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Application Document 6

Outline Drainage Impact Assessment

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This document contains the following existing report: 'Drainage Impact Assessment' as prepared by GHD on 5 September 2024. For the purpose of Consent Application, the document has been retitled to: 'Application Document 6 Outline Drainage Impact Assessment', alongside the addition of a new front cover.

Caledonia Project

Drainage Impact Assessment

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The Power of Commitment

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Abbreviations table

AOD	Above Ordnance Datum
BGS	British Geological Survey
CAR	Controlled Activity Regulations
CC	Climate Change
Cv	Coefficient of Volumetric Runoff
DIA	Drainage Impact Assessment
DTM	Digital Terrain Model
GPP	Guidance for Pollution Prevention
LDP	Local Development Plan
NIEA	Northern Ireland Environment Agency
NPF4	National Planning Framework 4
PAN	Planning Advice Notes
PHI	Pollution Hazard Index
PMI	Pollution Mitigation Index
Qbar	The peak rate of flow from a catchment for the mean annual flood (a return period of approximately 1:2.3 years
RD	Responsibilities of Developers
RHS	Rainwater Harvesting System
SEPA	Scottish Environment Protection Agency
SuDS	Sustainable Drainage System
SUDSWP	Sustainable Urban Drainage Scottish Working Party

1. Introduction

1.1 Purpose of this report

GHD have been appointed by Caledonia Offshore Wind Farm Limited to carry out a Drainage Impact Assessment (DIA) for two co-located substations, with associated parking and access roads, to support a Planning Permission in Principle for the construction and operation of two co-located onshore substation. The onshore substation is to be located c.5.8km southwest of the village of New Deer in Aberdeenshire, Northeast Scotland. The development consists of construction of two co-located onshore substations, with associated electricity infrastructure, facility buildings, parking and access roads. Sustainable Drainage Systems (SuDS) will be incorporated in the final proposal, to manage the surface water runoff within the development site. Therefore, this DIA will compare the pre versus post development drainage scenarios and set out how the proposals will sustainably manage any changes to the runoff regime for the site.

The DIA has been carried out based on a conceptual layout to demonstrate the viability of the development in this location. The design is subject to change through the detailed design process and in response to comments received during the planning application process. However, the design will, regardless of the final arrangement, retain the principles of drainage and SuDS set out in this DIA report.

1.2 Scope and limitations

This report has been prepared by GHD for Caledonia Offshore Wind Farm Limited and may only be used and relied on by Caledonia Offshore Wind Farm Limited for the purpose agreed between GHD and Caledonia Offshore Wind Farm Limited.

GHD otherwise disclaims responsibility to any person other than Caledonia Offshore Wind Farm Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Planning policy and guidance

Every new development in Scotland is obliged to follow the latest national and local policies regarding flooding and drainage. An overview of the latest and most relevant regulations in relation to drainage, are presented in the following sections.

2.1 National planning framework

National Planning Framework 4 (NPF4) was adopted by the Scottish Ministers on 13 February 2023, (Scottish Government, 2023), following approval by the Scottish Parliament in January 2023. This replaces National Planning Framework 3 and Scottish Planning Policy. NPF4 sets out the following guidance in relation to flood risk and drainage.

Under the "Flood risk and water management" section of NPF4, there is one policy that promotes the intention of strengthening resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding. This is policy 22.

Policy 22, Flood Risk and Water Management, ensures that flood risk is not exacerbated by development and facilitates the delivery of sustainable flood risk management solutions. An extract of Policy 22 relevant to flood risk, surface water management, natural flood management and drainage is provided below. Other matters such as water supply, health and safety, and policy impacts has been omitted for the purposes of the DIA report. The full policy can be found on the gov.scot web pages[1].

> *Policy 22*
>
> *"a) Development proposals at risk of flooding or in a flood risk area will only be supported if they are for:*
>
> *i. essential infrastructure where the location is required for operational reasons*
>
> *ii. water compatible uses*
>
> *iii. redevelopment of an existing building or site for an equal or less vulnerable use; or.*
>
> *iv. redevelopment of previously used sites in built up areas where the LDP has identified a need to bring these into positive use and where proposals demonstrate that long term safety and resilience can be secured in accordance with relevant SEPA advice.*
>
> *…….*
>
> *c) Development proposals will:*
>
> *i. not increase the risk of surface water flooding to others, or itself be at risk.*
>
> *ii. manage all rain and surface water through sustainable urban drainage systems (SUDS), which should form part of and integrate with proposed and existing blue-green infrastructure. All proposals should presume no surface water connection to the combined sewer;*
>
> *iii. seek to minimise the area of impermeable surface."*
>
> *…….*
>
> *e) Development proposals which create, expand or enhance opportunities for natural flood risk management, including blue and green infrastructure, will be supported."*

2.2 Planning advice notes

The Scottish Government have produced Planning Advice Notes (PANs) which provide advice on good practice. PAN's relevant to flood risk and drainage, these are discussed below.

[1] https://www.gov.scot/publications/national-planning-framework-4/pages/3/

Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems (Scottish Government, 2001)**:**

This PAN informs the developers about the planning application of new developments and the implementation of Sustainable Urban Drainage Systems (SuDS) to manage the surface water run-off on-site. Additionally, it outlines the responsibility of developers to incorporate a drainage strategy to the outline planning application. A list of what should be included in the drainage strategy is summarised below:

- *"An indication of the types of measures to be used*
- *Which measures will be considered in the detailed design*
- *Evidence of the sub-soil porosity and suitability for use of infiltration SuDS*
- *Pre- and post-development run-off calculation to determine the scale of SuDS required*
- *Assessment of flood risk where this is deemed appropriate*
- *Proposals for integrating the drainage system into the landscape or required public open space*
- *Demonstration of good ecological practice including habitat enhancement*
- *Estimates of land take for different drainage options based on initial calculations carried out to size any significant drainage structures."*

Planning Advice Note 79: Water and Drainage (Scottish Government, 2006)**:**

PAN 79 uses, as a starting point, the Scottish Planning Policy to lay out "*the roles of Scottish Water and the Scottish Environment Protection Agency (SEPA), and how they should interact with the planning system*" and give advice "*on the appropriateness of private schemes".* Among the key pre-application discussions is the Development Impact Assessments (section 39); a desk-top analysis to identify "*the scale and nature of development impacts on existing water and wastewater infrastructure".*

2.3 Sewers for Scotland

The fourth edition of Sewers for Scotland was adopted in October 2018 (Scottish Water, 2018). It provides a technical specification for the design and construction of sewerage infrastructure which would be offered up for adoption by Scottish Water. Key elements of the guidance are:

> *"The Sustainable Urban Drainage Scottish Working Party (SUDSWP) document 'Drainage Assessment: A Guide for Scotland' requires that a developer undertakes and submits a Drainage Assessment (DA) to the local Planning Authority with their planning applications. […]*
>
> *SUDS shall be used as part of a surface water management train that replicates as closely as possible the natural (undeveloped) flow runoff pattern of the site. […]*
>
> *The developer shall be wholly responsible for the design and construction of sewerage infrastructure, including SUD systems, to serve the proposed development. The developer and/or his designer shall certify that their design complies with this Specification and accept liability for compliance through their professional indemnity insurance. These responsibilities/liabilities shall not be discharged to Scottish Water following a satisfactory audit of their design."*

2.4 Aberdeenshire Council

2.4.1 Local development plan

The Aberdeenshire Council Local Development Plan (LDP) was adopted in January 2023: Aberdeenshire Council, Local Development Plan – Introduction and Polices, 2023. It sets out the policies on development and land use within the Aberdeenshire region. The LDP refers to two main sections (Climate Change and The Responsibility of Developers) relating to development, flood risk and SuDS, these are summarised below.

Climate Change, Policy C4 - Flooding

The principle aim of Policy C4 is to discourage development from taking place in areas which are, or may become, subject to flood risk. It advises that:

> "… *Development should not increase flood risk vulnerability and should avoid areas of medium to high risk, functional floodplain or other areas where the risks are otherwise assessed as heightened or unacceptable except where*:
>
> - *It is a development to alleviate flooding or erosion of riverbanks or the coast;*
> - *It is consistent with the flood storage and conveyance function of a floodplain;*
> - *It would otherwise be less affected by flooding (such as a play area or car park);*
> - *It is essential infrastructure. The location is essential for operational reasons for example for water-based navigation, agriculture transport or utilities infrastructure and an alternative lower risk location is not available.".*

It is important to note that section C4.6 of the policy states the council *"will not approve developments that may contribute to flooding issues elsewhere, and Sustainable Urban Drainage (SuDS) principles apply to all sites."*

Under Section 14 of the LDP the Responsibilities of Developers (RD) includes policies relevant to flood risk and drainage. The below extracts fall within the broader framework of Policy RD1 Providing Suitable Services, which aims to outline the responsibilities of developers in ensuring that developments are located and designed to take advantage of, or incorporate, the services, facilities, and infrastructure necessary to support them.

The Responsibility of Developers, Water and Wastewater Policy RD1.9

"We will support development when the developer satisfactorily meets the required standards for water, wastewater and surface-water drainage servicing in the new development."

The Responsibility of Developers, Water and Wastewater Policy RD1.13

"Surface water drainage must be dealt with in a sustainable manner, in ways that promote its biodiversity value, and in ways that avoid pollution and flooding, through the use of an integrated Sustainable Drainage System. This includes runoff from major construction sites."

This policy refers to The SuDS Manual (2015) and The Water Environment (Controlled Activities) (Scotland) Regulations 2011.

2.4.2 Surface water run-off guidance

The 'Drainage Impact Assessment Guidance for Developers and Regulators' published by Aberdeenshire Council, sets out the requirements on surface water drainage. Section 3 of the Guidance sets out the requirement for managing surface water runoff. Section 3.3, Technical Requirements for Surface Water Runoff, states:

> "*Where existing watercourses are being used to discharge the run-off from the development, the attenuation measures should be designed so as to retain any additional peak hour flows on the development site.*
>
> *In these types of location, the developer is firstly required to calculate the pre-development run-off for the existing site. In general, the two-year one hour rainfall event should be used…*
>
> *…The discharge rate from the developed site should not exceed the pre-development discharge rate. In general, the measures should be designed to ensure that flow arising from a 10-year return period rainfall event is attenuated on the site then released at a rate no greater than the pre-development peak hour flow rate."*

It is understood that the development should be designed to ensure that surface water run-off be attenuated on the site before releasing at a rate no greater than the pre-development runoff rate.

3. Development site

3.1 Existing site conditions

The development site is located c.5.8km southwest of the village of New Deer in Aberdeenshire, Northeast Scotland. The site is bound by unnamed country roads to the north and east, which connect into the B9005 and B9170. The Burn of Asleid flows southwards to the west, and the existing New Deer substation is situated to the south. Within the development boundary, and beyond in the surrounding land the predominant land use is undeveloped farmland.

The approximate site location is shown in Figure 1 below.

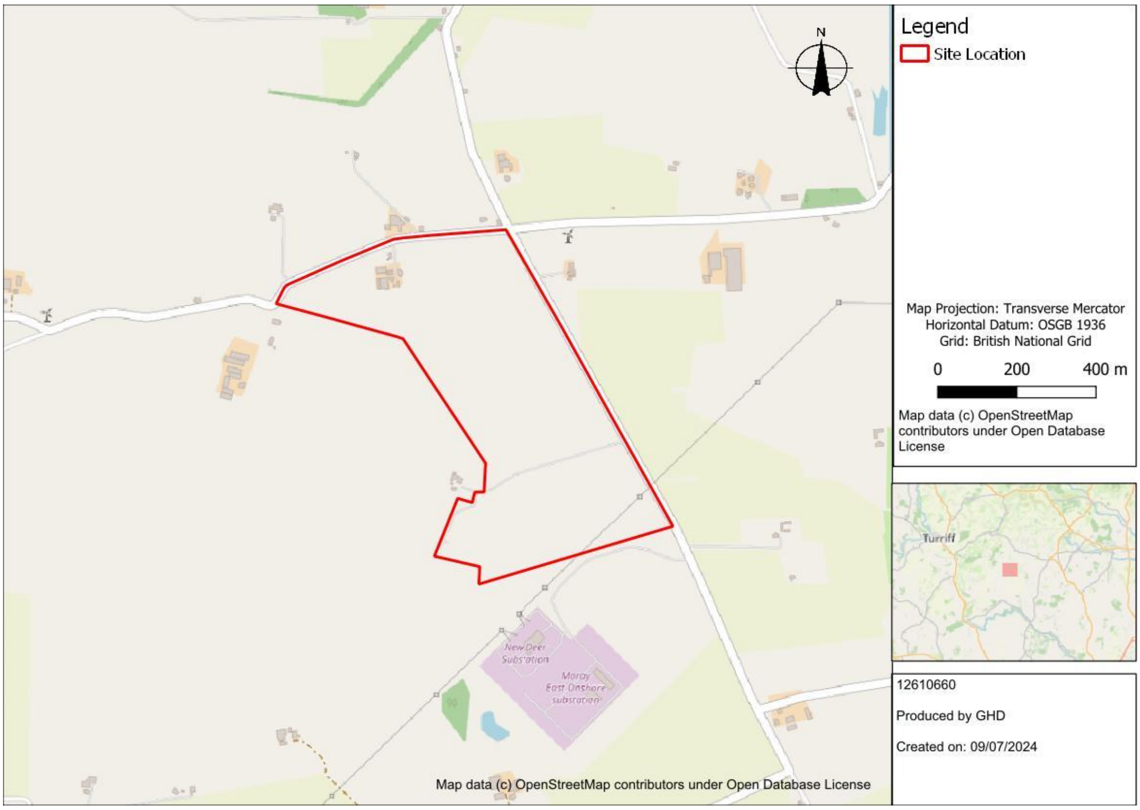

Figure 1 - Onshore substation site

Table 1 - Key site details summarises the key details for the site:

Table 1 - Key site details

Site location	New Deer, Aberdeenshire
Approximate site area (hectares)	9.02
National grid reference	NJ 82987 45248
Nearest postcode	AB53 6YA
Existing land use	Undeveloped land/ farmland
Local planning authority	Aberdeenshire council

3.2 Existing site geology and hydrogeology

The red line boundary covers an area of approximately 9.02ha and is primarily surrounded by undeveloped farmland. Section 4.3.1 discusses the geology of the area in more detail, but to summarise, the soils are drifts derived from slates, phyllites and other weakly metamorphosed argillaceous rocks with superficial deposits of Diamicton overlaying a bedrock geology of Macduff Formation.

The Burn of Asleid is the only watercourse near the site, flowing southwards past the site.

3.3 Existing topography

Elevation data for the site is based on remotely surveyed information provided by Emapsite. This is a 5m resolution Digital Terrain Model (DTM) covering the full site area. There was no site-specific topographic survey carried out at the time of writing.

The elevations within the red line boundary generally fall either east or west. The site is on the crest of the hill with the “ridge” being from midway on the southern boundary, in a northward direction, to the corner at the northern extent. Levels at the “ridge” reach a maximum of 112m Above Ordnance Datum (AOD). The lowest elevations within the red line boundary are 99m AOD in the southern corner of the site.

