Derrygrogan Little Solar Farm

Flood Risk Assessment and Drainage Strategy

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FRA and Drainage Strategy
V4
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1 Introduction

1.1 RPS Tetra Tech was commissioned by RES on behalf of Ballyteige Solar Limited ('the Applicant') to prepare a Flood Risk Assessment (FRA) and Conceptual Drainage Strategy in relation to the installation and operation of a solar farm on lands at Derrygrogan Little, County Offaly, Ireland ('the Proposal Site'). The description of development (hereafter referred to as 'the Proposed Development') is as follows:

"*"The development will consist of planning permission for a period of 10 years to construct and complete a Solar PV development with a total site area of c.28.1 hectares, to include solar PV ground mounted support structures, string inverters, transformer stations, electrical cabling and ducting, internal access tracks and hardstanding areas, perimeter fencing and access gate, CCTV, a temporary construction compound and other ancillary infrastructure including drainage, additional landscaping and habitat enhancement as required and associated site development works relating to the access of the site. The solar farm will be operational for 40 years in the townlands of Derrygrogan Little and Derrygrogan Big, Tullamore, Co. Offaly. A Natura Impact Statement (NIS) has been submitted with this application".*

1.2 The aim of the FRA is to outline the potential for the Proposal Site to be impacted by flooding, the impacts of the Proposed Development on flooding in the vicinity of the Proposal Site, and the proposed measures which could be incorporated into the development to mitigate the identified risk. The report has been prepared in accordance with the guidance detailed in the National Planning Framework (NPF) and the associated National Policy Objectives (NPO's). Reference has also been made to the National standards for sustainable drainage systems (SuDS), CIRIA SuDS manual (C753), BRE Digest 365 Soakaway Design, the County Offaly Strategic Flood Risk Assessment (SFRA) and the Shannon Upper & Lower River Basin (UOM25-26) Flood Risk Management Plan. This report has been prepared in consultation with Office of Public Works (OPW) and Offaly County Council.

1.3 This report is not intended to provide formal details of the final drainage design for the Proposed Development. However, it provides information regarding the capabilities of the conceptual surface water drainage strategy to meet the requirements of the NPF.

1.4 The desk study was undertaken by reference to information provided / published by the following bodies:

- The Office of Public Works;
- Environmental Protection Agency (EPA)
- Geological Survey Ireland (GSI)
- Ordnance Survey (OS); and
- Irish Water (Uisce Éireann)
- Offaly County Council

2 Planning Policy Context

National Planning Policy

2.1 The National Planning Framework (NPF)[1] was released in February 2018. The document advises that the following should be considered during the infrastructure planning process and management of developments within Ireland to enhance water quality and resource management (Chapter 9, National Policy Objective 57):

- Ensuring flood risk management informs place-making by avoiding inappropriate development in areas at risk of flooding in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities.
- Ensuring that River Basin Management Plan objectives are fully considered throughout the physical planning process.
- Integrating sustainable water management solutions, such as Sustainable Urban Drainage (SUDS), non-porous surfacing and green roofs, to create safe places.

2.2 Additionally, National Policy Objective (NPO) 58 makes reference to green infrastructure within the planning process, advising that:

- Integrated planning for Green Infrastructure and ecosystem services will be incorporated into the preparation of statutory land use plans.

2.3 Flood Risk Management Core Objectives are provided within the NPF and are comprised of the following:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere including that which may arise from surface water runoff;
- Ensure effective management of residual risk for developments permitted in floodplains;
- Avoid unnecessary restriction of national regional or local economic and social growth;
- Improving the understanding of flood risk and ensure flood risk management in accordance with best practice.

2.4 The Strategic Environmental Assessment (SEA) Statement has been prepared as part of the SEA of the NPF in accordance with the relevant national and EU legislation. This aims to signpost requirements and integrate environmental considerations into land use planning, to help inform the NPF.

Local Planning Policy

2.5 Each County Council is required to implement both National and European legislation within their local flood risk and sustainable drainage policy. The EU Water Framework Directive (WFD) (2000/60/EC) was transposed into Irish Law by the European Communities Water Policy Regulations 2003.

[1] https://cdn.npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

2.6 The County Offaly Development Plan 2021-2027 was adopted in September 2021 and incorporates both a SEA Environmental Report and a Strategic Flood Risk Assessment. Volume 1 (Written Statement) contains the following policies relevant to this report:

A. Flood Risk Assessment

CAEP-53: It is Council policy to support, in co-operation with the OPW, the implementation of the EU Flood Risk Directive, the Flood Risk Regulations (S.I. No. 122 of 2010) and the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009) and Department Circular Pl2/2014 or any updated / superseding version

CAEP-54: It is Council policy to protect Flood Zone A and Flood Zone B from inappropriate development and direct developments/land uses into the appropriate Flood Zone in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009 (or any superseding document) and the guidance contained in Development Management Standard DMS-106. Where a development/land use is proposed that is inappropriate within the Flood Zone, then the development proposal will need to be accompanied by a Development Management Justification Test and site specific Flood Risk Assessment in accordance with the criteria set out under with The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009 and Circular PL2/2014 (as updated/superseded). In Flood Zone C, (See DMS-106 where the probability of flooding is low (less than 0.1%, Flood Zone C), site-specific Flood Risk Assessment may be required and the developer should satisfy themselves that the probability of flooding is appropriate to the development being proposed. The County Plan SFRA datasets (including Benefitting Lands mapping), emerging CFRAMS mapping (including National Indicative Fluvial mapping), and the most up to date CFRAM Programme climate scenario mapping should be consulted by prospective planning applicants and the planning authority in determining planning applications.

