EP UK Investments

South Humber Bank Energy Centre Development Consent Order

South Marsh Road, Stallingborough, DN41 8BZ

Appendix 14B: Outline Drainage Strategy

Applicant: EP Waste Management Limited
Date: October 2019

DOCUMENT HISTORY

Revision	PEI Report issue		
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GLOSSARY

Abbreviation	Description
AEP	Annual Exceedance Probability
CC	Climate Change
CIRIA	Construction Industry Research and Information Association
DDF	Depth Duration Frequency
EA	Environment Agency
FRA	Flood Risk Assessment
Ha	Hectare
mAOD	Meters Above Ordnance Datum
NELIDB	North East Lindsey Internal Drainage Board
NELC	North East Lincolnshire Council
NPPF	National Planning Policy Framework
NSTS	Non-Statutory Technical Standards for SuDS
OSNGR	Ordnance Survey National Grid Reference
PPG	Planning Policy Guidance
ReFH2	Revitalised Flood Hydrograph Model
SHBEC	South Humber Bank Energy Centre
SuDS	Sustainable Drainage Systems

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1.0 INTRODUCTION

Background and Purpose of this Outline Drainage Strategy

1.1 AECOM Infrastructure and Environment Ltd (AECOM) were commissioned by EP Waste Management Ltd ('the Applicant') to prepare an Outline Surface Water Drainage Strategy for the Proposed Development of the South Humber Bank Energy Centre (SHBEC).

1.2 The Proposed Development is for the construction and operation of a new up to 95 MW energy from waste power station. The Proposed Development Site ('the Site') is located adjacent to the South Humber Bank Power Station (SHBPS) off South Marsh Road, Stallingborough in North East Lincolnshire centred at Ordnance Survey National Grid Reference (OS NGR) 523019, 413263 (see Figure 1).

1.3 The Proposed Development will occupy land which is currently undeveloped and therefore an increase of impermeable area will increase the rate and volume of surface water runoff (without mitigation). The Main Development Area of the Site is approximately 7 ha (see Figure 1).

1.4 The aim of this report is to provide an Outline Drainage Strategy for surface water runoff that is appropriate to the nature and scale of the Proposed Development, which will meet the necessary requirements of current planning guidance (refer to Section 2.0), and which will be sufficient to inform the Flood Risk Assessment (Preliminary Environmental Information (PEI) Report Appendix 14A, Volume III) and the development consent application. In order to meet this aim, the following was undertaken with regard to the Proposed Development:

- consultation with and obtaining data from North East Lincolnshire Council (NELC);
- consultation with and obtaining data from the Environment Agency (EA);
- review of publicly available data to determine the existing drainage infrastructure and its relation to the local Ordinary Watercourses (including those under the jurisdiction of North East Lindsey Internal Drainage Board (NELIDB)), Main Rivers and the Humber Estuary; and
- review of the Proposed Development design in light of the identified flood risks and identification of measures, where necessary, that would manage any residual flood risk to the Site to acceptable levels.

<u>Proposed Development Drawings</u>

1.5 This Outline Drainage Strategy report is based on the Proposed Development Site layout plan referred to below and shown in Figure 1. The drainage strategy will be reviewed when further design details are available during the detailed design phase; however, the broad principles are provided here.

1.6 Drawings illustrating the Proposed Development are provided in Volume II of the PEI Report. These include:

- Site Location Plan — Figure 1.1
- Proposed Development Site Layout Plan — Figure 4.1

1.7 Further details regarding the Proposed Development are provided in Chapter 4: The Proposed Development in PEI Report Volume I.

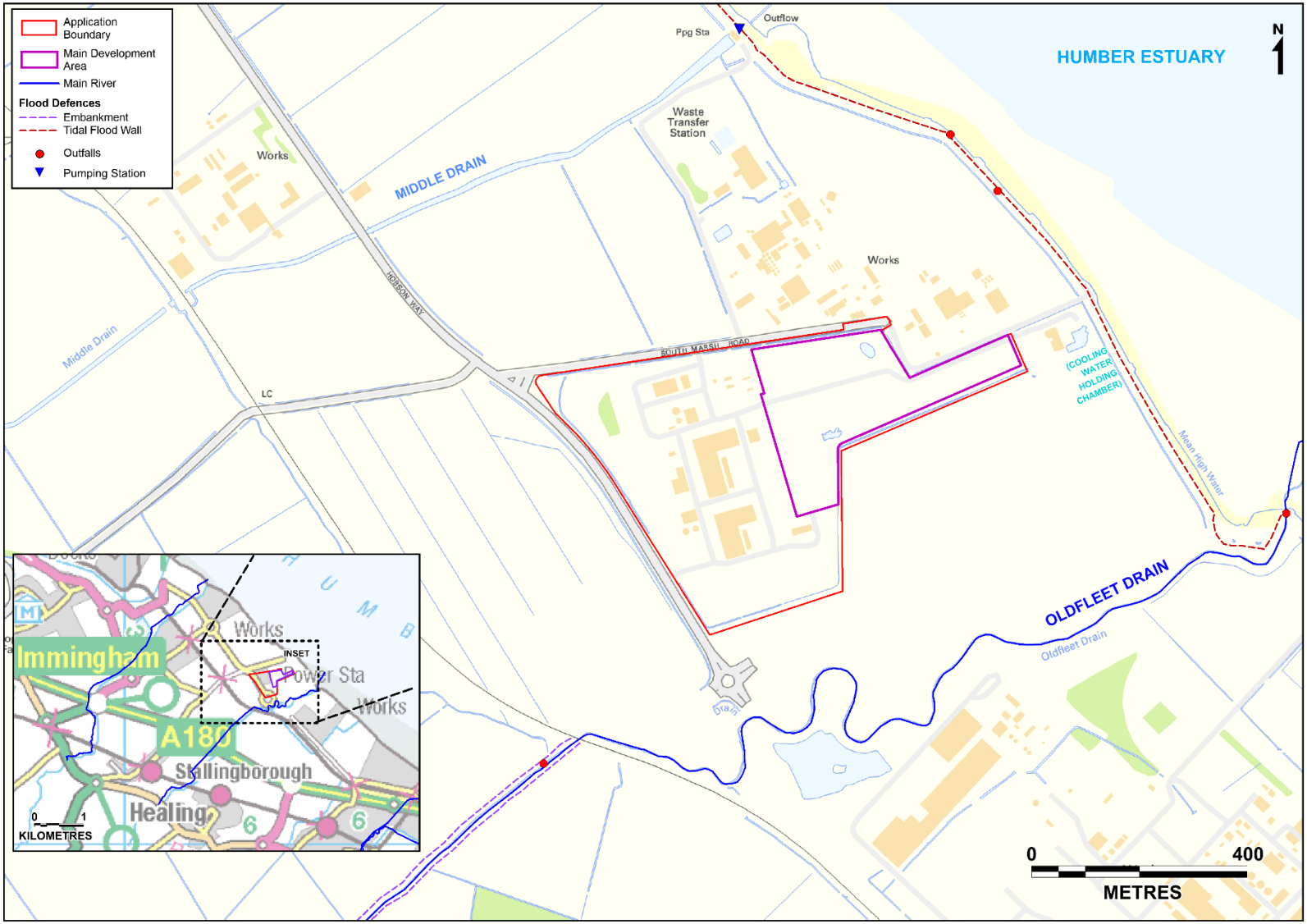

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Figure 1: The Site (in red) and Main Development Area (in purple)