A GIS appraisal of the catchment areas of the two watercourses in proximity to the site was carried out and is discussed in more detail in Section 4.2.

An overview of the site levels are shown in Figure 2, with colours used to describe the varying elevation and 1m contours extracted from the available elevation data.

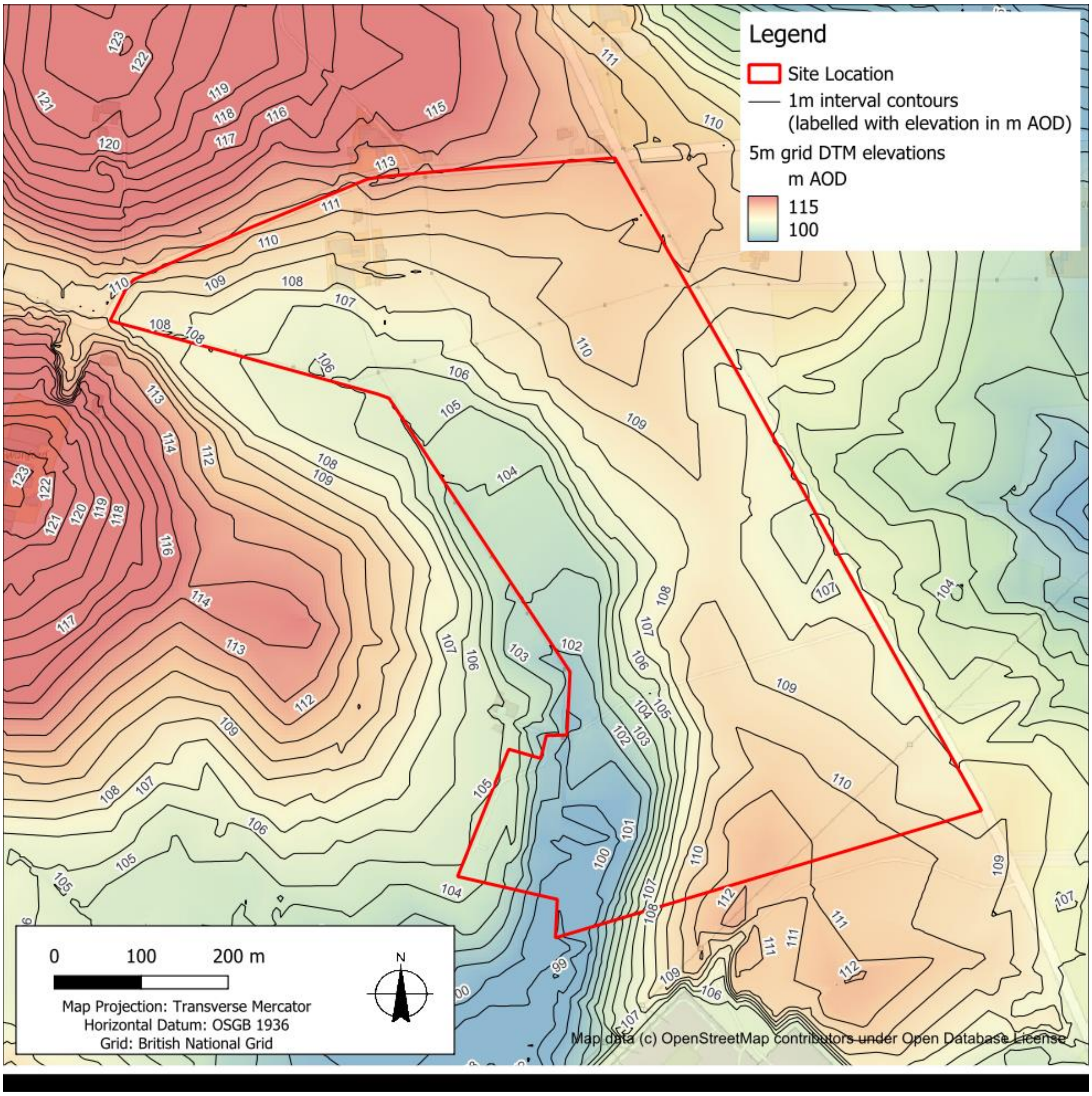

Figure 2 - Elevation data of the site area

3.4 Existing watercourses

The west of the site is bound by the Burn of Asleid. The upstream catchment area for this watercourse is approximately 3km^2. The Burn flows from northwest to southeast and at its closest, is 60m from the proposed site boundary. From the site, the watercourse continues for approximately 4.3km, flowing generally southeast, before confluencing with Little Water. At the point of the confluence, Little Water has a catchment area over five times larger than the Burn of Asleid.

There are no other identified watercourses within or near the site.

3.5 Proposed development

The proposed development is for the construction of two co-located substations, with their associated parking and access roads. Figure 3 shows the location of the development footprint within the red line boundary. A more detailed development layout is included within the drainage layout as Appendix C.

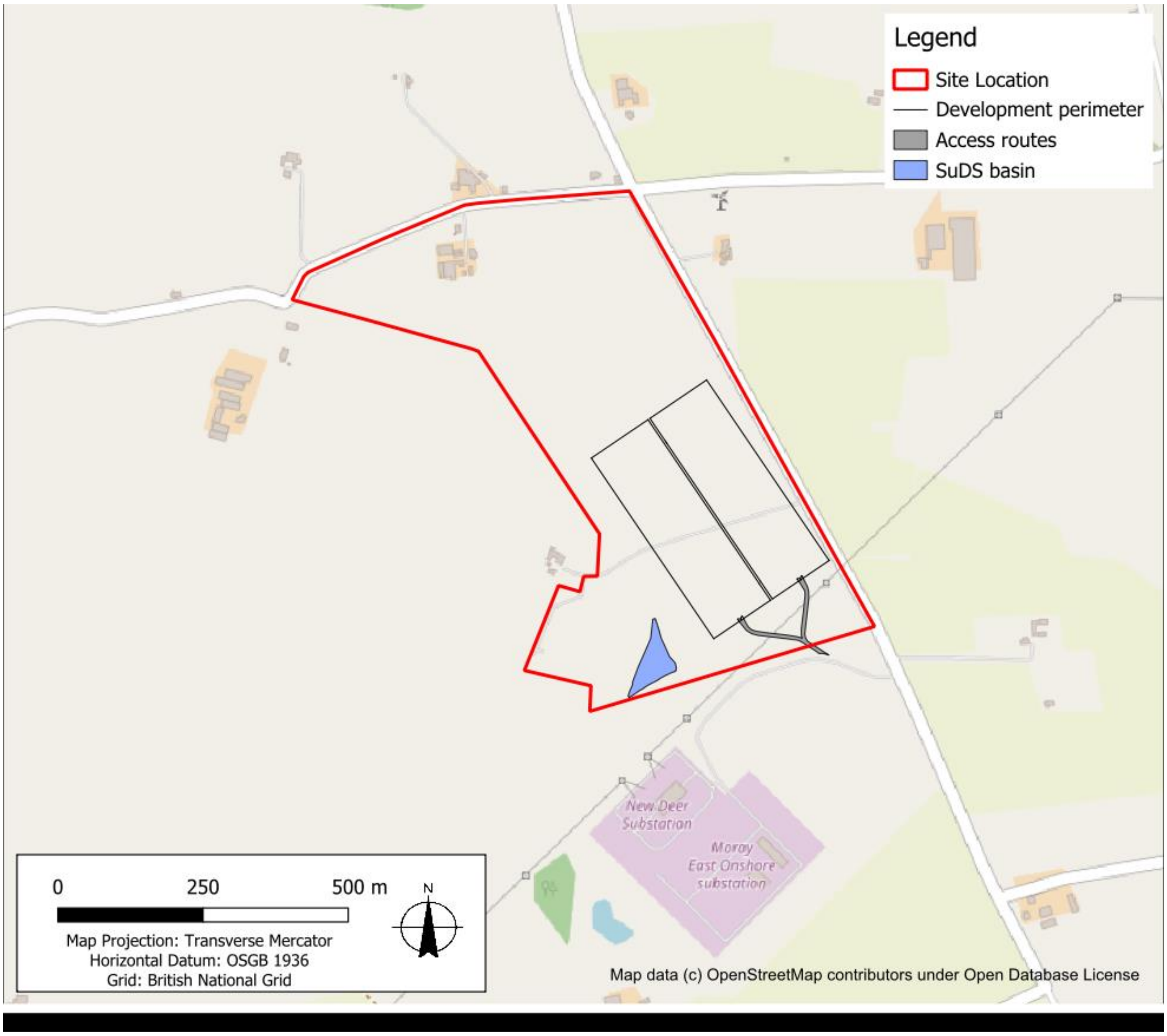

Figure 3 - Site layout

4. Drainage impact assessment

4.1 Surface water management

Based on the NPF4, developers, as well as local authorities, must seek to reduce the overall level of flood risk in the area through innovative design and appropriate application of SuDS.

Recognising the requirements of Aberdeenshire Council, NPF4, PANs, Sewers for Scotland and SEPA, surface water runoff from the proposed site should demonstrate:

- No increase in existing flow rates discharged to watercourse/public sewer
- Surface water runoff should be attenuated on site before releasing at a rate no greater than the pre-development runoff rate
- How runoff up to the 1 in 30 annual probability events will be managed to ensure no flooding of the site
- How runoff up to the 1 in 200 years plus climate change event will be dealt with, without increasing flood risk to the proposed buildings
- A neutral or better effect on the risk of flooding both on and off the site

Therefore, these elements of design shall be integrated into the drainage strategy for the scheme.

4.2 Existing runoff rates

The site is comprised entirely of greenfield land, with an area of approximately 9.02 ha.

The area for the proposed new development will be re-profiled to create a development platform suitable for the construction of two substations. At present, the site is positioned on the crest of a hill, with 46% of the area falling west to the Burn of Asleid catchment, and the remaining 54% falling east to the Little Water catchment as seen in Figure 4.

The existing runoff from the west side of the site will drain to the Burn of Asleid that is less than 100m from the proposed development area and within the planning application boundary.

Existing runoff from the east side will drain overland onto the unnamed single-track road beyond the planning application boundary. From here runoff will be collected in road drainage and assumed to be passed into the neighbouring fields to flow overland for more than 0.5km before draining to Little Water or its tributary.

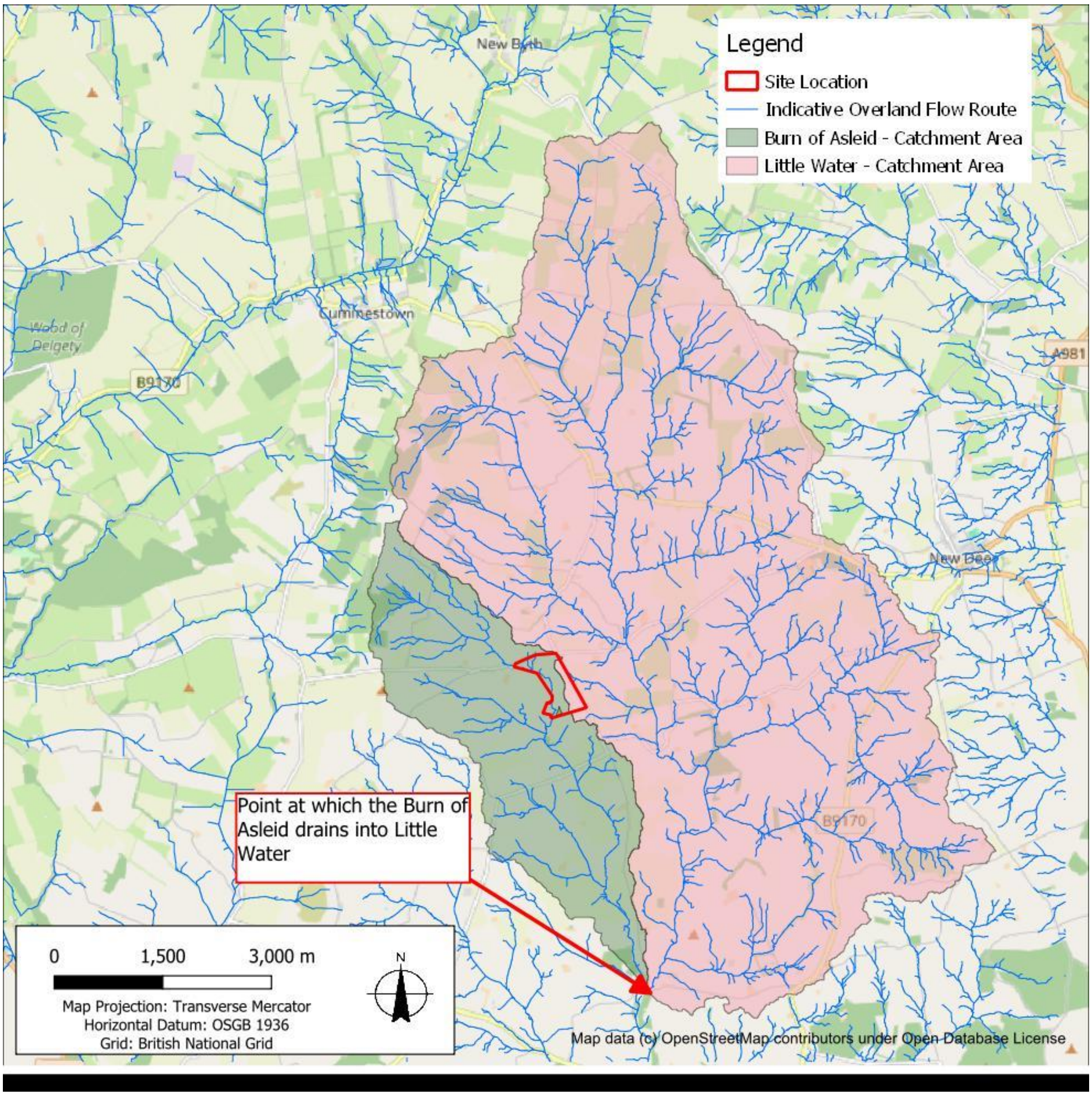

Figure 4 - Location of intersection of the burn of asleid catchment and the little water catchment

Existing greenfield runoff rates for a range of return periods are presented in Table 2 and this is split between west and east catchments of the site area identified earlier. Full greenfield runoff calculations using the ICP SUDS (IH124) tool in InfoDrainage can be found in Appendix B.

Table 2 - Existing (greenfield) runoff rates

Event	Existing (total) greenfield runoff rate for site (l/s) (9.02 ha)	Existing greenfield runoff rate to the burn of asleid catchment (l/s) (4.15 ha)	Existing greenfield runoff rate to the little water catchment (l/s) (4.87 ha)
1 in 1 year	18.7	8.65	10.15
Qbar	22.1	10.17	11.93
1 in 30 year	41.7	19.18	22.52
1 in 100 year	54.7	25.16	29.54
1 in 200 year	62.0	28.5	33.5

*where Qbar is defined as the peak rate of flow from a catchment for the mean annual flood (a return period of approximately 1:2.3 years).

