable if so required. This line is of high capacity and was used to supply up to 800t/h of [IP] steam (over 500MWth) to Wilton, when the heat demand on the Wilton International site was much higher. The pipeline is shown in green in the below figure, connecting to the existing intermediate pressure steam network on Wilton International.

Figure 3 Existing IP steam pipework



6.6 Based on current heat load demands on Wilton International, the most likely grade of steam needed by a new customer would be intermediate steam and so could utilise the existing pipeline.

6.7 If the heat load required by the new customer was a higher grade of steam then a new pipeline would need to be installed.

Second BAT Test: to what degree will the new Power Plant be CHP Ready?

Conclusion: The new Power Plant will be fully CHP Ready

7. THIRD BAT TEST: ONCE CHP-R PLANT IS OPERATING, THE OPERATOR SHOULD CARRY OUT PERIODIC REVIEWS OF OPPORTUNITIES FOR THE SUPPLY OF HEAT (BOTH EXISTING AND NEW).

7.1 Sembcorp is marketing Wilton International Site as a location capable of supplying a new customer with power, heat and other utilities. Depending on the size of the heat load required, and whether the current operating assets are capable of meeting the requirements, then steam from this project may be required.

7.2 Sembcorp Utilities UK is a major industrial energy, utilities and services provider to process industry companies with a strong belief and track record of adopting CHP and EfW where viable. The construction of Tees CCPP with CHP/Co-Gen capabilities will enable Sembcorp to attract new energy intensive manufacturing customers to the Wilton site. Therefore, Sembcorp will always carry out an assessment of a new customers heat load requirements as part of their overall utility demands.

Third BAT Test: Once CHP-R Plant is operating, the operator should carry out periodic reviews of opportunities for the supply of heat (both existing and new).

Conclusion: Sembcorp will carry out periodic reviews as a core part of its ongoing business activities