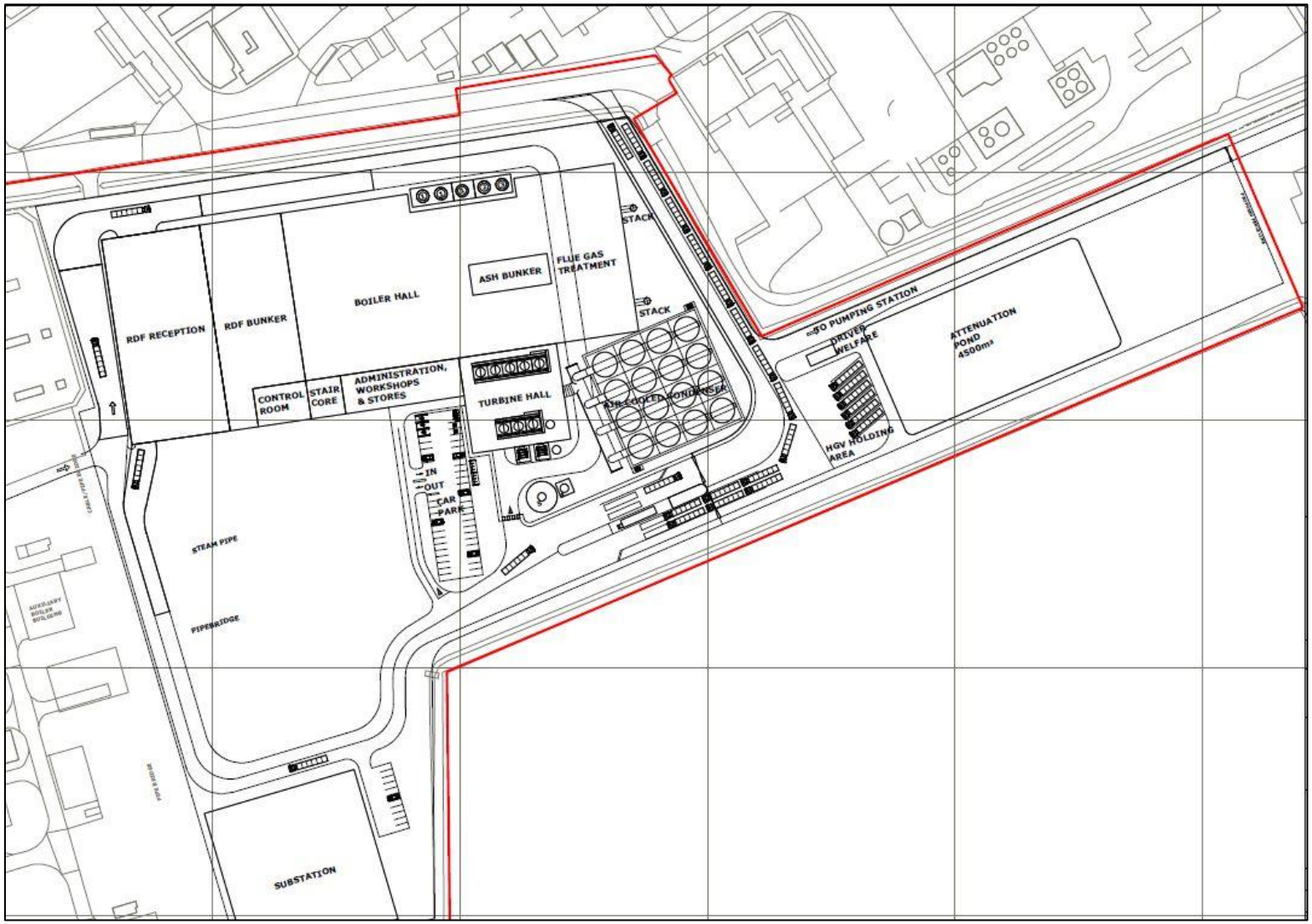

Figure 2: Proposed Development Layout (extract from Figure 4.1 in PEI Report Volume II)

2.0 POLICY AND STAKEHOLDER REQUIREMENTS

National Planning Policy Framework (2019)

2.1 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) and Planning Policy Guidance: Flood risk and coastal change (PPG) (Ministry of Housing, Communities and Local Government, 2019) requires that the new development should not increase flood risk both on the Site and to the area surrounding it. Surface water runoff should therefore not exceed the rates and volumes already generated by the existing Site and betterment should be provided where possible.

National Planning Statement EN-1 (2011)

2.2 Overarching National Policy Statement for Energy (EN-1) (Department of Energy & Climate Change, 2011a) provides the following general guidance relating to drainage assessments and climate change pertaining to energy production facilities:

- include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;
- consider if there is a need to be safe and remain operational during a worst-case flood event over the development's lifetime; and
- new energy infrastructure will typically be a long-term investment and will need to remain operational over many decades, in the face of a changing climate. Consequently, applicants must consider the impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure.

National Planning Statement EN-3 (2011)

2.3 Overarching National Policy Statement for Renewable Energy Infrastructure (EN-3) (Department of Energy & Climate Change, 2011b) provides the following general guidance relating to drainage, flood risk assessments and climate change pertaining to renewable energy production facilities:

- consider how the proposal would be resilient to effects of rising sea levels and increased risk from storm surge and tidal flooding resulting from climate change; and
- consider how plant will be resilient to increased risk of flooding and increased risk of drought affecting river flows.

Department for Environment, Food and Rural Affairs Non-Statutory SuDS Guidance (2015)

2.4 The Department for Environment, Food and Rural Affairs (Defra) published their Sustainable Drainage Systems: Non-Statutory Technical Standards (NSTS) in March 2015 (Defra, 2015) setting the requirements for the design, construction, maintenance and operation of SuDS (sustainable drainage systems). The NSTS are intended to be used alongside the NPPF and PPG.

2.5 The NSTS that are of chief concern in relation to the consideration of flood risk to and from development relate to runoff destinations, peak flow control and volume control as

provided in Table 1. Additional guidance is provided for structural integrity, designing for maintenance considerations and construction.

Table 1: Key NSTS relating to flood risk

CONSIDERATION	SUDS NSTS
Peak Flow Control	**NS2 –** "*For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must not exceed the peak greenfield runoff rate for the same event*"
	NS3 – "*For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event*".
Volume Control	**NS4 –** "*Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event*".
	NS5 – "*Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that*

CONSIDERATION	SUDS NSTS
	event".
	NS6 – "*Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk*".
Flood Risk within the Development	**NS7 –** "*The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event*".
	NS8 – "*The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development*"
	NS9 – "*The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property*"

Environment Agency

2.6 The EA general advisory comments set out the following recommendations:

- **Runoff Rates** – Peak discharge rates from a site will not increase as a result of a proposed development, up to a 1% Annual Exceedance Probability (AEP) (1 in 100 chance) storm event including an allowance for climate change (CC). The EA expects all applicants to strive to achieve greenfield runoff rates to reduce the impact of the development on the surface water drainage infrastructure, unless it is demonstrated that this is not practicable. Measures must ensure that surface water runoff will not increase flood risk to the development or third parties;
- **Storage Volumes** – Storage volume provision must be provided on site so that the Site will not flood from surface water during events up to a 3.3% AEP (1 in 30 chance) event. Surface water flooding will also be safely contained within the site boundary during all storm events up to a 1% AEP (1 in 100 chance) event, including an allowance for climate change;

- **Sustainable Drainage Techniques** – SuDS such as green roofs, ponds, swales and permeable pavements should be used. The SuDS hierarchy should be followed; and
- **Residual Risk** – The residual risk of flooding can be managed and contained safely on site should any drainage features fail or during an extreme storm event. The location, depth and flow routes of any over ground flooding should be clearly shown on a plan.

North East Lindsey Internal Drainage Board

2.7 The scoping consultation response from the North East Lindsey Internal Drainage Board (NELIDB) for the Consented Development (refer to Annex 2 of the Flood Risk Assessment (FRA) in Appendix 14A PEI Report Volume III), provided the following points for consideration:

- no development should be commenced until the Local Planning Authority (LPA) has approved a scheme for the provision, implementation and future maintenance of a surface water drainage system;
- the Board would support the use of SuDS and the drainage policies of NELC. Any discharge should be limited to the greenfield rate; however, Middle Drain Pump Station was designed to allow for areas of development (to the design standard of the day). Any potential increase in discharge would be subject to the drainage system being able to convey the flows (modelling required) and a development charge payable to the Board; and
- under the terms of the Land Drainage Act 1991 the prior written consent of the Board is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.

2.8 The EIA Scoping Opinion for the Proposed Development provided in Appendix 1B in the PEI Report Volume III identified the following additional requirements for consideration in the Environmental Statement and related FRA and drainage strategy, based on comments from the NELIDB:

- surface water discharge will be limited to the greenfield rate; and
- under the terms of the Land Drainage Act 1991 the prior written consent of the NELIDB is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.

North East Lincolnshire Council

2.9 The scoping consultation response from NELC for the Consented Development (refer to Annex 3 of the FRA in Appendix 14A PEI Report Volume III) stated that no development shall be commenced until a scheme for the provision of surface water drainage works has been approved in writing by the LPA. Such scheme shall be implemented to the satisfaction of the LPA.

2.10 NELC has created a SuDS Guide (NELC, 2016) which stipulates the expectations of NELC for designers and developers in regards to the use of SuDS. This guidance document has been produced based on best practice guidelines from the Construction Industry Research and Information Association (CIRIA) SuDS Manual (C753) (CIRIA, 2007).

2.11 The document details the requirements for SuDS, appropriate design processes and discusses various types of SuDS. Specific NELC requirements for drainage projects are also detailed with a checklist given for the required steps to be taken for the adoption of SuDS.

Anglian Water

2.12 Anglian Water's surface water drainage policy requires that the disposal hierarchy should be followed:

- discharge by infiltration to the ground;
- discharge to an open surface water body;
- discharge to a surface water sewer;
- discharge to a combined sewer;
- discharge to a foul sewer; and
- discharge rates and volumes are to be limited to the equivalent greenfield runoff rate (with on-site attenuation for all events up to the 1 in 100 (1% AEP) rainfall event plus climate change). Flooding must also not occur on any part of the development for the 1 in 30 year (3.3% AEP) rainfall event.

2.13 The scoping consultation response from Anglian Water in relation to the Consented Development (refer to Annex 4 of the FRA in Appendix 14A PEI Report Volume III) stated that the use of SuDS for the development is encouraged and provided a guidance document on the use of SuDS and an overview of the adoption policy should a developer seek to connect into an Anglian Water asset.