4.3 Proposed runoff rates

4.3.1 Soil classification of the site

The National Soil Map of Scotland (Scotland's Soils, 2024) describes the soils at the site to be comprised of *"Drifts derived from slates, phyllites and other weakly metamorphosed argillaceous rocks"*. The British Geological Survey's (BGS) Geology of Britain online mapping (British Geological Survey, 2024), describes the site to be underlain by superficial deposits of *"Banchory Till Formation – Diamiction."* overlaying a bedrock geology of *"Macduff Formation – Micaceous psammite, semipelite and pelite."*. BGS borehole records (British Geological Survey, GeoIndex Onshore, 2024) show no boreholes within proximity to the site or surrounding area.

Based on the National Soil Map of Scotland (Scotland's Soils, 2024), the proposed site area has a "moderate" risk of soil runoff. This is defined by the map as *"Soils have a moderate capacity to store rainfall or to allow water to infiltrate. Soils will reach saturation under some circumstances, leading to runoff"*.

4.3.2 Drainage hierarchy

For the management of surface water, Scottish Water's hierarchy was followed (Scottish Water, Surface Water Policy, (No Date)) since it provides an appropriate means of determining a suitable point of discharge, even though the proposed drainage network will not be offered up for adoption. The proposed solutions are given below, with option one the most preferred and option five the least preferred.

- *Preferred Option 1: Rainwater is stored and reused, such as rainwater harvesting and/or water butts*
- *Preferred Option 2: Surface water is drained into the soil through the use of a soakaway*
- *Preferred Option 3: Surface water is drained to a watercourse (open or piped), canal, loch or existing/proposed SuDS*
- *Preferred Option 4: Surface water is drained to a surface water sewer*
- *Preferred Option 5: Surface water is drained to a combined sewer."*

To move from a more to a less favourable solution a clear justification of the impracticality of each solution to the development site must be provided.

Therefore, for Option 1, a rainwater harvesting system (RHS) could help to reduce the volume of the runoff or the attenuation storage required on site. However, it is stated in the SuDS Manual (CIRIA, P.236, 2015) *"there is no robust evidence regarding the potential effectiveness of such components during significant events*". Furthermore, the proposals for the site do not include any facilities which require a water supply, so the potential for runoff to be re-used for some practical purpose is severely restricted, to the extent that discharge water volumes would remain unaltered. Hence, RHS could not be regarded as a reliable option to manage the total surface water runoff and one of the alternative options should therefore be examined.

Infiltration capacity of the soils is subject to testing through an intrusive ground investigation, which is yet to be completed. Given the National Soil Map of Scotland's description of the area is "*Soils have a moderate capacity to store rainfall or to allow water to infiltrate"* and *"Soils will reach saturation under some circumstances, leading to runoff",* the use of infiltration alone is unlikely to be sufficient to manage runoff from the new development. Some infiltration may be possible, but the design in this report has been produced on the basis that infiltration is not possible, subject to future testing.

As outlined in Section 3.2, the Burn of Asleid is located within 100m of the site boundary and is at a lower elevation than the proposed development level. Following the preferential Scottish Water hierarchy, with rainwater harvesting and infiltration drainage being discounted, discharge to a watercourse, attenuated and treated via SuDS, is proposed since this option will mimic the existing discharge regime from the site.

Based on the analysis of the drainage hierarchy, it is proposed that instead of splitting the runoff between the two catchments and having two outfalls, all runoff generated from the proposed site will be directed to an attenuation basin before discharging into the Burn of Asleid. Although this proposed arrangement will increase the total area contributing runoff to the Burn of Asleid catchment, the impact on the Burn and its downstream catchment area is considered minimal due to the restriction in peak rates provided by the SuDS basin and upstream drainage network.

The reduction in catchment area to Little Water is less than 0.1%. The minor increase in area contributing runoff to the Burn of Asleid will be managed through the use of SuDS and a restriction in peak flow to existing Qbar rates for all events up to an including the 1% Annual Exceedance Probability (AEP) plus 37% CC event. Between the proposed outfall location from the SuDS basin and the confluence of Little Water with the Burn of Asleid, the catchment is predominantly rural and so any minor changes in flow regime are considered unlikely to affect flood risk elsewhere. As this is consistent with SEPA standing advice no enquiry to SEPA was deemed necessary.

Since the proposed outfall to the Burn is located within the application boundary, no enquiry has been made to Scottish Water regarding the location or the capacity of sewers in the area.

4.3.3 Proposed drainage rational

The entire proposed substation area will be covered by a range of surfaces, none of which are greenfield or landscaping. These surfaces include roads, buildings and concrete plinths for equipment. Any area not occupied by these will be covered in a layer of gravel to minimise maintenance requirements on this high voltage site, such as grass cutting, that might otherwise be required. This results in a proposed area requiring formal drainage (including the large expanse of gravel). The proposed drainage strategy aims to ensure that through the use of interception at source, SuDS and bulk attenuation, that runoff rates post-development do not exceed the greenfield runoff rate as shown in Table 2 - Existing (greenfield) runoff rates.

Aberdeenshire Council were contacted on 27th June 2024 for advice regarding their policy towards drainage impact assessment. A follow up Microsoft Teams meeting was held on 24th July 2024. The approach outlined in this Drainage Impact Assessment (DIA) was summarised, with the SuDS design strategy and proposed restriction in runoff rates. Aberdeenshire Council provided positive feedback on the proposal and strategy for dealing with the change in runoff arrangements, post construction.

In line with NPF4, PANs, Sewers for Scotland, SEPA regulations, Aberdeenshire DIA guidance Section 3.3 and feedback from Aberdeenshire Council, the proposal is to limit the discharge rate for the site to no more than the existing greenfield Qbar discharge rate via a single outfall. This is for all events up to and including the 1% AEP plus a 37% uplift for climate change.

During the call with Aberdeenshire Council, it was identified that the minimum design storm that the drainage must be able to accommodate is the 3.33% AEP (1 in 30 year) event, plus an acceptable allowance for climate change. In this case, the agreed climate change uplift is 37%. However, it was also noted that any drainage must be capable of adequately draining the site to ensure buildings are not at an increased risk of flooding. It was agreed during the call that due to the non-residential nature of the development, and its location in a rural area, that designing the drainage to manage all storms up to the 1% AEP (not 0.5% AEP) plus climate change offered sufficient management of surface water runoff. This was on the basis that buildings and critical infrastructure would be assessed individually to ensure they were mitigated from any exceedance flows that might occur for larger events in excess of the 1% AEP plus 37% CC event.

The development area is located beyond SEPA flood map extents, and at an elevation above the nearby watercourse. With discharge rates to the Burn of Asleid being controlled to Qbar for all events up to the 1% AEP plus 37% CC, the impact on flood risk is considered to be low. Therefore consultation with SEPA was considered unnecessary since it would not provide any greater clarity on the drainage requirements and the proposals are consistent with the standing advice. As the site will outfall to an open watercourse, and does not propose to utilise a sewer connection, no consultation was undertaken with Scottish Water.

4.3.4 Outfall arrangement

The SuDS basin will discharge to the Burn of Asleid. The discharge rate will be equivalent to the greenfield runoff rate of the site and so a small diameter pipe is likely to be sufficient to form the final connection to the Burn of Asleid. The pipe will end at a precast concrete headwall to ensure there is an easily identifiable outlet for the drainage network that can be maintained.

To reduce the total length of pipe, risk of erosion to the Burns' channel and banks, and to provide an opportunity for further water quality management, the outfall will be set back from the Burn of Asleid main channel by approximately 5-10m. It is proposed to use an open vegetated channel to convey the flows from the headwall into the Burn.

The vegetated channel should enter the Burn of Asleid at approximately 45 degrees to the flow direction to encourage mixing of the two flows and to reduce turbulence of the flows.

4.4 Storage requirements (with consideration for climate change)

4.4.1 Climate change allowances

To ensure that the proposed discharge rates can be achieved, it will be necessary to provide surface water attenuation within the development, including the hard paved access routes. To ensure no increase in flood risk over the lifetime of the development, a climate change allowance should be factored into the attenuation/storage assessment. To understand the uplift required to allow for climate change SEPA's *'Climate Change Allowances for Flood Risk Assessment in Land Use Planning Version 4'* was consulted.

The site is located, as described by Map 1 of the SEPA document, in the Northeast Scotland catchment area. As discussed elsewhere in this report the site is located in two watercourse catchments. The total area of these catchments at the point of their confluence is 60.4km^2. Based on SEPA guidance, the choice of rainfall or river flow uplifts are based on the contributing catchment area. For the combined catchment this would suggest the most appropriate values to use are river flow allowance, in this location resulting in a 34% uplift in flows.

However, due to the size of the two catchments individually, 9.9km^2 for the Burn of Asleid and 50.5km^2 for Little Water, and the location of the site on the "ridge" dividing these two watercourse catchments, it is considered more reasonable to apply the peak rainfall allowance uplift rather than the peak river flow allowance. This is because there is no upslope area outside the site boundary contributing to the runoff rates. In simple terms, the site forms its own catchment area, and this is far less than the threshold of 50km^2 which would trigger the use of peak river flow allowances. Additionally, the peak rainfall intensity uplift is more conservative that the river flow uplift.

All climate change uplifts are for change to the year 2100 and applied as a percentage uplift to the existing rainfall data.

For the Northeast Scotland River Basin in which the development is located, a 37% allowance for climate change should be used in the design of surface water management infrastructure. Considering the lifespan of the development and the anticipated increase in rainfall intensity due to climate change, an estimate for surface water attenuation volume has been carried out for the development using industry standard software, InfoDrainage.

4.4.2 Attenuation storage arrangements

The runoff from the development will be managed through the use of unbound gravel surfacing (to be 275mm deep), filter drains (with under drains), oversized pipes and an attenuation SUDS basin. The basin is to have a base level lower than the outlet to provide a depth of standing water to generate greater ecological potential and water quality improvement opportunities.

The access routes are to be hard paved to ensure they are resilient to the loading of the heavy equipment that is brought to site. To provide a conservative estimate of attenuation volumes, the area of the access routes, beyond the 9.02 hectare substation site, has not been included in the allowable runoff rate calculations. This will help to ensure that the area of runoff removed from the Little Water catchment does not adversely affect the peak flows in Burn of Asleid.

The total attenuation storage required to limit all runoff to no more than 22.1l/s is c.26,384m^3. This is for attenuation of the runoff from the entire proposed impermeable area, including access roads south of the two substation sites. This volume is split between manholes (0.2%), pipes (1.4%), filter drains (6%) attenuation basin (27%) and the gravel surface layer (65.4%).

The conceptual drainage layout shown in Appendix C illustrates how the drainage and storage arrangements could be realised. During a rainfall event, surface runoff generated from the site will percolate through a 275mm deep layer of gravel, where initial treatment occurs. This gravel is assumed to be permeable to water with a 30% void ratio that provides at-source interception and attenuation. Depending on final ground conditions below this gravel, some rainfall volume may infiltrate. Infiltration has not been allowed for in the calculations to ensure a conservative design is provided. Runoff from concrete plinths, roofs and access roads will be discharged to the wider gravel surface, where it will percolate vertically and horizontally until it reaches the deeper filter drains positioned adjacent to the roads and along the maintenance strip between the two substation boundaries. These filter drains will offer further attenuation and convey flows downstream.

The access roads will have a filter drain located on one side, with the camber of the road used to ensure runoff is conveyed to these locations. These filter drains will discharge to the pipe network to ensure all runoff from the access routes are attenuated prior to discharge to the watercourse.

The attenuation basin is to be located to the west of the development platform, on land raised above the maximum mapped flood extent of the Burn of Asleid. The outlet to the Burn is to be via a pipe with the final 5 to 10m being formed of an open swale. The base of the basin is to be over dug by a minimum of 300-500mm to provide a permanent depth of water in the basin.

4.4.3 InfoDrainage modelling

To inform the DIA report, and to ensure a viable drainage solution for the site was presented, a detailed model of the proposed arrangement was constructed using the industry standard software Innovyze Info Drainage.

The first stage was to identify the proposed levels for the site, which had been defined by others as a level of 108.075m AOD for the full development platform. The various proposed land uses were then identified, and inflow areas assigned. Due to the flat nature of the site, a main carrier network arrangement was provided to help convey flows around the scheme, with SuDS (filter drains) used to intercept and treat runoff prior to discharge to this carrier network.

The use of gravel over most of the site was simulated as permeable paving, based on the similar properties of the subbase layer in permeable paving and gravel. Consultation with Autodesk (the software vendor) was required to identify anomalies in the model results. Due to the larger area of gravel, represented by permeable paving and the irregular shape of these areas, the software struggled to distribute the inputs along the full flow length. This resulted in false flags of “flooding” in the permeable paving, where the maximum water elevation at the upstream end exceeded the ground level of 108.075m which in reality would not occur. The maximum exceedance of ground level was 5mm, which in reality, would flow across the surface of the site until other areas of attenuation was able to receive it. It is also worth noting that there is an amount of volume missing in the model, as it assumes that the ground surface and permeable paving, which is designed with a slope to ensure sub surface flow, are parallel. In reality, the surface would be level but the underlying gravel layer would gradually get deeper. Overall, the modelling completed is therefore conservative.

Any localised exceedance of the gravel storage volume due to rainfall inputs would be distributed evenly across the entire gravel area, not just the single compartment modelled. Any emergence at ground level, which was identified to be less than 5mm deep, would flow at very shallow depth to other areas where storage was available. These areas of “flooding” were not able to be distributed to neighbouring areas in the model, but in reality this mechanism would remove any shallow ponding of less than 5mm.

Any equipment sensitive to pooling of water at the base should be raised on a plinth above the local finished ground level. Any buildings should either use a raised threshold, or ensure that levels around the perimeter encouraged exceedance flows towards the gravel areas, away from access points. This will help to manage the residual risk of pooling surface water from impacting on the site’s operation during large storm events.

A full summary of the Info Drainage model is included in Appendix D.

The design was developed to achieve no flooding during the 1 in 30 year (plus 37% CC). Simulations were also run for the 1 in 2 year (no CC), 1 in 200 year (no CC) and 1 in 100 year (plus 37% CC). The critical event was found to be 1 in 100 year plus 37% CC event. The default range of storm durations (between 15 minute and 24 hour) were simulated to ensure that the impact of rainfall duration was considered in the design process.

Pipe sizes varied between 150mm and 525mm depending on the location, capacity requirements and levels. A hydrobrake was used on the outlet from the basin to ensure that the volume was optimised, and rates did not exceed 22.1l/s for any of the above simulated storm durations of storm events.

Consultation with Aberdeenshire Council identified that the principles of this design arrangement and assumptions were sensible and in line with expectations of a development of this nature. It was agreed with the council that due to the lack of residential buildings, and all equipment being raised above ground level, that minor flooding would be acceptable on the site subject to the rate reaching the Burn of Asleid being managed. The modelling has identified that the proposed drainage arrangement meets these requirements. Consultation with the council is included in Appendix E.