2.14 The EIA Scoping Opinion for the Proposed Development (Planning Inspectorate, October 2019) provided in Appendix 1B in the PEI Report Volume III identified the following additional requirements for consideration in the PEI Report and related FRA and drainage strategy from Anglian Water:

- consideration to all potential sources of flooding - including foul drainage, sewage treatment and water services;
- consideration of any increased flood risks linked to climate change;
- consideration of whether the Proposed Development would lead to alterations in the drainage patterns around the Site; and
- Anglian Water fully supports the use of SuDS as an alternative to discharging surface water to the public sewerage network and welcome further details of the proposed method of surface water disposal including the SuDS attenuation feature being provided for comment.

2.15 The detailed design of the drainage scheme will take these considerations into account.

3.0 EXISTING SURFACE WATER MANAGEMENT

Existing Site Drainage

3.1 The drawings listed below provided in Annex 1 of this report illustrate the existing drainage infrastructure at the Site:

- Phase 1 & 2 (DRG DS2500);
- Phase 1 & 2 (DRG DS2506);
- Phase 1 (DRG DS2507); and
- Phase 2 (DRG DS2560).

3.2 The effluent from the boiler facilities of SHBPS discharge into effluent basins with buried outlet pipes connected to the cooling water pumping station at the far eastern extent of the Site. Surface water from the rooftop and access road areas of the Site that are already developed is currently collected via gullies and conveyed into these effluent basins via buried surface water pipelines. A body of standing water located at the far eastern extent of the Site next to the cooling water pumping station is a holding channel for water in and out of the cooling pipes. The combined water is discharged off Site into the Humber Estuary.

3.3 Surface water land drains (Ordinary Watercourses) exist around the perimeter of the Site; these eventually discharge to the Humber Estuary via Middle Drain Pumping Station (located approximately 550 m to the north of the Site). Site topography is generally flat, but slopes gently to the east (towards the Humber Estuary). No level information has been provided for these drains and it is understood that these land drains accept lateral drainage of surface water from the greenfield areas of the Site.

3.4 The plans and OS mapping show two existing ponds on Site, however these have been infilled in 2019.

Existing Surface Water Runoff Rates

3.5 In accordance with the policy guidance outlined in Section 2.0, new development should not increase flood risk on the Site and the surrounding area. Therefore, surface water runoff rates leaving the Site should not exceed the existing runoff rate.

3.6 The existing greenfield surface water runoff rate for the Main Development Area within the Site has been calculated using FEH Web Service (Centre for Ecology and Hydrology) catchment data and Depth Duration Frequency (DDF) FEH2013 rainfall model data for the local catchment area at OS NGR 523150, 413350.

3.7 Table 2 details the existing runoff rates calculated during the 1%, 3.3% and >99% AEP events, plus an allowance for climate change as defined by the EA's latest guidance (2019) (refer to Section 3.0 of the FRA in Appendix 14A of the PEI Volume III Report).

Table 2: Calculated ReFH2 greenfield surface water runoff rates for the Main Development Area within the Site

RAINFALL EVENT (AEP / 1 IN X YEARS)	REFH2 GREENFIELD RUNOFF RATES (L/S/HA)	TOTAL RUNOFF (7.3 HA) (L/S)
>99% (1 in 1)	0.5	3.7
3.3% (1 in 30))	1.2	8.8
1% (1 in 100)	1.6	11.5

4.0 PROPOSED SURFACE WATER MANAGEMENT

Un-attenuated Proposed Surface Water Runoff Rates

4.1 The runoff rate from the proposed land use within the Main Development Area will increase due to an increase in impermeable area (hardstanding and roofing). In practice, 100% of the Main Development Area will not be changed from greenfield to impermeable, however, it has been assumed at this stage that up to 6.5 ha will become impermeable as a worst-case scenario. The anticipated un-attenuated surface runoff rates, were calculated using the HR Wallingford Rational Method Procedure in MicroDrainage software:

$$Q = 2.78 \times C\ I\ A$$

Where
Q = runoff rate (l/s)
C = runoff coefficient (0.9 used to represent hard standing)
I = Rainfall intensity (mm/hr)
A = Site area (ha)

4.2 An assumed runoff coefficient of 0.9 has been used for the calculations. These rates are provided in Table 3.

Table 3: Calculated impermeable surface water runoff rates for the proposed land use within the Main Development Area (up to 6.5 ha); un-attenuated (including allowances for climate change)

FLOOD EVENT (% AEP / 1 IN X YEARS)	TOTAL SITE (6.5 HA) RUNOFF (L/S) FOR A RANGE OF RAINFALL DURATION								
	15 mins	30 mins	1 hr	2 hr	3 hr	5 hr	12 hr	24 hr	48 hr
50% (2)	440	289	181	127	100	71	39	23	14
20% (5)	775	503	316	201	151	104	53	31	18
10% (10)	1008	660	416	254	188	127	63	36	21
3.3% (30)	1390	917	579	340	247	163	80	45	26
2% (50)	1561	1036	656	381	275	181	88	50	28
1% (100)	1811	1207	766	439	316	207	100	57	32
1% (100) + 20% CC	2173	1448	919	527	379	248	120	68	38
1% (100) + 40% CC	2535	1690	1072	615	442	290	140	80	45

Surface Water Volume Attenuation Requirements

4.3 In order to not increase flood risk elsewhere, in accordance with the NPPF, EA, NELC, and NELIDB requirements, discharge of surface water runoff from the Main Development Area will be restricted to the existing greenfield runoff rate to prevent an increased risk of flooding downstream. A surface water attenuation solution will be implemented on Site to ensure the greenfield runoff rates presented in Table 2 are not exceeded.

4.4 The minimum achievable discharge from outfall control structures, for example a HydroBrake, is usually 5 l/s. Consultation with the NELIDB (refer to Annex 2 of the FRA in Appendix 14A PEI Report Volume III) concluded with an agreement in principle that a maximum discharge rate of 5 l/s during the 1 in 1 year event is acceptable for the total runoff from the Main Development Area of the Site.

4.5 The MicroDrainage Source Control quick storage estimate tool was used to calculate the necessary storage volumes, presented in Table 4 and Annex 2 of this report. FEH 2013 DDF rainfall data for the local catchment area (OS NGR) 523150, 413350 was used in the calculations. A conservative assumption of zero infiltration has been made, in the absence of permeability data for the site.

Table 4: Calculated surface water runoff attenuation volumes and areas for storage required for the Main Development Area (assuming up to 6.5 ha impermeable land use)

SCENARIO	RAINFALL EVENT (AEP / 1 IN X YEAR)	TOTAL STORAGE VOLUME (M^3) – MINIMUM	TOTAL STORAGE VOLUME (M^3) – MAXIMUM	TOTAL STORAGE PLAN AREA (ASSUMING 2 M DEPTH) (M^2) - MINIMUM	TOTAL STORAGE PLAN AREA (ASSUMING 2 M DEPTH) (M^2) - MAXIMUM
Free Discharge	1% (1 in 100) + 40% CC	7535	7935	3768	3968
No Discharge	1% (1 in 100) + 40% CC	8106		4053	

4.6 Table 4 also provides plan areas for each of the calculated volumes to indicate the area of land that is required for these storage areas. A 2 m depth was assumed for these calculations, based on the assumed depth of the land drains around the perimeter of the Site. These storage volumes are preliminary estimates, and further detailed surface water modelling will be undertaken as part of a detailed design phase to more accurately assess the storage volume requirements once the exact extent of proposed impermeable area is confirmed.

Proposed Surface Water Attenuation Solution

Consideration of Appropriate SuDS Techniques

4.7 In line with the NPPF, Defra, EA and NELIDB advisory recommendations, best practice guidelines and local planning policy, SuDS should be used as a preferential option. A summary of SuDS defined in the CIRIA SuDS Manual (C753) is given (CIRIA, 2007) in Table 5. This is not an exhaustive list and other options should be considered. It can be seen that the proposed storage pond is a preferable option, but other techniques should also be considered during the detailed design phase.

Table 5: Sustainable drainage systems

TECHNIQUE	DESCRIPTION	RESTRICTIONS OF USE
Storage Pond	Storage ponds can be used to attenuate overland runoff and slowly release it into a watercourse or sewer. These systems do not offer water quality benefits unless additional water quality measures are added such as filters or sedimentation volume.	Storage ponds may require substantial earthworks and thus incur high costs during the construction phase. Additionally, large ponds which store water above ground level may be classified as reservoirs which are subject to a range of legislative requirements. Land take requirements for storage ponds are likely to be substantial.
Permeable Paving	Permeable paving allows rainwater to infiltrate through a hard-standing surface to underlying soil or drainage infrastructure, from which it may infiltrate or be directed to a local watercourse or sewer.	Permeable pavements may be restricted by the presence of basements or groundwater levels as well as high imposed loads.
Rainwater Harvesting	Rainwater from roofs and hard surfaces can be stored and used for non-potable purposes. This can provide a reduction of surface water runoff through control at source as well as reducing the demand on the water supply system.	Rainwater harvesting is dependent on a consistent supply of rainwater which cannot be ensured. As such it will be used as a supplement to conventional water supply only.
Below Ground Attenuation	Below ground storage tanks will attenuate surface water flows in much the same way as surface water ponds, although with reduced land take. Storage tanks will typically require a hydro brake to ensure a steady and controlled discharge.	Upfront costs are likely to be high for buried storage tanks. The maintenance regime may be onerous or involve heightened health and safety risks due to enclosed spaces.

Attenuation Storage

4.8 Surface water runoff is to be collected on Site and conveyed to a surface water attenuation pond SuDS feature via the use of gullies, drainage ditches/ swales where possible. Site topography is conducive for flows to be gravity drained to a surface water attenuation area located at the eastern edge of the Main Development Area within the Site where opportunity is presented for attenuation based SuDS (see Figure 2). The extent of this pond illustrated in Figure 2 will accommodate the total storage plan area required (as presented in Table 4) assuming a 2 m depth.

4.9 It is proposed that this attenuation pond will outfall into one of the existing land drainage ditches located along the southern or northern boundary of the Site using a flow control mechanism such as a Hydro-Brake to limit the discharge to greenfield rates. The detailed drainage design stage will confirm that the bed levels of the local land drains into which the attenuation solution will discharge are appropriate relative to the bed levels of the storage solution to ensure they are positively drained by gravity (i.e. to confirm that no additional pumping is required).

4.10 These drains flow east towards the Humber Estuary, and divert water either north to Middle Drain pumping station located approximately 550 m north of the Site, or south eastwards to Oldfleet Drain that outfalls via a flapped culvert into the Estuary approximately 450 m south-east of the Site. The two additional outfalls located north of the Site along one of these drains also enable runoff to discharge whilst tide levels are low enough and the flaps are open.

4.11 As the Middle Drain pumping station discharges into the tidal Humber Estuary, it may be the case that during some high tide events, discharges into either the southern or northern drains become restricted. Design for this will be allowed for during the detailed design phase. To illustrate the effect that this may have on the storage volume, a conservative assumption that no discharge is allowed into the drain during the duration of the critical storm has been applied in this outline strategy. An indicative storage volume for this scenario was calculated and is also presented in Table 4.

4.12 A detailed drainage design phase will confirm the storage volumes required once the exact impermeable area of the proposed land use is confirmed, and it will confirm the exact location and feasibility of the proposed outfall from the attenuation pond into the existing land drainage network.

4.13 This proposed Outline Drainage Strategy is in accordance with the principles defined by the NPPF, PPG, EA, NELC, NELIDB and Anglian Water as defined in Section 2.0. Further consultation will be undertaken at the detailed design phase with NELC to obtain their approval for the provision, implementation and future maintenance of the surface water drainage (SuDS) scheme, and with NELIDB to obtain their discharge consent into either of the land drains on the southern or northern boundaries of the Site.

5.0 RESIDUAL RISK MITIGATION

Drainage System Failure and Maintenance

5.1 Following the completion of the Proposed Development, an additional residual risk relates to maintenance of the on Site drainage infrastructure. Failure, blockage and capacity exceedance above that of the design events for the drainage system are a potential risk to the Site and the surrounding area.

5.2 In order to reduce the risks, maintenance of the system will be incorporated in general site management and remains the responsibility of EP Waste Management Ltd. A manual will be prepared detailing each drainage feature on Site, the maintenance required, timescales for maintenance and who is responsible for undertaking the maintenance. Maintenance of the Site drainage system will include all pipes, discharge structures and any SuDS implemented on Site in accordance with the recommendations in the SuDS Manual.

Design Capacity Exceedance

5.3 CIRIA C635 provides guidance on measures that can be incorporated into the detailed design of developments to steer surface water that has exceeded the capacity of the drainage system away from buildings and route it towards the intended point of attenuation and discharge (for example along swales and roads using raised kerbing and through parking areas). The overspill feature of the surface water attenuation solution on Site will be designed to convey water towards either of the land drains found along the southern or northern boundaries of the Site following further consultation with the NELIDB to obtain their agreement, in the event of overtopping.

6.0 REFERENCES

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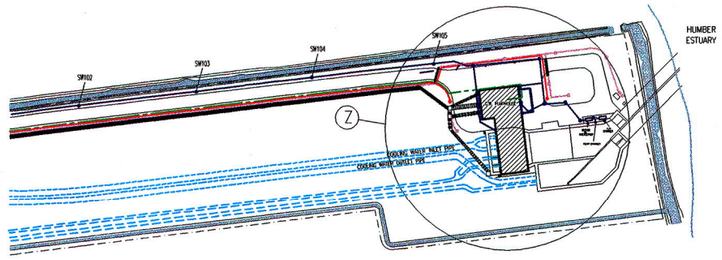
ANNEX 1: EXISTING DRAINAGE INFRASTRUCTURE DRAWINGS

- DRG DS2500 – Site services Phase 1 and Phase 2
- DRG DS2506 – Surface, foul, oily water HRSG blowdown services
- DRG DS2507 – Surface waste Phase 1
- DRG DS2560 – Surface water Phase 2

I.V.O. GENERATION SERVICES (UK) LTD SOUTH HUMBER BANK POWER STATION

IVO GROUP



SITE CONTINUATION FROM X - X

SOUTH MARSH ROAD

PLAN GRID

CAR PARK

WORKSHOP & STORE

OFFICE BLOCK

BRITISH GAS COMPOUND

INSTRUMENT BUILDING

REGULATOR BUILDING PHASE TWO

REGULATOR BUILDING PHASE ONE

BOILER HOUSE PHASE ONE

BOILER HOUSE PHASE TWO

WATER TREATMENT BUILDING

RAW WATER TANK

DEMIN WATER TANK

CONDENSATE TREATMENT TANK

STEAM TURBINE BUILDING

ELECTRICAL BUILDING

AUXILIARY BOILER BUILDING

GAS TURBINE BUILDING

CONTROL BUILDING

G.I.S. BUILDING

NATIONAL GRID COMPOUND

GAS BOTTLE STORE

EMERGENCY DIESEL GENERATOR

FUEL GAS PREHEATER

LIQUID/DUST SEPERATOR

SETTLEMENT POND

PUMP

HOBSON WAY

PHASE 1

PHASE 2

E.T.L.

TEMPORARY MAIN

"ABANDONED SURFACE WATER PIPE TO SETTLING POND"

TERMINATION NOT KNOWN

INTERCONNECTION PHASE 1 TO PHASE 2

CONNECTION TO TANKS FOR EMPTYING

DETAIL 'Y'
STATION GRID SETTING OUT

GRID NORTH
TRUE NORTH
GAS TURBINE BUILDING
413285N
572285E

ENLARGED AREA 'Z'

- DITCH
- ABANDONED SURFACE WATER DRAIN
- EFFLUENT PUMPED MAIN
- GAS MAIN (ABB SPECIFICATION)
- RAW WATER MAIN (BLUE MDPE, SDR 17.6 MP 3bar)
- POTABLE WATER MAIN (BLUE MDPE, SDR 17.6 MP 2.5bar)
- FIRE FIGHTING MAIN (BLUE MDPE, SDR 11 MP 10bar)
- DEMIN WATER MAIN (BLUE MDPE, SDR 17.6 MP 4bar)
- TWIN COMPRESSED AIR LINES (BLUE MDPE, SDR 11 MP 9.5bar)
- EFFLUENT MAIN (BLACK MDPE, SDR 17.6 MP 2bar)
- SURFACE WATER DRAIN AND MANHOLE
- BOILER BLOWDOWN DRAIN
- FOUL WATER DRAIN AND MANHOLE
- OILY WATER DRAIN AND MANHOLE
- COMBINED DRAINAGE AND KERB SYSTEM (150 uPVC-CS OUTLET)
- ROAD CHANNEL (150 uPVC-CS OUTLET)
- 6 No. CABLE DUCTS ARRANGED THUS: 150 DIA.
- CABLE DRAMPIT
- LIGHTING COLUMN (LC)
- BT CABLE DUCT & DRAMPIPE
- FIRE HYDRANT
- PILED MONUMENT
- CABLE TRENCH
- FENCE

A. BYPASS OIL INTERCEPTOR EAST. NORTH OF AUX. BOILER HOUSE.
B. OIL SEPERATOR (LOCAL TREATMENT). NORTH OF AUX. BOILER HOUSE
C. FOUL TREATMENT UNIT FTU2. NORTH OF AUX. BOILER HOUSE.
D. OIL SEPERATOR (LOCAL TREATMENT). SOUTH OF WORKSHOP.
E. FOUL TREATMENT UNIT FTU1. WEST OF BRITISH GAS COMPOUND.
F. FOUL PUMP STATION FPS1. NORTH OF OFFICE BLOCK.
G. CLASS 1 OIL SEPERATOR. WEST OF OIL CONTAINMENT TANK.
H. BY-PASS OIL INTERCEPTOR (LOCAL TREATMENT). NATIONAL GRID COMPOUND.
J. BY-PASS OIL INTERCEPTOR (LOCAL TREATMENT). NATIONAL GRID COMPOUND.
K. CESS POOL. NATIONAL GRID COMPOUND.
L. CONDENSATE COLLECTING TANK. I.V.O. GAS COMPOUND
M. NEUTRALISATION PIT. NORTH WEST CORNER STEAM TURBINE BUILDING.
N. FILTER TRAP EAST SIDE WORKSHOP & STORE.