4.4.4 Cv values

It is important to note that the coefficient of volumetric runoff (Cv) values used in the InfoDrainage model have been specified based on the predominant land covering of each input area. For parts of the site covered by gravel, a Cv value of 0.85 is used, while a Cv value of 0.9 is used for areas covered by buildings and roads. As the site, once constructed, will be industrial and fully developed across its entire area, no allowance for urban creep was included in the design of the drainage.

4.5 Treatment provision of surface water through SuDS

The SuDS Manual (CIRIA C753, 2015) details a wide range of drainage techniques, some of which may be incorporated within the proposed drainage design. Attenuation and SuDS will be incorporated into the proposed development to decrease runoff rate and volume where possible across the site, and to provide treatment to runoff prior to discharge into the adjacent watercourse.

An outline of a potential drainage solution is shown in Appendix C. The different SuDS techniques that could be used and that are displayed in Appendix C are listed below:

- A layer of clean gravel will cover the majority of site, to reduce the need for access for maintenance activities such as grass cutting. Given the nature of the site, this also provides additional health and safety benefits during the operational phase, since operatives would not be required to work near live electrical equipment. This gravel will be used to provide at source interception and treatment to runoff.
- Runoff and sub-surface flows within the gravel will be intercepted by filter drains situated below. To improve conveyance, storage and access for maintenance, these filter drains will have a perforated pipe in the base. These have an outlet to a main carrier pipe network.
- The main carrier pipe network drains to an on-line attenuation basin. When the flows into the basin exceed the permissible discharges out of the basin, water levels will rise as it stores (attenuates) the excess volume. Detention basins also provide sediment removal and help to reduce levels of nutrients, heavy metals and toxic materials.
  - The detention basin will have a base level below the outlet to ensure an area of permanent water to help promote wildlife, ecology and water quality improvement compared to a ‘dry’ basin.

The SuDS Manual (CIRIA C753, 2015) states that to deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (PMI) that equals or exceeds the pollution hazard index (PHI).

Table 3 shows an extract from Table 26.2 from the SuDS Manual (CIRIA C753, 2015), illustrating the pollution hazard indices. The total PHI for different land use classifications relevant to this development is shown in Table 3. It should be noted that PHI and PMI are unitless.

Table 3 - Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs (see reason below)	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day	Low	0.5	0.4	0.4
Total		**0.7**	**0.6**	**0.45**

In determining the land use classification of the site's various areas, consideration was given to its final use.

There are a number of buildings proposed on site. None of these are involved in the production/manufacture of goods and there is not understood to be chemicals or particulates released from within the building that could settle on the roof and be drained to the surface water network. Therefore, to reflect this reduced pollution risk, the roofs have been classed as 'Residential' despite the lack of overnight accommodation.

The on-site access tracks and substations were considered most similar to 'low traffic roads' since access to the site is likely to be infrequent. Therefore, the classification of an industrial yard was not considered to be relevant to the sites intended use. There is no proposed movement of goods around the site that could be dropped or contaminated during wet weather.

Table 4 shows the PMI for individual SuDS components and the total SuDS PMI for each pollution hazard, where:

$$\textbf{Total SuDS PMI} = \textbf{mitigation index}_1 + 0.5\,(\textbf{mitigation index}_2) + 0.5\,(\textbf{mitigation index}_3)$$

Table 4 - Pollution mitigation indices for discharge to surface water

	Mitigation indices		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Gravel covering (PMI values of a filter drain) (First stage of treatment)	0.4	0.4	0.4
Filter Drain to convey flows (Second stage of treatment)	0.4	0.4	0.4
Detention Basin for attenuation storage with a permanent body of water below outlet, it has been classed as pond for PMI values (Final stage of treatment)	0.7	0.7	0.5
Total SuDS PMI	**0.95**	**0.95**	**0.85**

Table 4 demonstrates that the proposed SuDS treatment can suitably treat the surface water such that it exceeds the necessary PMI values.

4.6 Substation drainage provisions for oil

4.6.1 Areas containing oil

As there is a potential for significant pollution to occur from elements of the site that contain oils, these include:

- Four transformers
- Eight shunt reactors

4.6.2 Relevant guidance and regulations

The 'Guidance for Pollution Prevention (March 2022) - Use and design of oil separators in surface water drainage systems: GPP 3' was produced by the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA). This document provides guidance on environmental legislation and was reviewed as part of the DIA to understand the requirements for oil management.

There is a legal requirement to prevent pollution to surface water and where appropriate, that oil interceptors are required as part of the management strategy for sites that require oil to be used, such as a substation. Oil interceptors are to be used anywhere there is a risk of oil entering surface waters or sewers from rainfall runoff. The proposed substation site is classified as ‘High Risk’, as defined by the guidance documents, since it is an “industrial site where oil is stored or used”.

During ‘normal’ operation, no oil will be handled within the site but there is a residual risk during a failure of the equipment. As the discharge is ultimately to an open watercourse, it is likely that the Water Environment (Controlled Activities) (Scotland) Regulations 2011 – more commonly known as the Controlled Activity Regulations (CAR), with their amendments will apply.

4.6.3 Oil management strategy

As the substation will not be releasing other pollutants (such as acid, solvents, detergents etc.), there is no requirement for the discharge to be drained to a foul sewer as outlined in Section 2.5 of the GPP3 guidance. The flow chart illustrated in Section 3 GPP3, outlines the best method to select an appropriate oil interceptor type. This concludes the development, with its risk of large infrequent spills, with an outlet to a watercourse, will require a class 1 full retention separator with alarm. One will be required for each of the areas at risk of oil spillage. SuDS should be used downstream of the interceptor to polish the outgoing flows before reaching the watercourse. It is noted that class 1 separators “*are designed to achieve a discharge concentration of less than 5 mg/litre of oil under standard test conditions. These separators are required for discharges to surface water drains and the water environment. Many Class 1 separators contain coalescing devices, which draw the oil droplets together and facilitate the separation.”*

The higher risk areas of the site, where there is the potential for a significant release of oils (e.g. transformers which are cooled by oil) will be served by a dedicated and bespoke drainage system which can adequately contain the potential oil contaminants. This will be separate from the wider surface water drainage system with a single outlet (per area) that is monitored for oils. It will allow the drainage from these areas to be automatically isolated during a spillage event, such that the oil is contained locally to the failed equipment, until it can be removed by specialist contractors and disposed of in accordance with the relevant regulations. However, during normal operation flows will discharge from this outlet and discharge to the wider network. Therefore, the runoff and discharges from the potential pollution areas have been allowed for within the design of the surface water drainage network and attenuation volumes, which reflect the conventional operation of the drainage for these areas.

4.6.4 Location and sizing of oil separators

Due to the distribution of the oil containing equipment across the site, there will be a need to incorporate a number of full retention Class 1 separators at the requisite locations. These shall be fitted with integral silt collection, alarm and an automatic closure ‘deadstop’ mechanism to prevent flow through the unit in instances of excessive oil levels.

The full retention separators will be ventilated such that build-up of potentially flammable or explosive vapour is prevented and will include both an excessive oil level and system cleaning alarm and installed which is connected to the site’s control room. The system will also include an oil sampling chamber and shall be of sufficient size to allow collection from flowing discharge.

The full retention separators are to be sized to accommodate the run-off area from each of the twelve pieces of equipment, allowing for a suitable buffer for the bunding from the plinth on which this equipment is mounted.

A Klargester / Kingspan Full Retention Separator NSFA010 (or equivalent) is suggested as an appropriate treatment unit for the SGT areas, one for each of the four locations due their distributed locations across the site. These units can drain up to 555m^2, while each SGT perimeter fence area is 360m^2.

For the shunt reactors, despite their closer proximity in the current arrangement of the site, a conservative design has been used to ensure that in the event they are more spaced out in future there is suitable allowance of interceptors. Each shunt reactor is to be paired with a Klargester / Kingspan Full Retention Separator NSFP006. These units can treat up to 335m^2, approximately 50% more than the current footprint area of each shunt reactor.

The final arrangement, sizing and detailing of the oil intervention measures are to be confirmed during the detailed design stage.

5. Maintenance and management

Implementing Sustainable Urban Drainage Systems (SuDS) will effectively decrease peak runoff rates and improve water quality before it is released into the adjacent Burn. Nevertheless, to guarantee the drainage network's continuous functionality, it is essential to maintain the system throughout the lifespan of the development. This chapter will outline the maintenance and management proposed for the drainage system to ensure this is achieved.

5.1 Construction phase

The Principal Contractor shall assume responsibility for gathering, treating, and disposing of surface water runoff to an approved suitable location. The construction phase includes a variety of tasks that may introduce physical contaminants to the surface water quality, such as:

- Handling, storing and stockpiling materials, as well as their spillage and disposal.
- Earthmoving work that could undermine soil integrity, boosting sediment dispersal potential.
- Excavating and setting down foundations.
- Implementing both temporary and permanent structures.
- Development of drainage paths and utility conduits.
- Using and moving construction machinery.

These operations might prompt the release of physical contaminants like sediment and silt. Heavy rain may cause further sediment in water runoff due to vehicle-induced soil damage, while dry and windy conditions might lead to soil dust contaminating parts of the unfinished drainage system. Thus, these processes might contribute to the entry of sediments into water bodies either directly or indirectly, affecting the surrounding surface water's physical, chemical, and biological integrity.

Additional protocols during the establishment of the surface and wastewater systems include:

- The Principal Contractor must prevent any rubble or silt from infiltrating the drainage system and remove any that does manage to enter.
- All unfinished drainages must have manufacturer-produced caps installed to prevent exposure rather than temporary solutions which might escape into the larger drainage network.
- Prompt cleaning and covering of all newly built manholes, silt traps, and inspection chambers.
- Where feasible, completion of open landscaping, such as the land around the SuDS basin, at the end of the building stage to reduce erosion and limit sediment build-up.
- Protection of areas during both construction phase and establishment phase of the systems using silt fences or straw bales to block sediment travel.
- Finally, the Principal Contractor is to meticulously design and execute landscaping projects to avert deposition of loose materials prone to movement on paved surfaces.

5.2 Permanent phase

Chapter 32 of the CIRIA SuDS Manual (2015) sets out a recommended approach to Operation and Maintenance of drainage networks and discusses general good practise for operation and maintenance activities. Maintenance will be undertaken by the client, landowner, or an appointed maintenance company.

Visits should be made as often as is necessary to fulfil the required standard of maintenance. The required maintenance can be divided into two categories:

- Regular maintenance: basic tasks undertaken on a frequent and planned schedule,
- Occasional maintenance: tasks that are likely to be required only periodically.

The client, landowner or an appointed maintenance company will be provided with a 'Maintenance Record' so that they are aware of the function and maintenance requirements of the drainage system.

The record should include:

- Details of the new site drainage system
- Specific operation and maintenance requirements for proprietary products including:
    - Oil interceptors
    - Filter drains
    - SuDS basin
    - Vortex control structure

It is recommended that the frequency of inspections is increased during the first year of operation and are conducted after every significant storm event. This will ensure the drainage system is functioning correctly and if necessary, implement any improvement works to optimise performance. Thereafter frequency of inspection can be as necessary to ensure ongoing operation of the system, this is likely to be six monthly or less.

Elements that are to be inspected include:

- Inlets and outlets – ensure that inlets and outlets are clear and that flows in/out are not impeded.
    - Any obstruction or build-up of material must be removed as soon as it is seen or reported.
- Integrity of the structure – a visual inspection of attenuation basin and associated pipework to check for any seepages, leaks or build-up of sediment. This inspection is to also include structural damage to any 'hard' features like headwalls or outlets.
    - Any defects are to be remediated as soon as practicably possible once it has been seen or reported.
- Water Quality – Is there evidence of poor water quality in the surface water storage systems, e.g., algae, oils or odours?
    - If so, further inspection remedial actions are to be taken, which include investigation to locate the source and/or hydraulic issues which may be causing the quality reduction.
- Check for sediment/silt build up by carrying out a visual inspection of the basin, headwall, manholes, sumps, gullies, drains and filter drains.
- Any evidence of sediment/silt build up is to be reported and inspected further by an appropriate engineer to determine whether silt removal is to be initiated.
- Litter, debris or vegetation to be checked by carrying out a visual inspection of the filter drains to determine the presence invasive vegetation and the overall health of the systems.
- Removal of invasive vegetation is critical to the performance of the basin. As such, remedial actions are to be taken immediately when an appropriate engineer deems it necessary.
- Evidence of inefficiencies; is there any evidence of surface water building up at the inlet which could indicate that the connections are blocked or damaged?
    - If so, remedial actions are to be implemented including things such as clearance of any debris preventing free movement of water and internal CCVT inspection of the drainage network to confirm internal condition.

6. Foul water drainage

Post-construction, the site will accommodate two co-located substations, with associated parking and access roads. This will include, for each substation, a control building. GHD understand from the Client that the sites are largely “unmanned” and will not have a ‘24/7’ presence. However, there will be periods where there are operatives working in or around the site and so there is a need to provide welfare facilities.

In the absence of details on the number of visitors or likely duration of visits, it has been assumed for this DIA that there will not be a continuous flow of foul sewage from the site, and that any flows generated will be intermittent/periodic in nature.

Available asset plans provided in support of the development show no public sewers in the vicinity of the development, where a viable foul connection could be made, via gravity or otherwise. As a result, any foul water generated by the development will need to be discharged via alternative means. The final arrangement and design of the foul water drainage is yet to be determined as part of the detailed design, and in consultation with third parties such as SEPA and Scottish Water. The final solution is likely include methods such as package treatment plant with an outfall to the Burn of Asleid, or a cesspit type arrangement where waste is tankered away for disposal as required, subject to the necessary approvals.

7. Conclusion

In support of the development, a proposed drainage layout has been provided that captures, treats and restricts runoff from the site at 22.1l/s, the existing Qbar greenfield runoff rate. In accordance with Scottish Waters hierarchy, and general good industry practice, the disposal of surface water through the capture/re-use and infiltration have been discounted due to the sites use and underlying soils and geology. Therefore, the next and most suitable point of discharge is to the adjacent watercourses, as per the existing pre-development scenario.

A total of c.26,384m^3 of storage volume is required to achieve the restriction in rate. A 275mm deep gravel layer across the site, filter drains, a detention basin (overdug below the outlet) and a length of swale at the confluence with the Burn of Asleid is proposed to provide both treatment and attenuation of runoff, including to the areas of access road south of the development area.

The twelve areas of the site which present a risk of significant oil contamination will have their own dedicated oily water drainage system, which will discharge to the wider surface water system serving the site. This will include several treatment features including, sumps, bunds and full retention separators, as required. This will both treat conventional runoff as well as provide sufficient means of intercepting and storing more significant pollution events (e.g., from a leakage) prior to discharge to the nearby watercourse. This DIA provides a viable surface water drainage strategy for the proposed development which accords with all national and local legislative requirements.