NOTE:
SERVICES (OTHERTHAN CABLES) CROSS ROADS INSIDE SERVICE SLEEVES.

'ABB' REFERENCE DRAWINGS, PHASE ONE.

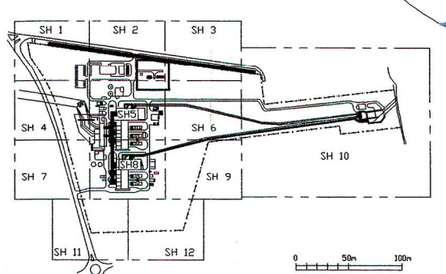
20108/B/001	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 1 OF 12
20108/B/002	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 2 OF 12
20108/B/003	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 3 OF 12
20108/B/004	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 4 OF 12
20108/B/005	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 5 OF 12
20108/B/006	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 6 OF 12
20108/B/007	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 7 OF 12
20108/B/008	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 8 OF 12
20108/B/009	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 9 OF 12
20108/B/010	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 10 OF 12
20108/B/011	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 11 OF 12
20108/B/012	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 12 OF 12
20108/B/013	CW PIPELINE GA SI BUILDING TO CW PUMPHOUSE
20108/B/014	CW PIPELINE CONSTRUCTION DETAILS
20108/B/021	HARD LANDSCAPING
20108/L/325	GA OF EFFLUENT BASIN EAST
20108/L/330	GA OF OIL CONTAINMENT TANK
20108/L/332	GA & RC DETAILS OF EFFLUENT BASIN WEST
20108/L/333	GA & RC DETAILS OF BYPASS OIL INTERCEPTOR WEST
20108/L/334	GA & RC DETAILS OF BYPASS OIL INTERCEPTOR EAST
20108/L/335	GA & RC DETAILS OF RAW WATER BREAK TANK

'ABB' REFERENCE DRAWINGS, PHASE TWO.

20162/B/001	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 1 OF 12
20162/B/002	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 2 OF 12
20162/B/003	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 3 OF 12 (NOT USED)
20162/B/004	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 4 OF 12
20162/B/005	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 5 OF 12
20162/B/006	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 6 OF 12
20162/B/007	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 7 OF 12
20162/B/008	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 8 OF 12
20162/B/009	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 9 OF 12
20162/B/010	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 10 OF 12
20162/B/011	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 11 OF 12 (NOT USED)
20162/B/012	LAYOUT OF ROADS AND EXTERNAL SERVICES - SHEET 12 OF 12 (NOT USED)
20162/B/013	CW PIPELINES GA LAYOUT
20162/B/014	CW PIPELINE CONSTRUCTION DETAILS - SHEET 1
20162/B/015	CW PIPELINE CONSTRUCTION DETAILS - SHEET 2
20162/B/901	STANDARD DETAILS
20162/B/990	
20162/L/325	GA EFFLUENT BASIN EAST
20162/L/327	GA/RC DETAILS EFFLUENT BASIN WEST + PUMP CHAMBER
20162/L/328	GA OIL CONTAINMENT TANK
20162/L/239	RC DETAILS OIL CONTAINMENT TANK
20162/L/330	GA/RC DETAILS BYPASS OIL INTERCEPTORS

DRAWSIGN REFERENCE DRAWINGS.

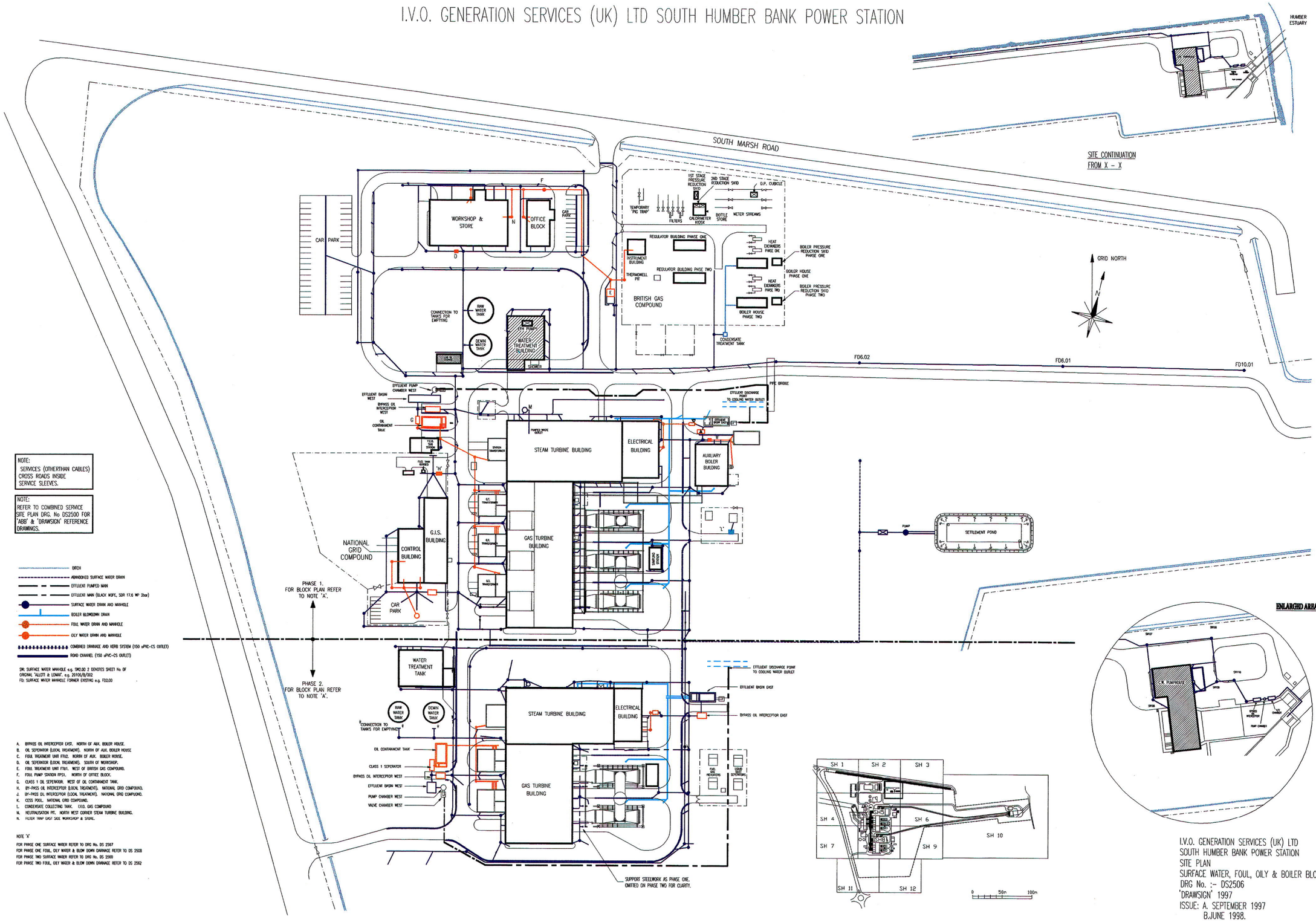
DS2500	SITE PLAN. COMBINED SITE SERVICE LAYOUT. PHASE 1 & 2.
DS2501	BLOCK PLAN. COMBINED SITE SERVICE LAYOUT. PHASE 1.
DS2502	SITE PLAN. GAS & COMPRESSED AIR MAINS. PHASE 1 & 2.
DS2503	BLOCK PLAN. GAS & COMPRESSED AIR MAINS. PHASE 1.
DS2504	SITE PLAN. POTABLE, RAW & DEMIN WATER MAINS. PHASE 1 & 2.
DS2505	BLOCK PLAN. POTABLE, RAW, & DEMIN WATER MAINS. PHASE 1.
DS2506	SITE PLAN. SURFACE WATER, FOUL, OILY & BLOWDOWN DRAINAGE. PHASE 1 & 2
DS2507	BLOCK PLAN. SURFACE WATER DRAINAGE. PHASE 1.
DS2508	BLOCK PLAN. FOUL, OILY WATER DRAINAGE & BLOW DOWN DRAINS. PHASE 1
DS2509	SITE PLAN. CABLE DUCTS, LIGHTING, B.T. CABLES. PHASE 1 & 2.
DS2510	BLOCK PLAN. CABLE DUCTS, LIGHTING, B.T. CABLES. PHASE 1.
DS2511	SITE PLAN. EXTERNAL FIRE MAIN. PHASE 1 & 2.
DS2512	BLOCK PLAN. EXTERNAL FIRE MAIN. PHASE 1.
DS2513	SITE PLAN. BUILDINGS & ROADS. PHASE 1 & 2.
DS2514	SPARE. NOT USED
DS2515	SITE PLAN. HAZARDOUS MATERIAL PHASE 1& 2.
DS2558	BLOCK PLAN. COMBINED SITE SERVICE LAYOUT. PHASE TWO
DS2559	BLOCK PLAN. POTABLE, RAW & DEMIN WATER MAINS. PHASE 2.
DS2560	BLOCK PLAN. SURFACE WATER DRAINAGE. PHASE 2.
DS2561	BLOCK PLAN. FOUL, OILY WATER DRAINAGE & BLOWDOWN DRAINS. PHASE 2.
DS2562	BLOCK PLAN. CABLE DUCTS, LIGHTING, B.T. CABLES. PHASE 2.
DS2563	BLOCK PLAN. EXTERNAL FIRE MAIN. PHASE 2.
DS2564	BLOCK PLAN. GAS & COMPRESSED AIR MAINS. PHASE TWO



I.V.O. GENERATION SERVICES (UK) LTD
SOUTH HUMBER BANK POWER STATION
SITE PLAN
COMBINED SITE SERVICE LAYOUT PHASE 1 & 2
DRG No. :- DS2500
'DRAWSIGN' 1997
ISSUE: A. SEPTEMBER 1997
B.JUNE 1998.