8. Bibliography

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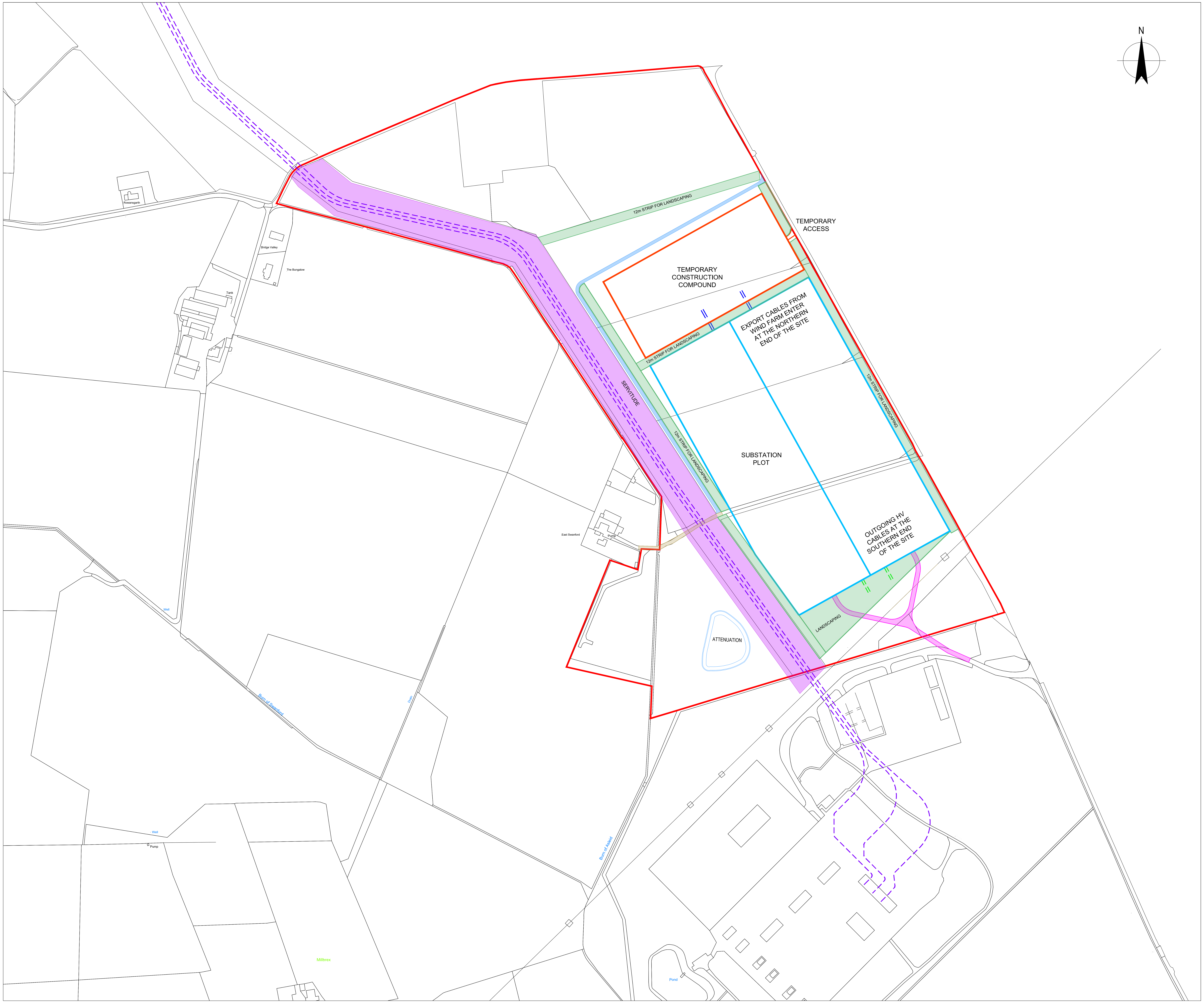
Appendix A Site layout



NOTES

1. POTENTIAL LANDSCAPE ZONES SHOWN IN THE VICINITY OF THE SUBSTATION ONLY.
   FOR FULL LANDSCAPING DETAILS REFER TO THE LANDSCAPE MITIGATION PLAN.

LEGEND

- OWNERSHIP / DEVELOPMENT BOUNDARY LIMITS
- 2 x 1GW SUBSTATION PLOTS (2 @ Approx. 400m x 125m)
- TEMPORARY CONSTRUCTION COMPOUND (250m x 120m)
- POTENTIAL LANDSCAPING ZONES (12m Min.)
- INDICATIVE 275kV HV CABLE ROUTE (EXPORT CABLES)
- INDICATIVE 400kV HV CABLE ROUTES (OUTGOING)
- EXISTING MORAY EAST SERVITUDE (HV CABLE ROUTE)
- POTENTIAL SITE ACCESS OPTION
- POTENTIAL EAST SWANFORD ACCESS OPTION
- EAST SWANFORD ACCESS 'UNCHANGED'

0 25 50 75 100 125m

SCALE 1:2500 AT ORIGINAL SIZE

REV	DATE	DOC STATUS	ORIGIN	REVIEW	APP
02	05/12/2023	ISSUED FOR REVIEW	PDO	*CJ	*GS
01	02/10/2023	ISSUED FOR REVIEW	PDO	*CJ	*GS

CALEDONIA Offshore Wind Farm

GHD

CONTRACTOR DRAWING NUMBER -

CONTRACTOR REV -

GEODETIC PARAMETERS -

DRAWING TITLE

LOCATION 1
(Burnside)
PREFERRED OVERVIEW PLAN FOR EIA

STATUS: ISSUED FOR REVIEW

SCALE: 1:2500 @ A1

DRAWING NUMBER: UKCAL-GHD-01-ONS-ENG-DWG-00016

SHEET NUMBER: 001

REV: 02

Appendix B Existing greenfield runoff rate – 9.02ha

Project:	Date: 21/06/2024		
	Designed by: [redacted]	Checked by:	Approved By:
Report Title: UK and Ireland Rural Runoff Calculator	Company Address:		

ICP SUDS / IH 124

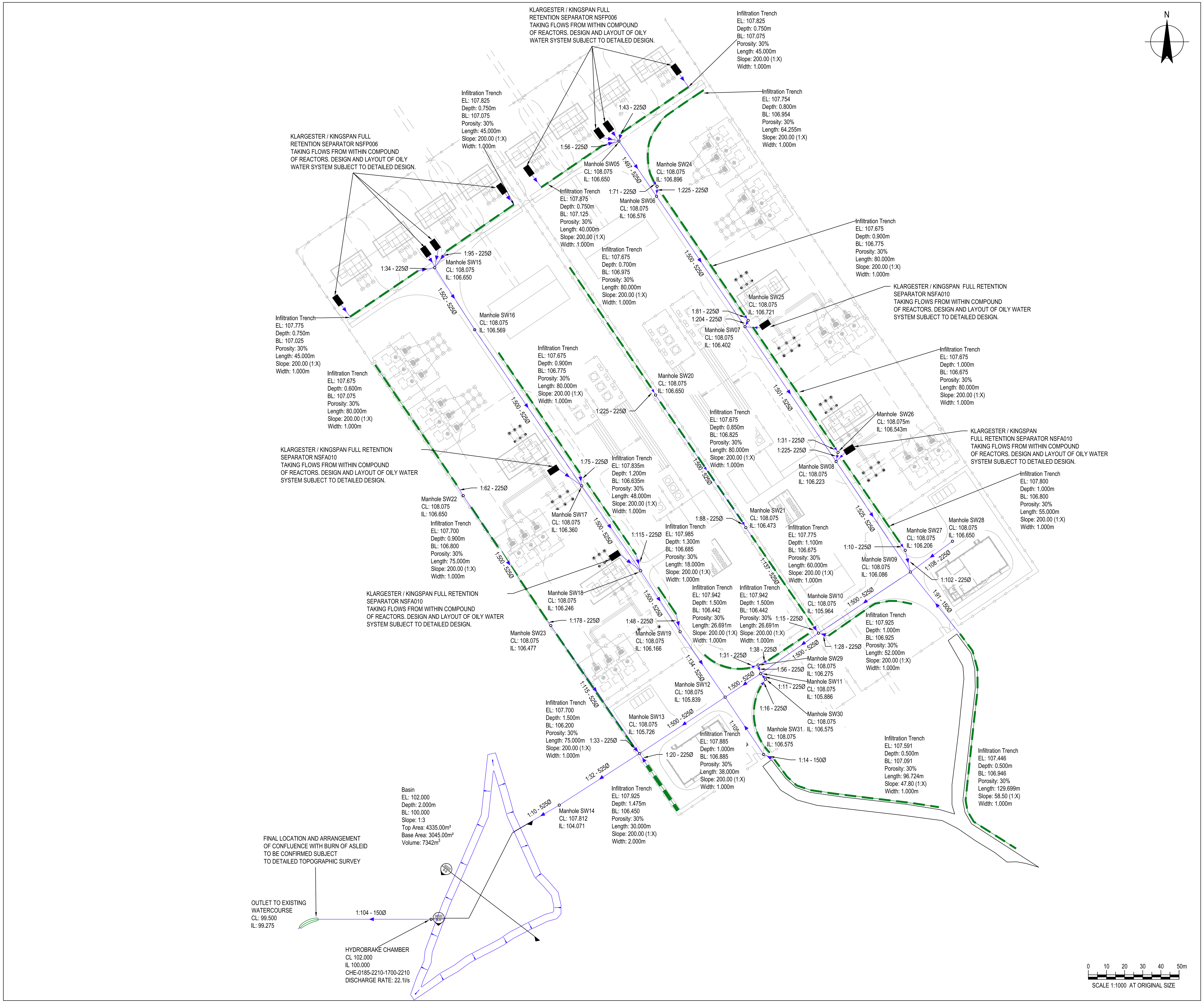
Details

Method	ICP SUDS
Area (ha)	9.024
SAAR (mm)	900.0
Soil	0.3
Region	Region 1
Urban	0
Return Period (years)	0

Results

Region	QBAR Rural (L/s)	QBAR Urban (L/s)	Q 1 (years) (L/s)	Q 30 (years) (L/s)	Q 100 (years) (L/s)
Region 1	22.1	22.1	18.8	41.7	54.7

Appendix C Onshore substation – preliminary proposed drainage layout



KEY

- FILTER TRENCH WITH UNDER DRAIN
- SURFACE WATER DRAINAGE NETWORK
- FULL RETENTION SEPARATOR
- MANHOLE
- SWALE

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. NO WORK SHOULD COMMENCE ON SITE UNTIL WRITTEN APPROVAL IS RECEIVED FROM THE PLANNING AUTHORITY.
3. DRAINAGE DESIGN BASED ON SITE LAYOUT DRAWING: _401-12610660-LOC1-014-MDL_01 2x1GW.dwg_
4. FOR SURFACE WATER DRAINAGE STANDARD DETAILS SEE DRAWINGS: UKCAL-GHD-01-ONS-ENG-DWG-00018 & 19
5. MANHOLE NUMBERING BEGINS AT SW05, DUE TO UPDATES TO DESIGN FOLLOWING CHANGES TO SITE LAYOUT.
6. PIPES WITH LESS THAN 1.2m COVER SUBJECT TO VEHICLE LOADING, TO BE LAID WITH A CONCRETE SURROUND.
7. COVER LEVELS INDICATED ON THE DRAWING ARE NOMINAL AND MAY BE ADJUSTED TO SUIT FINISHED GROUND LEVELS AS NECESSARY.
8. PRIOR TO CONSTRUCTION, THE ACTUAL POSITION AND DEPTH OF SERVICES LIKELY TO BE AFFECTED BY THE WORK SHOULD BE ESTABLISHED BY MEANS OF A HAND DIG IN CLOSE LIAISON WITH THE STATUTORY SERVICE AUTHORITIES. THE CONTRACTOR SHALL IMMEDIATELY INFORM GHD OF ANY SERVICES EXPOSED THAT MAY AFFECT THE DESIGN.

SITE LAYOUT IS SUBJECT TO CHANGE DURING DETAILED DESIGN

REV	DATE	DOC STATUS	ORIGIN	REVIEW	APP
P03	05/09/2024	UPDATE TO BASIN	RP	DR	SD
P02	30/08/2024	ISSUED FOR INFORMATION	RP	DR	GS
P01	02/08/2024	ISSUED FOR REVIEW	RP	DR	GS

CALEDONIA Offshore Wind Farm

GHD

CONTRACTOR DRAWING NUMBER: -	CONTRACTOR REV: -
GEODETIC PARAMETERS: -	
DRAWING TITLE: ONSHORE SUBSTATION - PRELIMINARY SURFACE WATER DRAINAGE NETWORK	
STATUS: ISSUED FOR INFORMATION	SCALE: 1:1000
DRAWING NUMBER: UKCAL-GHD-01-ONS-ENG-DWG-00017	SHEET NUMBER: 001 / REV: P03

Appendix D InfoDrainage model outputs – critical storm

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:X)	500.00
Max. Slope (1:X)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Pipe Size Library

Default

Add. Increment (mm)	75

Diameter (mm)	Min. Slope (1:X)	Max. Slope (1:X)
100	0.00	0.00
150	0.00	0.00

Manhole Options

Apply Offset	☐
An error has occurred while processing TextBox 'txtSynchroniseManholeInvertLevelsHeader': The expression contains object 'SynchroniseManholeInvertLevelsTitle' that is not defined in the current context.	▣

Manhole Size Library

Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Additional Sizing

Connection (mm)	900
Diameter / Length (m)	0.900
Width (m)	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Access

Depth (m)	Ladder Protrusion (mm)
0.000	130
3.000	230

Benching Requirements

Landing Width (mm)	500
Benching Width (mm)	225

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	Scotland And Ireland
M5-60 (mm)	15.0
Ratio R	0.250
Summer	☐
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	37.000
30.0	37.000
2.0	0.000
200.0	0.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

FSR: 100 years: Increase Rainfall (%): +37: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area (1)	FSR: 100 years: +37 %: 15 mins: Winter	0.01	5.3	2.455
Catchment Area (2)	FSR: 100 years: +37 %: 15 mins: Winter	0.01	2.4	1.115
Catchment Area (3)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	7.4	3.408
Catchment Area (5)	FSR: 100 years: +37 %: 15 mins: Winter	0.01	2.3	1.064
Catchment Area (6)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	7.1	3.270
Catchment Area (8)	FSR: 100 years: +37 %: 15 mins: Winter	0.12	50.7	23.476
Catchment Area (9)	FSR: 100 years: +37 %: 15 mins: Winter	0.06	23.1	10.681
Catchment Area (10)	FSR: 100 years: +37 %: 15 mins: Winter	0.05	22.9	10.616
Catchment Area (11)	FSR: 100 years: +37 %: 15 mins: Winter	0.09	36.8	17.041
Catchment Area (12)	FSR: 100 years: +37 %: 15 mins: Winter	0.09	36.8	17.041
Catchment Area (13)	FSR: 100 years: +37 %: 15 mins: Winter	0.05	20.4	9.450
Catchment Area (14)	FSR: 100 years: +37 %: 15 mins: Winter	0.05	20.4	9.450
Catchment Area (16)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	15.7	7.265
Catchment Area (18)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	15.1	6.968
Catchment Area (43)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	14.8	6.863

Catchment Area (44)	FSR: 100 years: +37 %: 15 mins: Winter	0.03	14.4	6.647
Catchment Area (15)	FSR: 100 years: +37 %: 15 mins: Winter	0.16	63.6	29.443
Catchment Area (17)	FSR: 100 years: +37 %: 15 mins: Winter	0.13	50.8	23.515
Catchment Area (19)	FSR: 100 years: +37 %: 15 mins: Winter	0.27	105.5	48.780
Catchment Area (20)	FSR: 100 years: +37 %: 15 mins: Winter	0.27	107.2	49.601
Catchment Area (21)	FSR: 100 years: +37 %: 15 mins: Winter	0.31	121.9	56.378
Catchment Area (22)	FSR: 100 years: +37 %: 15 mins: Winter	0.26	101.2	46.838
Catchment Area (23)	FSR: 100 years: +37 %: 15 mins: Winter	0.20	77.4	35.815
Catchment Area (24)	FSR: 100 years: +37 %: 15 mins: Winter	0.13	52.8	24.444
Catchment Area	FSR: 100 years: +37 %: 15 mins: Winter	0.37	145.1	67.119
Catchment Area (4)	FSR: 100 years: +37 %: 15 mins: Winter	0.43	168.2	77.792
Catchment Area (25)	FSR: 100 years: +37 %: 15 mins: Winter	0.05	22.7	10.484
Catchment Area (26)	FSR: 100 years: +37 %: 15 mins: Winter	0.11	44.3	20.482
Catchment Area (27)	FSR: 100 years: +37 %: 15 mins: Winter	0.50	196.8	91.048
Catchment Area (28)	FSR: 100 years: +37 %: 15 mins: Winter	0.45	179.2	82.908
Catchment Area (29)	FSR: 100 years: +37 %: 15 mins: Winter	0.35	137.9	63.780
Catchment Area (30)	FSR: 100 years: +37 %: 15 mins: Winter	0.10	42.5	19.655

Catchment Area (31)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	7.3	3.378
Catchment Area (32)	FSR: 100 years: +37 %: 15 mins: Winter	0.05	22.2	10.262
Catchment Area (33)	FSR: 100 years: +37 %: 15 mins: Winter	0.18	71.2	32.950
Catchment Area (34)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	17.7	8.191
Catchment Area (35)	FSR: 100 years: +37 %: 15 mins: Winter	0.38	150.2	69.478
Catchment Area (36)	FSR: 100 years: +37 %: 15 mins: Winter	0.47	184.9	85.545
Catchment Area (37)	FSR: 100 years: +37 %: 15 mins: Winter	0.28	109.4	50.605
Catchment Area (38)	FSR: 100 years: +37 %: 15 mins: Winter	0.17	66.0	30.519
Catchment Area (39)	FSR: 100 years: +37 %: 15 mins: Winter	0.06	25.4	11.733
Catchment Area (40)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	7.8	3.593
Catchment Area (41)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	6.7	3.084
Catchment Area (42)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	18.1	8.395
Catchment Area (45)	FSR: 100 years: +37 %: 15 mins: Winter	0.12	48.9	22.631
Catchment Area (46)	FSR: 100 years: +37 %: 15 mins: Winter	0.06	23.3	10.774
Catchment Area (47)	FSR: 100 years: +37 %: 15 mins: Winter	0.19	75.8	35.060
Catchment Area (48)	FSR: 100 years: +37 %: 15 mins: Winter	0.00	1.4	0.632
Catchment Area (49)	FSR: 100 years: +37 %: 15 mins: Winter	0.54	215.0	99.469

Catchment Area (50)	FSR: 100 years: +37 %: 15 mins: Winter	0.34	133.2	61.616
Catchment Area (51)	FSR: 100 years: +37 %: 15 mins: Winter	0.28	110.6	51.172
Catchment Area (52)	FSR: 100 years: +37 %: 15 mins: Winter	0.08	33.3	15.381
Catchment Area (53)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	16.4	7.568
Catchment Area (54)	FSR: 100 years: +37 %: 15 mins: Winter	0.04	17.3	8.002
Catchment Area (55)	FSR: 100 years: +37 %: 15 mins: Winter	0.02	6.6	3.033
Catchment Area (56)	FSR: 100 years: +37 %: 15 mins: Winter	0.30	119.9	55.454
Catchment Area (57)	FSR: 100 years: +37 %: 15 mins: Winter	0.24	100.1	46.292
Catchment Area (58)	FSR: 100 years: +37 %: 15 mins: Winter	0.23	90.4	41.812
Catchment Area (7)	FSR: 100 years: +37 %: 15 mins: Winter	0.07	29.2	13.484
Catchment Area (59)	FSR: 100 years: +37 %: 15 mins: Winter	0.10	39.9	18.480

FSR: 100 years: Increase Rainfall (%): +37: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
Outfall	FSR: 100 years: +37 %: 240 mins: Winter	99.500	99.275	99.425	0.150	19.0	0.000	0.000	19.0	382.905	Flood Risk
Manhole (9)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	105.726	106.018	0.293	433.0	0.331	0.000	432.9	632.536	OK
Manhole (11)	FSR: 100 years: +37 %: 30 mins: Winter	107.812	104.071	104.279	0.208	432.9	0.236	0.000	432.4	631.607	OK
Manhole (22)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	105.886	106.486	0.600	230.1	0.678	0.000	230.7	544.852	Surcharged
Manhole (23)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	105.964	106.580	0.615	208.3	0.696	0.000	210.8	489.088	Surcharged
Manhole (25)	FSR: 100 years: +37 %: 15 mins: Winter	108.075	106.650	107.673	1.023	100.5	1.157	0.000	94.8	46.317	Surcharged
Manhole (27)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.206	106.642	0.436	12.2	0.493	0.000	12.0	24.516	Surcharged
Manhole (28)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.543	106.683	0.140	19.8	0.158	0.000	19.5	42.590	OK
Manhole (31)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.721	106.893	0.172	30.5	0.195	0.000	30.4	39.406	OK
Manhole (32)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.896	107.043	0.147	22.4	0.166	0.000	22.3	21.738	OK
Manhole (13)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.275	106.494	0.219	21.8	0.248	0.000	21.6	39.432	OK
Manhole (20)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.575	106.608	0.033	8.8	0.038	0.000	8.9	10.740	OK
Manhole (29)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.650	106.767	0.117	21.9	0.132	0.000	22.4	26.551	OK
Manhole (5)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.576	106.726	0.150	40.5	0.170	0.000	39.7	47.799	OK
Manhole (30)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.402	106.685	0.283	64.3	0.320	0.000	57.4	132.539	OK
Manhole (34)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.223	106.658	0.435	74.6	0.492	0.000	88.2	173.891	OK
Manhole (35)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.086	106.634	0.548	145.8	0.620	0.000	137.0	325.678	Surcharged
Manhole	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.650	106.771	0.121	21.1	0.137	0.000	21.8	26.147	OK
Manhole (1)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.569	106.747	0.178	54.5	0.201	0.000	50.6	64.931	OK
Manhole (2)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.360	106.561	0.201	61.8	0.227	0.000	61.7	130.414	OK

Manhole (3)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.246	106.493	0.247	81.8	0.280	0.000	81.0	111.234	OK
Manhole (4)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.166	106.437	0.271	92.3	0.307	0.000	91.3	124.293	OK
Manhole (6)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	105.839	106.410	0.571	327.1	0.645	0.000	326.2	497.323	Surcharged
Manhole (10)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.650	106.774	0.124	24.6	0.140	0.000	24.4	31.175	OK
Manhole (12)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.473	106.597	0.124	40.8	0.141	0.000	44.5	85.626	OK
Manhole (7)	FSR: 100 years: +37 %: 30 mins: Winter	108.075	106.650	106.773	0.123	24.3	0.139	0.000	23.9	30.013	OK
Manhole (8)	FSR: 100 years: +37 %: 60 mins: Winter	108.075	106.477	106.577	0.100	39.2	0.113	0.000	38.7	84.113	OK
Manhole (14)	FSR: 100 years: +37 %: 15 mins: Winter	108.075	106.575	106.879	0.304	19.7	0.343	0.000	20.7	13.135	Surcharged

Project:: Caledonia OWF 12610660	Date: 01/08/2024		
	Designed by: [redacted]	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	GHD: 41 - 51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +37: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FSR: 100 years: +37 %: 1440 mins: Winter	101.431	101.431	1.431	1.431	144.5	4986.973	0.000	0.000	22.0	2572.967	32.077	OK
Infiltration Trench	FSR: 100 years: +37 %: 60 mins: Winter	107.292	107.146	0.042	0.121	10.5	1.029	0.000	0.000	10.5	21.940	85.957	OK
Infiltration Trench (1)	FSR: 100 years: +37 %: 30 mins: Winter	106.631	106.364	0.056	0.164	17.9	2.335	0.000	0.000	19.0	22.645	91.971	OK
Infiltration Trench (2)	FSR: 100 years: +37 %: 60 mins: Winter	107.226	106.960	0.051	0.160	15.7	2.163	0.000	0.000	15.5	34.204	86.125	OK
Infiltration Trench (3)	FSR: 100 years: +37 %: 30 mins: Winter	107.346	107.200	0.046	0.125	12.8	1.091	0.000	0.000	12.2	14.661	85.110	OK
Infiltration Trench (4)	FSR: 100 years: +37 %: 30 mins: Winter	107.365	107.233	0.040	0.108	9.3	0.855	0.000	0.000	9.7	12.166	86.870	OK
Infiltration Trench (5)	FSR: 100 years: +37 %: 60 mins: Winter	107.608	107.272	0.133	0.197	24.2	3.736	0.000	0.000	24.1	51.109	54.689	OK
Porous Paving	FSR: 100 years: +37 %: 1440 mins: Winter	108.042	107.707	0.242	0.024	4.7	79.436	0.136	0.000	2.1	136.630	23.860	OK
Porous Paving (1)	FSR: 100 years: +37 %: 1440 mins: Winter	108.043	107.715	0.244	0.023	3.7	60.600	0.170	0.000	1.8	112.180	24.044	OK
Porous Paving (2)	FSR: 100 years: +37 %: 1440 mins: Winter	108.076	107.683	0.276	0.031	7.8	142.495	5.253	0.000	3.1	211.696	14.380	Flood
Porous Paving (3)	FSR: 100 years: +37 %: 1440 mins: Winter	108.076	107.690	0.277	0.035	7.9	137.688	8.468	0.000	4.7	220.671	11.835	Flood
Porous Paving (4)	FSR: 100 years: +37 %: 1440 mins: Winter	108.075	107.670	0.276	0.034	9.0	171.065	7.337	0.000	3.7	235.025	13.676	Flood
Porous Paving (5)	FSR: 100 years: +37 %: 960 mins: Winter	108.078	107.704	0.278	0.057	12.3	154.771	13.573	0.000	7.2	206.203	7.386	Flood
Porous Paving (6)	FSR: 100 years: +37 %: 960 mins: Winter	108.080	107.659	0.279	0.048	18.8	235.314	25.961	0.000	11.7	300.128	5.769	Flood

Infiltration Trench (6)	FSR: 100 years: +37 %: 30 mins: Winter	107.342	107.193	0.042	0.118	10.1	1.019	0.000	0.000	10.6	12.883	86.088	OK
Infiltration Trench (7)	FSR: 100 years: +37 %: 15 mins: Winter	107.338	107.141	0.063	0.187	25.7	2.254	0.000	0.000	20.4	13.468	80.247	OK
Porous Paving (8)	FSR: 100 years: +37 %: 1440 mins: Winter	108.029	107.692	0.229	0.019	3.3	57.605	0.000	0.000	1.4	91.966	27.046	OK
Infiltration Trench (8)	FSR: 100 years: +37 %: 60 mins: Winter	107.234	106.969	0.059	0.194	20.9	2.754	0.000	0.000	20.9	47.207	83.434	OK
Porous Paving (10)	FSR: 100 years: +37 %: 1440 mins: Winter	108.078	107.624	0.277	0.051	14.5	286.247	21.863	0.000	7.3	341.984	8.932	Flood
Infiltration Trench (9)	FSR: 100 years: +37 %: 60 mins: Winter	107.192	106.813	0.117	0.138	14.6	2.894	0.000	0.000	14.3	30.132	84.790	OK
Porous Paving (7)	FSR: 100 years: +37 %: 1440 mins: Winter	108.076	107.629	0.276	0.036	13.2	265.640	14.366	0.000	5.5	314.540	12.377	Flood
Infiltration Trench (10)	FSR: 100 years: +37 %: 60 mins: Winter	107.120	106.917	0.045	0.117	12.1	1.312	0.000	0.000	12.2	24.560	89.967	OK
Porous Paving (9)	FSR: 100 years: +37 %: 1440 mins: Winter	108.076	107.651	0.276	0.032	10.1	197.413	10.038	0.000	4.4	256.245	13.047	Flood
Porous Paving (11)	FSR: 100 years: +37 %: 1440 mins: Winter	108.077	107.709	0.277	0.040	6.3	107.888	5.440	0.000	3.4	179.895	12.515	Flood
Porous Paving (12)	FSR: 100 years: +37 %: 1440 mins: Winter	108.042	107.704	0.241	0.031	4.4	77.771	0.480	0.000	1.9	123.854	22.460	OK
Porous Paving (13)	FSR: 100 years: +37 %: 1440 mins: Winter	108.078	107.647	0.278	0.056	14.8	268.542	24.979	0.000	9.6	374.317	6.897	Flood
Porous Paving (14)	FSR: 100 years: +37 %: 1440 mins: Winter	108.077	107.708	0.277	0.048	6.9	120.009	7.153	0.000	4.1	193.932	11.031	Flood
Infiltration Trench (11)	FSR: 100 years: +37 %: 30 mins: Winter	107.439	107.195	0.064	0.220	24.0	3.148	0.000	0.000	24.5	31.601	71.894	OK
Infiltration Trench (12)	FSR: 100 years: +37 %: 60 mins: Winter	107.352	106.984	0.127	0.159	16.8	3.195	0.000	0.000	16.5	34.882	79.219	OK
Infiltration Trench (13)	FSR: 100 years: +37 %: 30 mins: Winter	107.120	106.900	0.145	0.225	35.8	3.549	0.000	0.000	32.2	37.534	77.916	OK
Porous Paving (15)	FSR: 100 years: +37 %: 480 mins: Winter	108.081	107.687	0.281	0.070	29.2	205.875	27.785	0.000	13.9	198.098	1.213	Flood

Project:: Caledonia OWF 12610660	Date: 01/08/2024		
	Designed by: [redacted]	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	GHD: 41 - 51 Grey Street Newcastle Upon Tyne		