ISSUE 'A'. PHASE ONE.
ISSUE 'B'. PHASE TWO ADDED.

I.V.O. GENERATION SERVICES (UK) LTD SOUTH HUMBER BANK POWER STATION



NOTE:
SERVICES (OTHERTHAN CABLES) CROSS ROADS INSIDE SERVICE SLEEVES.

NOTE:
REFER TO COMBINED SERVICE SITE PLAN DRG. No DS2500 FOR 'ABB' & 'DRAWSIGN' REFERENCE DRAWINGS.

- DITCH
- ABANDONED SURFACE WATER DRAIN
- EFFLUENT PUMPED MAIN
- EFFLUENT MAIN (BLACK WIPE, SDR 17.6 WP 20ar)
- SURFACE WATER DRAIN AND MANHOLE
- BOILER BLOWDOWN DRAIN
- FOUL WATER DRAIN AND MANHOLE
- OILY WATER DRAIN AND MANHOLE
- COMBINED DRAINAGE AND KERB SYSTEM (150 uPVC-CS OUTLET)
- ROAD CHANNEL (150 uPVC-CS OUTLET)

SW: SURFACE WATER MANHOLE e.g. SW2.00 2 DENOTES SHEET No OF ORIGINAL 'ALLOT & LOANS'. e.g. 2610L/B/002
FD: SURFACE WATER MANHOLE FORMER EXISTING e.g. FD2.00

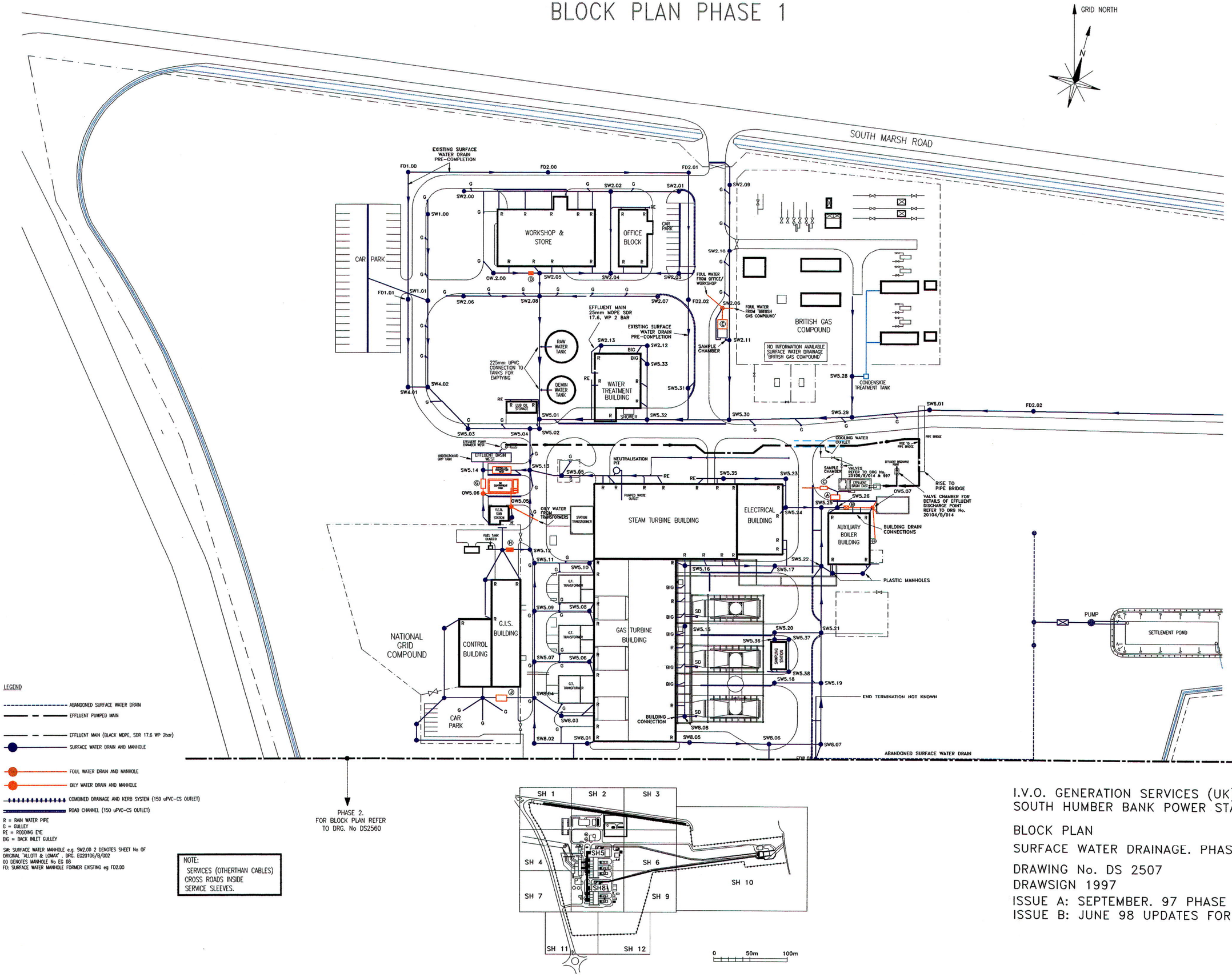
A. BYPASS OIL INTERCEPTER EAST. NORTH OF AUX. BOILER HOUSE.
B. OIL SEPERATOR (LOCAL TREATMENT). NORTH OF AUX. BOILER HOUSE
C. FOUL TREATMENT UNIT FTU2. NORTH OF AUX. BOILER HOUSE.
D. OIL SEPERATOR (LOCAL TREATMENT). SOUTH OF WORKSHOP.
E. FOUL TREATMENT UNIT FTU1. WEST OF BRITISH GAS COMPOUND.
F. FOUL PUMP STATION FPS1. NORTH OF OFFICE BLOCK.
G. CLASS 1 OIL SEPERATOR. WEST OF OIL CONTAINMENT TANK.
H. BY-PASS OIL INTERCEPTOR (LOCAL TREATMENT). NATIONAL GRID COMPOUND.
J. BY-PASS OIL INTERCEPTOR (LOCAL TREATMENT). NATIONAL GRID COMPOUND.
K. CESS POOL. NATIONAL GRID COMPOUND.
L. CONDENSATE COLLECTING TANK. I.V.O. GAS COMPOUND
M. NEUTRALISATION PIT. NORTH WEST CORNER STEAM TURBINE BUILDING.
N. FILTER TRAP EAST SIDE WORKSHOP & STORE.

NOTE 'A'
FOR PHASE ONE SURFACE WATER REFER TO DRG No. DS 2507
FOR PHASE ONE FOUL, OILY WATER & BLOW DOWN DRAINAGE REFER TO DS 2508
FOR PHASE TWO SURFACE WATER REFER TO DRG No. DS 2509
FOR PHASE TWO FOUL, OILY WATER & BLOW DOWN DRAINAGE REFER TO DS 2582

I.V.O. GENERATION SERVICES (UK) LTD
SOUTH HUMBER BANK POWER STATION
SITE PLAN
SURFACE WATER, FOUL, OILY & BOILER BLOWDOWN DRAINAGE. PHASE 1 & 2
DRG No. :- DS2506
'DRAWSIGN' 1997
ISSUE: A. SEPTEMBER 1997
B.JUNE 1998.

ISSUE 'A'. PHASE ONE.
ISSUE 'B'. PHASE TWO ADDED.

BLOCK PLAN PHASE 1



LEGEND

- ABANDONED SURFACE WATER DRAIN
- EFFLUENT PUMPED MAIN
- EFFLUENT MAIN (BLACK MDPE, SDR 17.6 WP 2bar)
- SURFACE WATER DRAIN AND MANHOLE
- FOUL WATER DRAIN AND MANHOLE
- OILY WATER DRAIN AND MANHOLE
- COMBINED DRAINAGE AND KERB SYSTEM (150 uPVC-CS OUTLET)
- ROAD CHANNEL (150 uPVC-CS OUTLET)

R = RAIN WATER PIPE
G = GULLEY
RE = RODDING EYE
BIG = BACK INLET GULLEY

SW: SURFACE WATER MANHOLE e.g. SW2.00 2 DENOTES SHEET No OF ORIGINAL "ALLOTT & LOMAX" . DRG. EG20106/B/002
OD DENOTES MANHOLE No EG 08
FD: SURFACE WATER MANHOLE FORMER EXISTING eg FD2.00

NOTE:
SERVICES (OTHERTHAN CABLES) CROSS ROADS INSIDE SERVICE SLEEVES.