Porous Paving (16)	FSR: 100 years: +37 %: 960 mins: Winter	108.079	107.641	0.279	0.059	19.9	263.929	28.853	0.000	11.0	297.460	4.964	Flood
Porous Paving (17)	FSR: 100 years: +37 %: 1440 mins: Winter	108.076	107.680	0.276	0.031	8.6	155.877	7.894	0.000	4.3	233.916	13.241	Flood
Porous Paving (18)	FSR: 100 years: +37 %: 960 mins: Winter	108.078	107.701	0.278	0.030	6.4	77.498	5.843	0.000	3.7	113.654	10.988	Flood
Infiltration Trench (14)	FSR: 100 years: +37 %: 60 mins: Winter	107.224	106.918	0.049	0.143	14.5	2.155	0.000	0.000	14.4	34.183	87.035	OK
Porous Paving (19)	FSR: 100 years: +37 %: 960 mins: Winter	108.078	107.693	0.278	0.035	9.6	120.056	9.431	0.000	5.4	164.569	10.170	Flood
Porous Paving (20)	FSR: 100 years: +37 %: 1440 mins: Winter	108.077	107.604	0.277	0.046	15.8	326.369	21.436	0.000	6.7	355.942	10.482	Flood
Infiltration Trench (15)	FSR: 100 years: +37 %: 30 mins: Winter	106.926	106.792	0.051	0.157	15.7	1.407	0.000	0.000	16.1	19.250	90.159	OK
Porous Paving (21)	FSR: 100 years: +37 %: 960 mins: Winter	108.078	107.670	0.278	0.036	15.4	202.697	16.113	0.000	7.6	246.028	10.047	Flood
Infiltration Trench (16)	FSR: 100 years: +37 %: 30 mins: Winter	106.879	106.806	0.104	0.121	12.1	0.594	0.000	0.000	11.6	13.708	89.932	OK
Porous Paving (22)	FSR: 100 years: +37 %: 1440 mins: Winter	108.077	107.668	0.276	0.026	8.1	149.810	7.995	0.000	4.0	218.213	13.374	Flood
Infiltration Trench (17)	FSR: 100 years: +37 %: 30 mins: Winter	106.617	106.536	0.042	0.094	8.3	0.533	0.000	0.000	8.2	8.729	94.852	OK
Infiltration Trench (20)	FSR: 100 years: +37 %: 30 mins: Winter	106.599	106.492	0.023	0.050	2.5	0.280	0.000	0.000	2.5	2.580	97.291	OK
Porous Paving (23)	FSR: 100 years: +37 %: 480 mins: Winter	108.079	107.739	0.278	0.023	8.9	55.262	3.742	0.000	3.9	77.707	12.290	Flood
Porous Paving (24)	FSR: 100 years: +37 %: 960 mins: Winter	108.029	107.732	0.229	0.012	1.7	17.807	0.000	0.000	0.8	33.667	31.003	OK
Infiltration Trench (18)	FSR: 100 years: +37 %: 30 mins: Winter	107.230	107.046	0.045	0.121	12.3	1.254	0.000	0.000	12.3	14.858	89.863	OK
Porous Paving (25)	FSR: 100 years: +37 %: 960 mins: Winter	108.079	107.706	0.279	0.048	11.6	134.462	13.405	0.000	8.2	205.697	6.871	Flood
Infiltration Trench (19)	FSR: 100 years: +37 %: 30 mins: Winter	107.161	106.945	0.561	0.495	70.9	10.051	0.000	0.000	63.2	65.336	54.284	OK

Infiltration Trench (21)	FSR: 100 years: +37 %: 30 mins: Winter	107.113	106.982	0.038	0.097	8.4	0.760	0.000	0.000	8.8	10.776	91.587	OK
Porous Paving (26)	FSR: 100 years: +37 %: 1440 mins: Winter	108.048	107.686	0.248	0.027	6.6	121.072	3.121	0.000	2.7	183.414	17.756	OK
Infiltration Trench (22)	FSR: 100 years: +37 %: 15 mins: Winter	109.169	107.340	0.054	0.249	29.2	3.471	0.000	0.000	19.6	13.208	66.366	OK
Infiltration Trench (23)	FSR: 100 years: +37 %: 15 mins: Winter	109.230	107.316	0.067	0.370	39.9	7.759	0.000	0.000	19.4	17.894	43.848	Flood Risk

Project:: Caledonia OWF 12610660	Date: 01/08/2024		
	Designed by: [redacted]	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	GHD: 41 - 51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +37: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
Outlet	FSR: 100 years: +37 %: 960 mins: Winter	Pipe	Pond	Outfall	102.000	101.228	0.150	1651.550	1.2	1.26	22.0	Surcharged
Pipe (11)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (11)	Pond	107.812	104.279	0.199	631.607	5.7	0.28	432.4	OK
Pipe (23)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (23)	Manhole (22)	108.075	106.580	0.525	489.088	1.0	0.98	210.8	Surcharged
Pipe (9)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (9)	Manhole (11)	108.075	106.018	0.250	632.536	4.2	0.5	432.9	OK
Pipe (34)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (1)	Infiltration Trench (3)	108.075	107.779	0.043	6.785	1.1	0.07	6.0	OK
Pipe (35)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (2)	Infiltration Trench (4)	108.075	107.767	0.053	19.978	1.3	0.12	9.5	OK
Pipe (38)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (4)	Infiltration Trench	108.075	107.748	0.056	22.221	1.3	0.13	10.5	OK
Pipe (39)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (5)	Infiltration Trench (5)	108.075	107.785	0.102	23.850	0.6	0.22	11.0	OK
Pipe (40)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (6)	Infiltration Trench (1)	108.075	107.751	0.059	36.056	2.2	0.15	18.0	OK
Pipe (37)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (3)	Infiltration Trench (6)	108.075	107.778	0.051	20.928	1.5	0.11	10.1	OK
Pipe (47)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (7)	Manhole (32)	108.075	107.070	0.134	20.267	0.8	0.34	20.7	OK
Pipe (48)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (8)	Infiltration Trench (7)	108.075	107.749	0.048	5.738	1.0	0.05	5.3	OK
Pipe (30)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench (8)	Manhole (31)	108.075	106.890	0.145	47.180	0.8	0.36	21.0	OK
Pipe (31)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (10)	Infiltration Trench (8)	108.075	107.691	0.070	32.370	1.3	0.21	13.6	OK

Pipe (32)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench (9)	Manhole (28)	108.075	106.796	0.103	30.113	0.8	0.15	14.3	OK
Pipe (49)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (7)	Infiltration Trench (9)	108.075	107.702	0.088	30.856	1.0	0.15	14.6	OK
Pipe (50)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (10)	Manhole (27)	108.075	106.879	0.225	15.324	1.0	0.07	12.2	OK
Pipe (51)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (9)	Infiltration Trench (10)	108.075	107.730	0.053	24.886	1.7	0.12	12.1	OK
Pipe (52)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (11)	Infiltration Trench (5)	108.075	107.794	0.097	16.713	0.5	0.16	7.8	OK
Pipe (53)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (12)	Infiltration Trench (5)	108.075	107.780	0.092	11.557	0.4	0.12	5.4	OK
Pipe (54)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (13)	Infiltration Trench (2)	108.075	107.720	0.071	34.789	1.5	0.21	15.7	OK
Pipe (58)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (15)	Infiltration Trench (11)	108.075	107.779	0.075	35.032	1.4	0.23	16.7	OK
Pipe (59)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (16)	Infiltration Trench (12)	108.075	107.718	0.100	35.671	1.0	0.23	16.8	OK
Pipe (60)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (17)	Infiltration Trench (13)	108.075	107.739	0.097	14.216	1.1	0.11	11.2	OK
Pipe (61)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (18)	Infiltration Trench (13)	108.075	107.773	0.094	8.820	0.7	0.08	8.4	OK
Pipe (64)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (20)	Infiltration Trench (14)	108.075	107.669	0.067	34.814	1.5	0.19	14.5	OK
Pipe (66)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (21)	Infiltration Trench (15)	108.075	107.732	0.051	19.628	2.3	0.11	15.7	OK
Pipe (68)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (22)	Infiltration Trench (16)	108.075	107.730	0.074	13.852	1.1	0.08	12.1	OK
Pipe (22)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (17)	Manhole (13)	108.075	106.509	0.131	8.713	0.7	0.09	8.2	OK
Pipe (69)	FSR: 100 years: +37 %: 15 mins: Winter	Pipe	Manhole (13)	Manhole (22)	108.075	106.396	0.124	17.267	1.5	0.43	29.8	OK
Pipe (70)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (20)	Manhole (13)	108.075	106.477	0.129	2.570	0.3	0.03	2.5	OK

Pipe (71)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (23)	Infiltration Trench (17)	108.075	107.834	0.037	8.882	1.9	0.05	8.3	OK
Pipe (72)	FSR: 100 years: +37 %: 15 mins: Winter	Pipe	Porous Paving (24)	Infiltration Trench (20)	108.075	107.783	0.021	1.623	1.4	0.02	2.7	OK
Pipe (73)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (18)	Manhole (23)	108.185	107.005	0.177	14.817	1.1	0.13	12.4	OK
Pipe (74)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (25)	Infiltration Trench (18)	108.075	107.773	0.059	15.224	1.5	0.14	12.3	OK
Pipe (75)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (19)	Manhole (9)	108.075	107.009	0.127	65.331	2.7	0.54	63.2	Surcharged
Pipe (76)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (21)	Manhole (20)	108.075	106.952	0.038	10.760	2.0	0.07	8.8	OK
Pipe (77)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (20)	Manhole (22)	108.075	106.608	0.165	10.740	1.5	0.05	8.9	OK
Pipe (78)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (26)	Infiltration Trench (21)	108.075	107.769	0.047	17.485	1.4	0.09	8.5	OK
Pipe (33)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving	Infiltration Trench (3)	108.075	107.767	0.044	8.188	1.2	0.08	6.8	OK
Pipe (42)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Porous Paving (14)	Infiltration Trench (11)	108.075	107.787	0.067	17.670	0.8	0.19	7.9	OK
Pipe (45)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (29)	Manhole (5)	108.075	106.767	0.133	26.551	0.5	0.1	22.4	OK
Pipe (79)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (5)	Manhole (30)	108.075	106.726	0.202	47.799	0.6	0.18	39.7	OK
Pipe (82)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (34)	Manhole (35)	108.075	106.658	0.492	173.891	0.6	0.42	88.2	OK
Pipe (80)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (30)	Manhole (34)	108.075	106.657	0.333	85.950	0.7	0.27	59.1	OK
Pipe	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (4)	Manhole (29)	108.075	107.196	0.058	12.142	1.2	0.14	9.7	OK
Pipe (1)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (3)	Manhole (29)	108.050	107.156	0.063	14.638	1.4	0.15	12.2	OK
Pipe (13)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (32)	Manhole (5)	108.075	107.043	0.135	21.738	0.9	0.72	22.3	OK

Project:: Caledonia OWF 12610660	Date: 01/08/2024 Designed by: [redacted]	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	GHD: 41 - 51 Grey Street Newcastle Upon Tyne		

Pipe (20)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (31)	Manhole (30)	108.075	106.893	0.159	39.406	1.0	0.84	30.4	OK
Pipe (25)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (28)	Manhole (34)	108.075	106.683	0.138	42.590	0.8	0.61	19.5	OK
Pipe (24)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (27)	Manhole (35)	108.075	106.625	0.225	15.268	0.3	0.24	12.1	Surcharged
Pipe (26)	FSR: 100 years: +37 %: 15 mins: Winter	Pipe	Manhole (25)	Manhole (35)	108.075	107.673	0.225	46.317	2.4	1.9	94.8	Surcharged
Pipe (27)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (35)	Manhole (23)	108.075	106.634	0.525	325.665	0.8	0.64	137.0	Surcharged
Pipe (4)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (22)	Manhole (6)	108.075	106.486	0.525	544.852	1.1	1.07	230.7	Surcharged
Pipe (4) (1)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (6)	Manhole (9)	108.075	106.410	0.431	762.220	1.9	1.52	328.1	Surcharged
Pipe (2)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole	Manhole (1)	108.075	106.771	0.147	25.935	0.5	0.1	21.8	OK
Pipe (3)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (1)	Manhole (2)	108.075	106.747	0.182	64.719	0.8	0.23	50.6	OK
Pipe (5)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (2)	Manhole (3)	108.075	106.561	0.224	130.414	0.7	0.29	61.7	OK
Pipe (6)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (3)	Manhole (4)	108.075	106.493	0.259	173.452	1.0	0.38	81.4	OK
Pipe (14)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (4)	Manhole (6)	108.075	106.437	0.421	124.293	0.6	0.22	91.3	OK
Pipe (15)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (6)	Manhole	108.050	107.150	0.070	12.854	1.0	0.2	10.6	OK
Pipe (16)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench	Manhole	108.000	107.101	0.076	21.913	0.9	0.23	10.5	OK
Pipe (17)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Porous Paving (19)	Manhole (1)	108.075	107.760	0.050	12.681	1.7	0.11	10.9	OK
Pipe (29)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (10)	Manhole (12)	108.075	106.774	0.115	31.175	0.7	0.11	24.4	OK
Pipe (36)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (12)	Manhole (23)	108.075	106.597	0.370	85.626	0.3	0.11	44.5	OK

Pipe (41)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (11)	Manhole (10)	108.075	107.106	0.142	31.541	0.9	0.76	24.6	OK
Pipe (43)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench (12)	Manhole (12)	108.075	106.958	0.089	34.853	1.1	0.3	16.5	OK
Pipe (44)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (13)	Manhole (23)	108.075	106.872	0.186	37.517	2.3	0.23	32.1	OK
Pipe (28)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (16)	Manhole (4)	108.075	106.795	0.061	13.688	1.3	0.15	11.5	OK
Pipe (19)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (15)	Manhole (3)	108.075	106.733	0.093	19.217	1.0	0.33	16.2	OK
Pipe (18)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench (14)	Manhole (2)	108.075	106.865	0.078	34.154	1.2	0.24	14.4	OK
Pipe (7)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Manhole (7)	Manhole (8)	108.075	106.773	0.110	30.013	0.7	0.11	23.9	OK
Pipe (8)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Manhole (8)	Manhole (9)	108.075	106.577	0.195	84.113	0.5	0.09	38.7	OK
Pipe (10)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (1)	Manhole (9)	108.075	106.304	0.074	22.618	1.7	0.21	19.0	OK
Pipe (12)	FSR: 100 years: +37 %: 60 mins: Winter	Pipe	Infiltration Trench (2)	Manhole (8)	108.075	106.896	0.104	34.169	0.9	0.4	15.4	OK
Pipe (21)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (5)	Manhole (7)	108.075	107.230	0.100	30.434	1.4	0.37	24.3	OK
Pipe (46)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (22)	Manhole (14)	109.615	107.205	0.150	18.925	1.5	0.42	20.2	OK
Pipe (55)	FSR: 100 years: +37 %: 15 mins: Winter	Pipe	Manhole (14)	Manhole (6)	108.075	106.879	0.150	13.135	1.2	1.2	20.7	Surcharged
Pipe (56)	FSR: 100 years: +37 %: 30 mins: Winter	Pipe	Infiltration Trench (23)	Manhole (35)	109.663	107.137	0.150	25.836	1.2	1.06	19.8	Flood Risk