PHASE 2.
FOR BLOCK PLAN REFER TO DRG. No DS2560

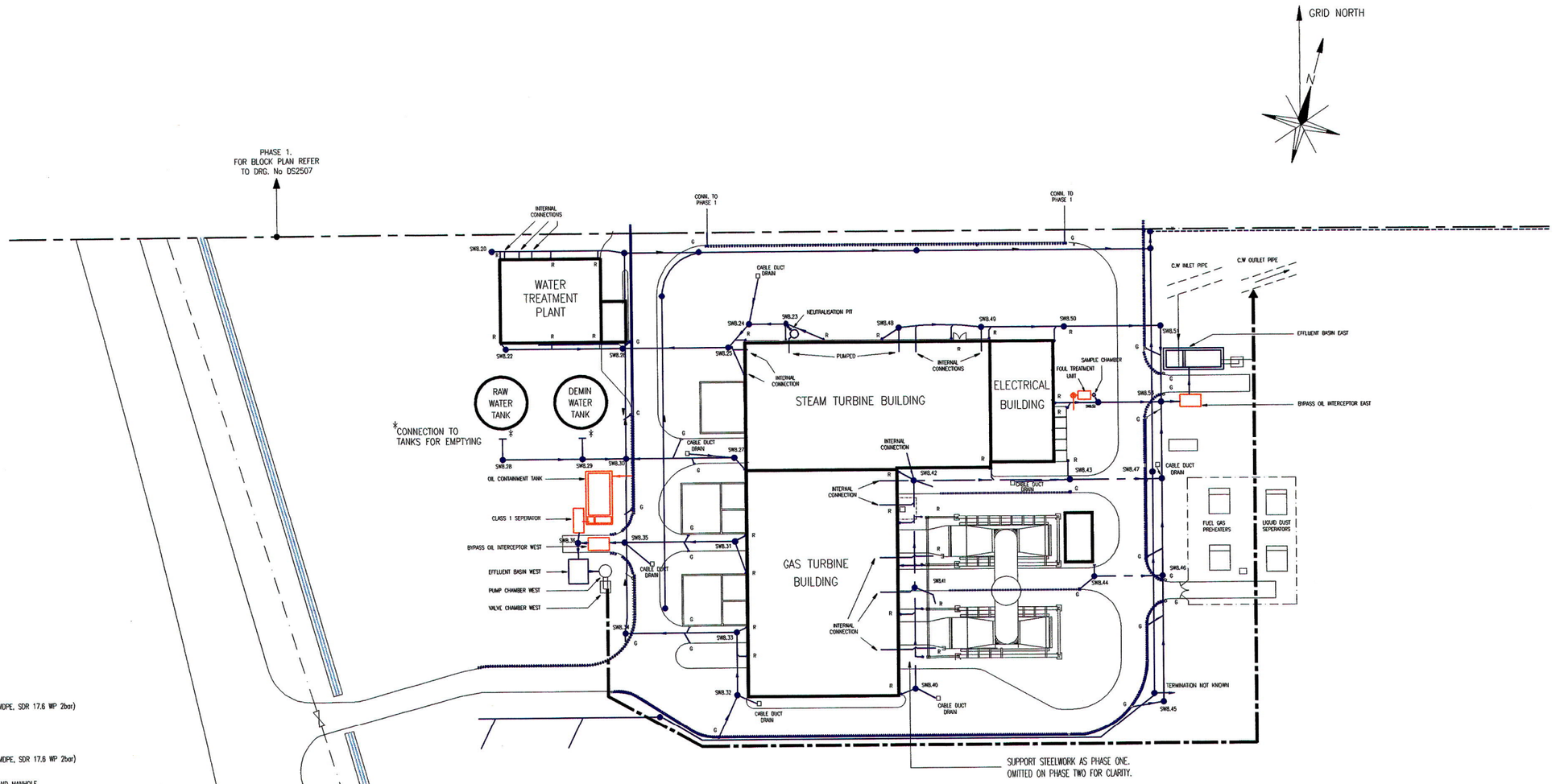
I.V.O. GENERATION SERVICES (UK) LTD
SOUTH HUMBER BANK POWER STATION

BLOCK PLAN

SURFACE WATER DRAINAGE. PHASE 1

DRAWING No. DS 2507
DRAWSIGN 1997
ISSUE A: SEPTEMBER. 97 PHASE ONE
ISSUE B: JUNE 98 UPDATES FOR PHASE TWO

BLOCK PLAN PHASE TWO



EFFLUENT MAIN (BLACK MDPE, SDR 17.6 WP 2bar)

EFFLUENT PUMPED MAIN

EFFLUENT MAIN (BLACK MDPE, SDR 17.6 WP 2bar)

SURFACE WATER DRAIN AND MANHOLE

FOUL WATER DRAIN AND MANHOLE

OILY WATER DRAIN AND MANHOLE

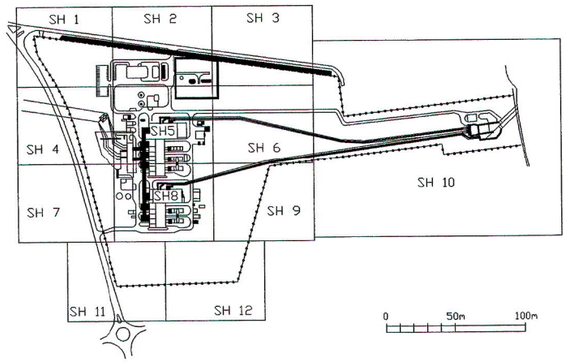
COMBINED DRAINAGE AND KERB SYSTEM (150 uPVC-CS OUTLET)

ROAD CHANNEL (150 uPVC-CS OUTLET)

R – RAINWATER PIPE
G – GULLEY
RE – RODDING EYE
BIG – BACK INLET GULLEY

SW: SURFACE WATER MANHOLE e.g SW2.00 2 DENOTES SHEET No OF ORIGINAL 'ALLOT & LOMAX'. DRG EG2010G/B/002
00 DENOTES MANHOLE No EG 08
FD: SURFACE WATER MANHOLE FORMER EXISTING e.g FD2.00

NOTE:
SERVICES (OTHERTHAN CABLES) CROSS ROADS INSIDE SERVICE SLEEVES.



I.V.O. GENERATION SERVICES (UK) LTD
SOUTH HUMBER BANK POWER STATION
SITE PLAN
SURFACE WATER PHASE TWO
DRG No. :- DS2560
'DRAWSIGN' 1997
ISSUE: A. JUNE 1998