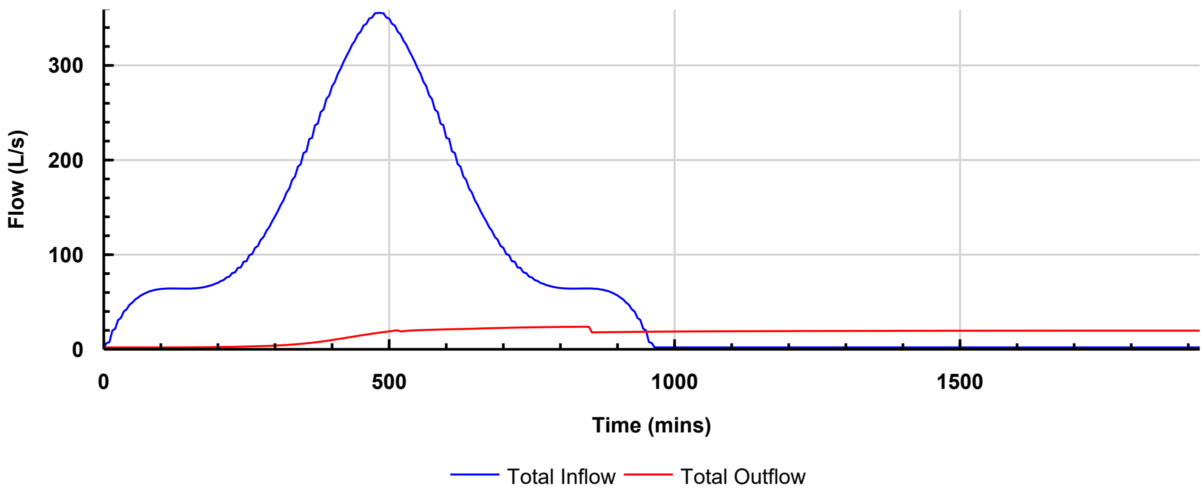
Phase
FSR: 100 years: Increase Rainfall (%): +37: 960 mins: Winter

Tables

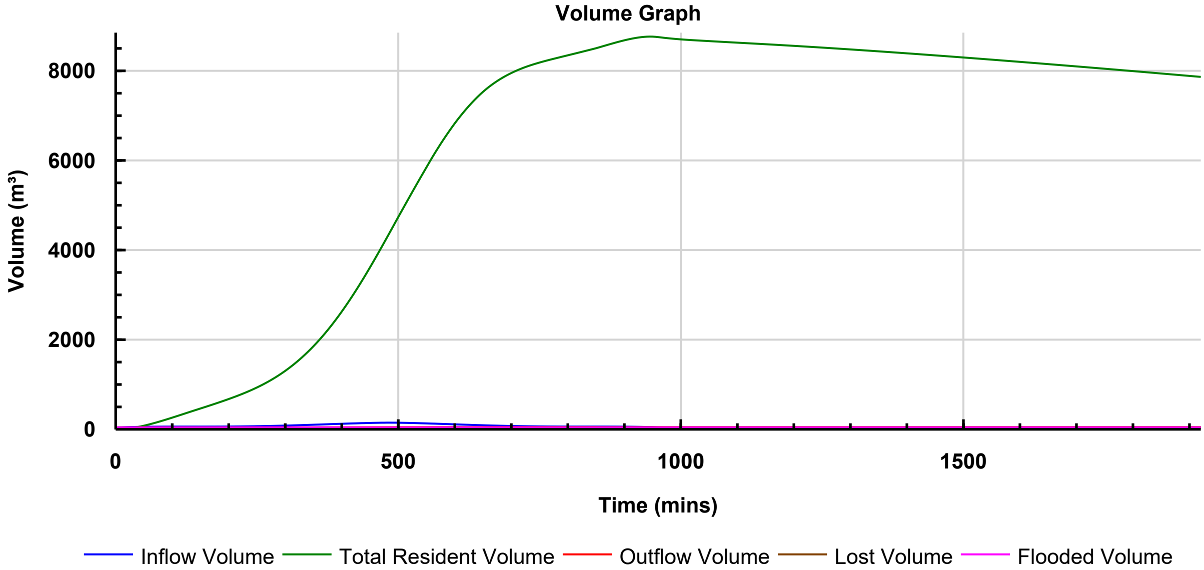
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Outfall			22.0	1651.550
TOTAL	355.4	8094.292	22.0	1651.550

Graphs

Flow Graph



Volume Graph



Appendix E Consultation with Aberdeenshire council

[redacted]

From: [redacted]
Sent: 24 July 2024 15:04
To: [redacted]
Cc: [redacted]
Subject: Meeting Minutes - GHD 24/07/2024 (ENQ/2024/0040)

CompleteRepository: 12610660
Description: Caledonia OWF Onshore Infrastructure Concept Design
JobNo: 12610660
OperatingCentre: 401
RepoEmail: [redacted]
RepoType: Proposal

Hi [redacted]

Thanks for your time in the meeting today. As discussed, and requested, we have summarised our call in the points below. I trust these are an accurate representation of what we discussed but let us know otherwise.

- The overall topic of the call was to discuss the principles of the surface water drainage design for the new substation.
  - The participants were [redacted] from GHD, and [redacted] from the flood risk management team in Aberdeenshire Council.
- GHD introduced the site location, layout, and drainage features that are proposed, such as the surface types/cover, the filter trenches, the attenuation basin, and the use of a single outfall. These basic principles were acceptable to Aberdeenshire Council (AC)
- GHD explained the rationale for choosing a single point of discharge into the Burn of Asleid, a small watercourse adjacent to the site, and limiting the runoff rate to Qbar for the whole site for all events up to the 100 year plus 37% climate change.
  - This included discussion on the use of FSR rainfall data and InfoDrainage modelling of the proposed drainage.
  - Both the rationale and rainfall data were confirmed by AC to be suitable in this case.
- GHD also mentioned that there will be oil-containing equipment on the site and that specific measures will be put in place to manage the risk of spills.
- There was a discussion around some technical points on the drainage design and modelling, including the Cv values. Overall, it was concluded that using conservative approaches to Cv values (with explanation in the report) and ensuring the equipment and buildings were resilient to flooding was sensible at this site.
- AC stressed the need for a clear maintenance schedule for drainage systems in the submitted document, highlighting it as a common shortfall in applications.
- AC offered to review the drainage design before the full application stage and to provide feedback.

Actions:

- Drainage Design: Review the use of shallow gravel as storage and water quality treatment for the site and provide feedback to GHD (**Action: AC**)
- Planning Application: Provide the planning application number to Andrew for record linkage (**Action: GHD**) This is now confirmed to be: **ENQ/2024/0040**
- Cv Values: Confirm the acceptability of Cv values for the project and communicate findings to the team (**Action: AC**)

Kind regards

[redacted]

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[redacted]

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Connect

Please consider the environment before printing this email

[redacted]

From: [redacted]
Sent: 12 July 2024 10:47
To: [redacted]
Cc: [redacted]
Subject: RE: DIA Advice

Hi [redacted]

Apologies for the delayed response. I have answered your queries below:

1. For proposed drainage, the minimum is 1 in 30-yr (plus an acceptable allowance for climate change). However, any drainage must be capable of adequately draining the site to ensure buildings are not at an increased risk of flooding. It may be better to discuss this at a meeting so I can get a better idea of what you're planning and maybe give you a steer if required.
2. 37% uplift in inputs is correct in this case.
3. So long as drainage to the receptor was controlled then this would likely be the most acceptable solution, assuming the drainage system installed could be proven to be effective. Again, happy to discuss that over Teams.
4. This could be acceptable, but infiltration tests would need to be conducted to verify that the soil has the capacity to take a reasonable volume of water before I could confirm this.

Again, I am more than happy to have an informal or formal Pre-app meeting to chat about this next week if that suits you.

Kind Regards,
[redacted]

From: [redacted]
Sent: Thursday, June 27, 2024 4:24 PM
To: [redacted]
Cc: [redacted]
Subject: RE: DIA Advice

You don't often get email from [redacted]. Learn why this is important

Hi [redacted]

I have been passed this email trail as I am undertaking the DIA report for the development on the land north of New Deer Substation, Turriff, AB53 6XS. I trust you are familiar with the general intention of the site to be developed from greenfield land to a pair of 1GW substations. Further to the points listed below, and your colleague [redacted] comment of "Agree with the importance of maintenance but this should also consider who is intended to perform. This could be included in their Maintenace Strategy" I had a few points I wanted to discuss with you that have been raised through the reporting and outline design process.

I am happy to discuss these in a more formal pre-app meeting should you wish to discuss the scheme as a whole in more detail, but thought it easiest to table them here in the first instance.

1. I note the guidance on the councils website (here) does not detail the required upper limit for design return periods of the sites proposed drainage network. There is reference to a minimum Drainage Design now being 1 in 30-yr (plus an acceptable allowance for climate change, see point below on this) in your emails but is there an expectation for larger events, such as the 1% AEP or 0.5% AEP rainfall events?
    a. If so are these larger events permitted on site flooding so long as it doesn't leave site, all of this inclusive of an uplift for climate change?
2. Can you please confirm what uplift in rainfall you would expect for climate change at a commercial development such as this? Our interpretation of the SEPA guidance (here) is that as the catchment area is less than 30km2 the peak rainfall allowances should be used, and that this equates to a 37% uplift in infall inputs. Can you confirm if you support this value?
3. The site layout is broadly rectangular, as can be seen on the attached, and is located at the crest of a hill. As such the current runoff arrangement based on GIS analysis is for a roughly equal split west and east. The existing runoff from the west side of the proposed development area will drain to the Burn of Asleid that is approximately 100m west and within the planning application boundary. Existing runoff from the east however will drain onto the unnamed single track road before being intercepted by a number of highway drains/ditches and flowing overland across open fields for more than 0.5km before draining to Little Water or its tributary. It is proposed due to the proximity of the Burn of Asleid and the ability to make a direct connection to the watercourse that all the sites positively drained area is discharged to this receptor. This will also ensure a single drainage network can be constructed for the site and limit the additional construction and disruption needed to make a viable connection to Little Water. This will however remove some area of existing runoff to the Little Water catchment, a GIS assessment identifies this to be less than 0.1% of the Little Water catchment area. Will you be accepting of a single point of discharge to the Burn of Asleid?
    a. It is proposed to discharge at no more than the equivalent Qbar rate of the positively drained area of the site.
4. The sites land uses post construction will be four main kinds, hard paved roads, buildings, concrete plinths for machinery and gravel. The purpose of the gravel is to ensure a low maintenance surface inside the high voltage/risk areas of the site. This gravel will be of a reasonable depth (final depth TBC) placed onto the finished earthwork level of the site. It's not proposed to be lined to prevent infiltration. Risk from oily water spills will be managed locally to machines with oil in them with connections to positive drainage as required. Given the extent of the site that will be covered in gravel, approximately 8 of the total 10 hectares, would you accept that these areas are not positively drained as part of the sites drainage network and instead drain freely to the ground below like the grass covered land currently does, with positive drainage limited to the other three land uses?

I hope the above make sense, if you would prefer to discuss in a meeting or on the phone please do let me know. My contact details are below.

Regards,

[redacted]

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[redacted]

The Power of Commitment

Connect

From: [redacted]
Sent: Thursday, April 11, 2024 10:46 AM
To: [redacted]
Cc: [redacted]
Subject: RE: DIA Advice

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Hi [redacted]

Apologies for the delay with this, I thought you were CC'd into the emails above but apparently not (see attached).

We are satisfied with the scope of the DIA you provided but would also emphasise the points mentioned in the chain attached.

Kind Regards,
[redacted]

From: [redacted]
Sent: Tuesday, April 9, 2024 9:22 PM
To: [redacted]
Cc: [redacted]
Subject: RE: DIA Advice

Good evening [redacted]

I wanted to check up on the below request, and if you consider a pre-application meeting is necessary or if you are comfortable with the below scope being progressed?

Thanks,
[redacted]

From: [redacted]
Sent: Monday, March 11, 2024 5:27 PM
To: [redacted]
Cc: [redacted]
Subject: RE: DIA Advice

Good afternoon [redacted],

Hope you are well? Last year we discussed the requirement for the Caledonia Offshore Windfarm to complete a Drainage Impact Assessment to support the onshore planning application. Following your correspondence we have progressed the procurement activity for this piece of work and will shortly be appointing a consultant to complete the DIA on our behalf. We have produced the scope based on the basic requirements identified in the guidance document provided. I have listed these out at the bottom of the email.

Section 2.3 of the guidance notes that a pre-application meeting may be necessary for those projects which meet certain thresholds to confirm the scope in advance of submission, and that this meeting is at the discretion of the planning officer. The Caledonia project meets this threshold, and so could you please advise if you are comfortable with the project proceeding based on the scope items listed below, or if a meeting is required? If so, we would invite our consultant to the meeting to provide technical input.

Please do let me know if you would like to discuss further.

Best Regards,
[redacted]

Proposed DIA Scope Items:

- Review of the site location, topographic information, surrounding area and infrastructure, surface and subsurface hydrology.
- Review of any existing desk study information.
- Review of current and historical drainage patterns.
- Soil classification for the site.
- Assessment of impermeable surfaces in the proposed conceptual design and derivation of pre- and post-development flow rates.
- Provision of an outline SuDS design strategy for the site. The DIA should consider the calculated flood levels and overland flows to inform the SuDS design strategy.
- Attenuation design tailored for 1 in 30-year return period rainfall event (additionally accounting for acceptable allowance for Climate Change).
- Assessment of the needs for managing oily water and inclusion of requisite oil interceptors.
- Proposals for wastewater drainage. It should be assumed that a foul water connection will not be required for the operational lifetime of the development.
- Production of a ground model showing the proposed SuDS design, the placement and deposition of material associated with the design and provide confirmation that site has adequate space to accommodate the proposed drainage design.
- Using conservative assumptions prior to Ground Investigation (GI) information being available, determine whether drainage infiltration is a feasible solution. If so, provide a cost for undertaking site infiltration tests to BRE 365 methodologies (max no. 3 tests), calculation of soil permeabilities and production of an infiltration report (which is to be appended to the DIA).
- The DIA should highlight the maintenance strategy required for the proposed drainage design (surface water and foul drainage).
- A rough order of magnitude cost (ROM) to develop the design and implement the proposed drainage option at the site.
- An indicative timescale to develop the design and implement the proposed drainage option at the site.
- Undertake all necessary 3rd party liaisons, including, but not limited to, SEPA and the local planning authority; and
- Include a letter from the water authority, specifying the location of the nearest public sewers and confirming their availability to service the site. (Note that a foul drainage connection will not be sought for this site, so this item may not be applicable).

From: [redacted]
Sent: Friday, November 24, 2023 11:22 AM

To: [redacted]
Subject: DIA Advice

You don't often get email from [redacted] Learn why this is important

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Hi [redacted]

Apologies for the delayed response.

We have standing advice regarding drainage impact assessments on our website:
https://www.aberdeenshire.gov.uk/environment/flooding/drainage-impact-assessment

Some of this is out of date however, such as that minimum Drainage Design is now 1 in 30-yr (plus an acceptable allowance for climate change) in line with Sewers for Scotland and not designed for 1 in 10-year attenuation. I do have more recent info we can send them but normally for drainage design we would refer designers to the Sewers for Scotland (v4) for technical matters.

If you have any other queries then please don't hesitate to get in touch.

Kind Regards,
[redacted]

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