ISSUE 'A'. PHASE TWO

ANNEX 2: SOURCE CONTROL CALCULATIONS

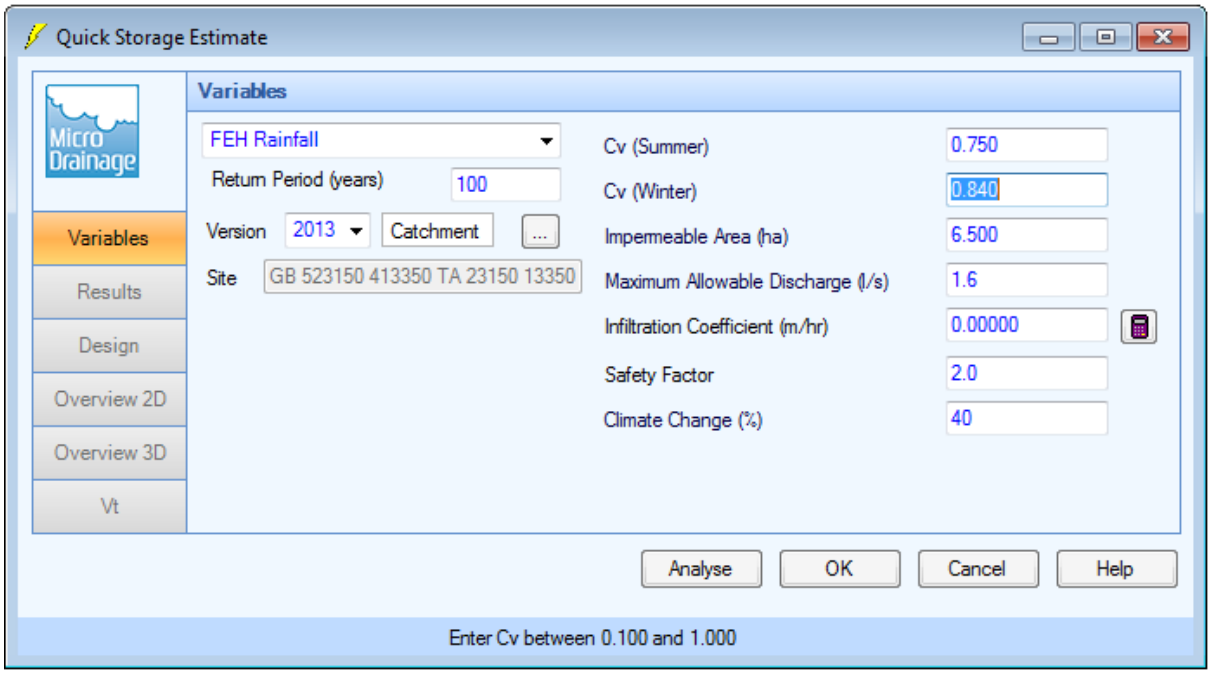


Figure 3: Source Control Input for Greenfield Run-off Discharge Rate

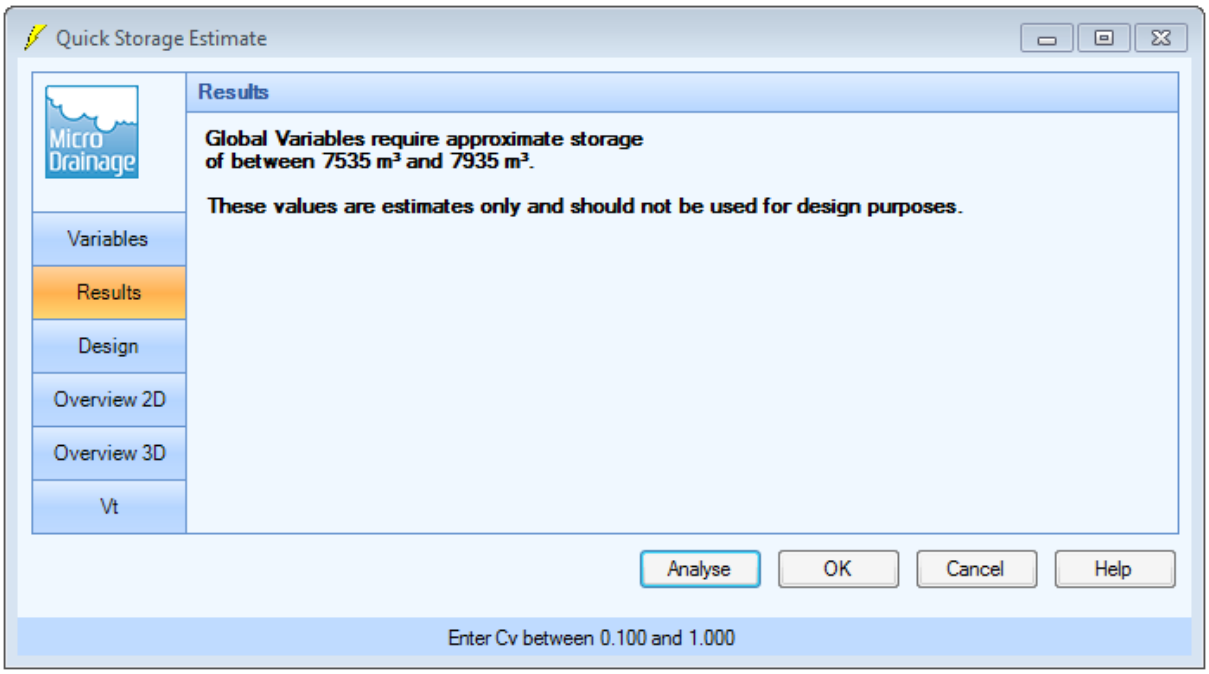


Figure 4: Source Control Output for Greenfield Run-Off Discharge Rate

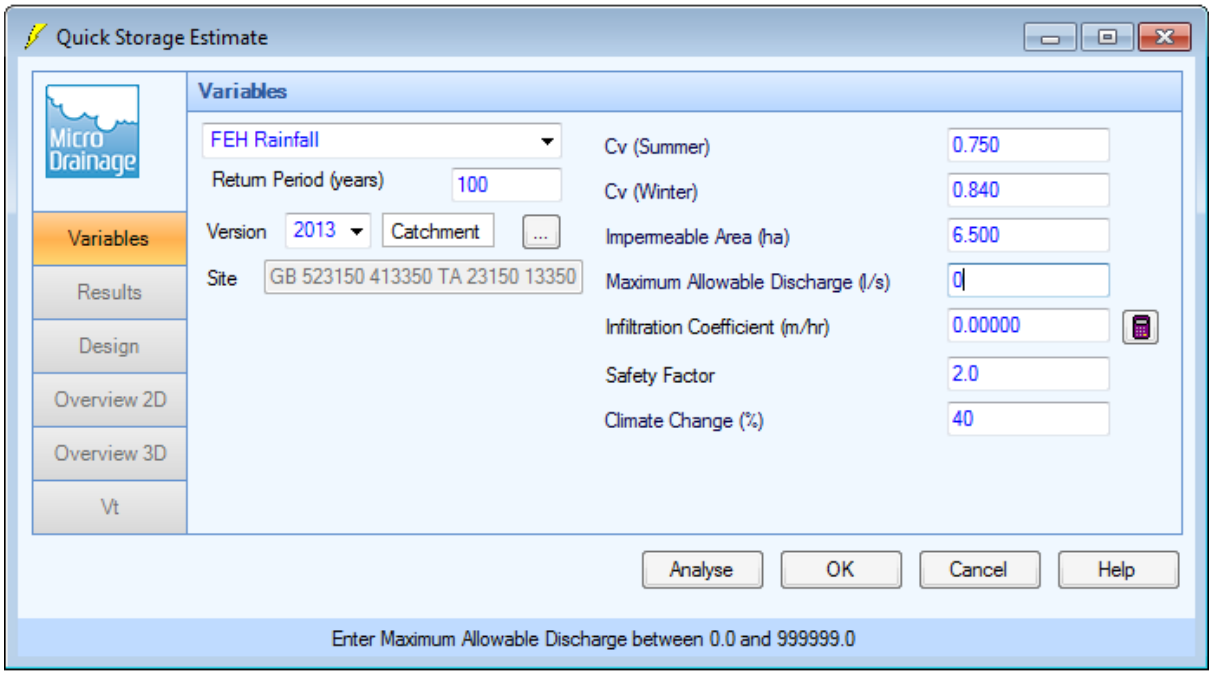


Figure 5: Source Control Output for No Discharge

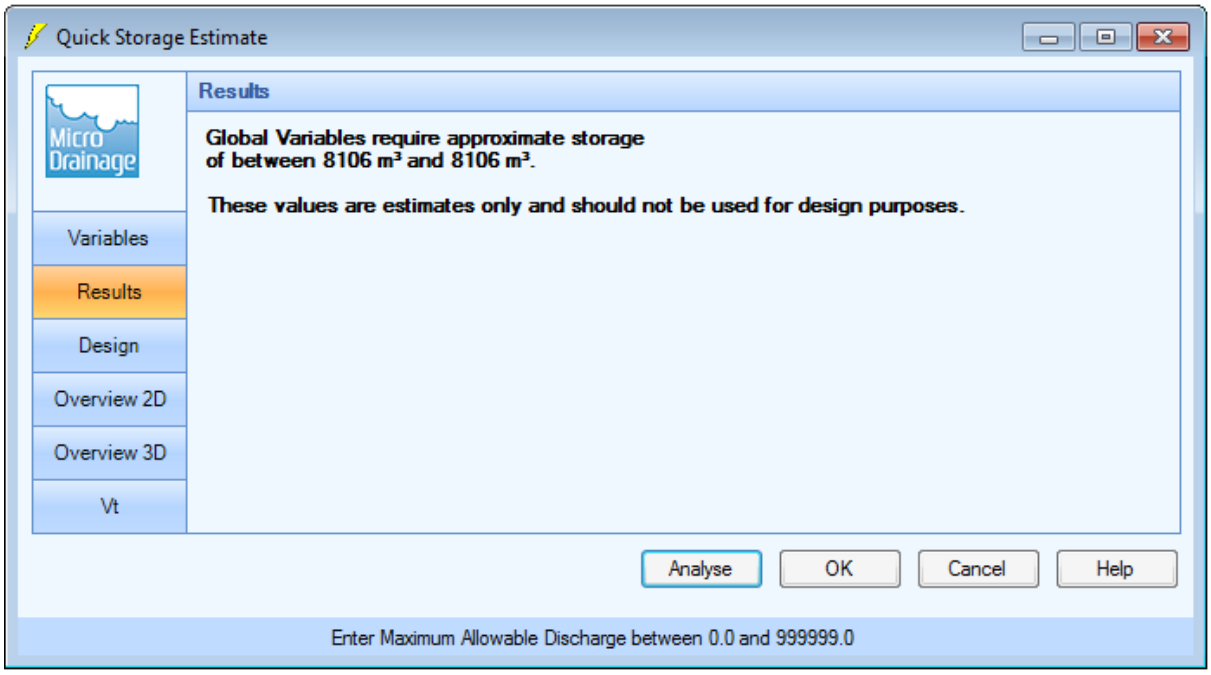


Figure 6: Source Control Output for No Discharge