CAEP-55: It is Council policy to require a Site-specific Flood Risk Assessment (FRA) for all planning applications in areas at risk of flooding (fluvial, pluvial or groundwater), even for developments deemed appropriate in principle to the particular Flood Zone. The detail of these site-specific FRAs will depend on the level of risk and scale of development. A detailed site-specific FRA should quantify the risks, the effects of selected mitigation and the management of any residual risks. The assessments shall consider and provide information on the implications of climate change with regard to flood risk in relevant locations. The 2009 OPW Draft Guidance on Assessment of Potential Future Scenarios for Flood Risk Management (or any superseding document) and available information from the CFRAM Studies shall be consulted with to this effect.

CAEP-56P: It is Council policy to ensure that applications to existing developments in flood vulnerable zones provide details of structural and non-structural risk management measures to include, but not be limited to specifications of the following - floor levels, internal layout, flood resilient construction, flood resistant construction, emergency response planning, access and egress during flood events.

CAEP-57: It is Council policy to work with other bodies and organisations, as appropriate, to help protect critical infrastructure, including water and wastewater, within the county, from risk of flooding. Any potential future variations to the Plan shall consider,

as appropriate any new and/or emerging data, including, when available, any relevant information contained in the CFRAMS Flood Risk Management Plans and as recommended in the SFRA for the Plan.

CAEP-58: It is Council policy to have regard to the findings and recommendations of the current Strategic Flood Risk Assessment prepared as part of the County Development Plan.

CAEP-59 It is Council policy to consult with the Office of Public Works (OPW) in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and the Council will retain a strip of 10 metres on either side of such channel where required, to facilitate access thereto.

CAEP-60: It is Council policy to consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in Offaly.

CAEP-61: It is Council policy to work with the OPW and other relevant Departments and agencies to implement the recommendations of the CFRAM programme to ensure that flood risk management policies and infrastructure are progressively implemented, and to also work with catchment-based Flood Planning Groups, (including where catchments go beyond the Council's administrative boundary) in the development and implementation of catchment-based strategies for the management of flood risk – including those relating to storage and conveyance

CAEP-62: It is Council policy that where resources are available and subject to compliance with the Habitats and Birds Directives, the Council will contribute towards the improvement and / or restoration of the natural flood risk management functions of flood plains.

CAEP-63: It is Council policy to take account of and incorporate into local planning policy and decision making, including possible future variations to this plan, the recommendations of the Flood Risk Management Plans (FRMPs), including planned investment measures for managing and reducing flood risk.

B. Green Infrastructure and Sustainable Drainage Systems

CAEP-67: It is Council policy to minimise and limit the extent of hard surfacing and paving and require the use of sustainable urban drainage systems (SuDs) where appropriate, for new developments or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.

CAEP-68: It is Council policy to discourage the use of hard non-porous surfacing and pavements within the boundaries of rural housing sites that are within 100 metres of watercourses of a significant conveyance capacity or adjacent to Flood Zone A or B areas.

CAEP-69: It is Council policy to encourage the use of Green Roofs and Green Walls particularly on apartment, industrial, commercial, leisure and educational buildings.

CAEP-70: It is Council policy to encourage and facilitate the maintenance of rivers and waterways by statutory authorities and the cleaning of drains in urban areas where appropriate subject to the requirements of OPW Best Practice Guidelines.

C. Flood Risk Management

CAEO-11: It is an objective of the Council to ensure that flood risk management is incorporated into the preparation of Local Area Plans in accordance with 'The Planning System and Flood Risk Management - Guidelines for Planning Authorities (2009).

CAEO-12: It is an objective of the Council to co-operate with the Office of Public Works (OPW) in the delivery of the Birr, Portarlington and Rahan Flood Relief Schemes and other schemes that may be brought forward in the lifetime of this Plan.

2.7 The site is not identified to be within the Arterial Drainage Scheme (ADS) or a Drainage District (DD).

Climate Change Allowances

2.8 Advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW Draft Guidance on Assessment of Potential Future Scenarios for Flood Risk Management (2009). Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "extreme" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change in relation to river flows and sea levels are given in Table 1.

Table 1. Climate Change Scenarios (100-year)

Criteria	MRFS – *to be considered for most development scenarios*	HEFS – *to be considered in relation to high value, high vulnerability development which cannot be relocated*
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1000mm

2.9 The Catchment Flood Risk Assessment and Management (CFRAM) Mapping and Guidance advises that a 20% climate change allowance should be applied during a Mid-Range Scenario. The proposed drainage strategy is designed to accommodate the 1 in 100 year plus 20% climate change design storm event.

3 Consultation

Office of Public Works

3.1 The FRA has been prepared in consultation the OPW. The OPW advised that they do not provide site specific information, and all flood data available from the OPW is published on their website, floodinfo.ie.

Offaly County Council

3.2 OCC were contacted in regard to SFRA risk mapping for the site. OCC sent across available Strategic Flood Risk Assessment mapping and confirmed within a telephone conversation that they did not have any site-specific surface water flood risk information for the site.

4 Site Description

Site Description

4.1 The site is located at Irish Grid Reference N 40969 29155, is irregular in shape and occupies an area of approximately 28.1 hectares (ha). The site location is presented in Figure 1.

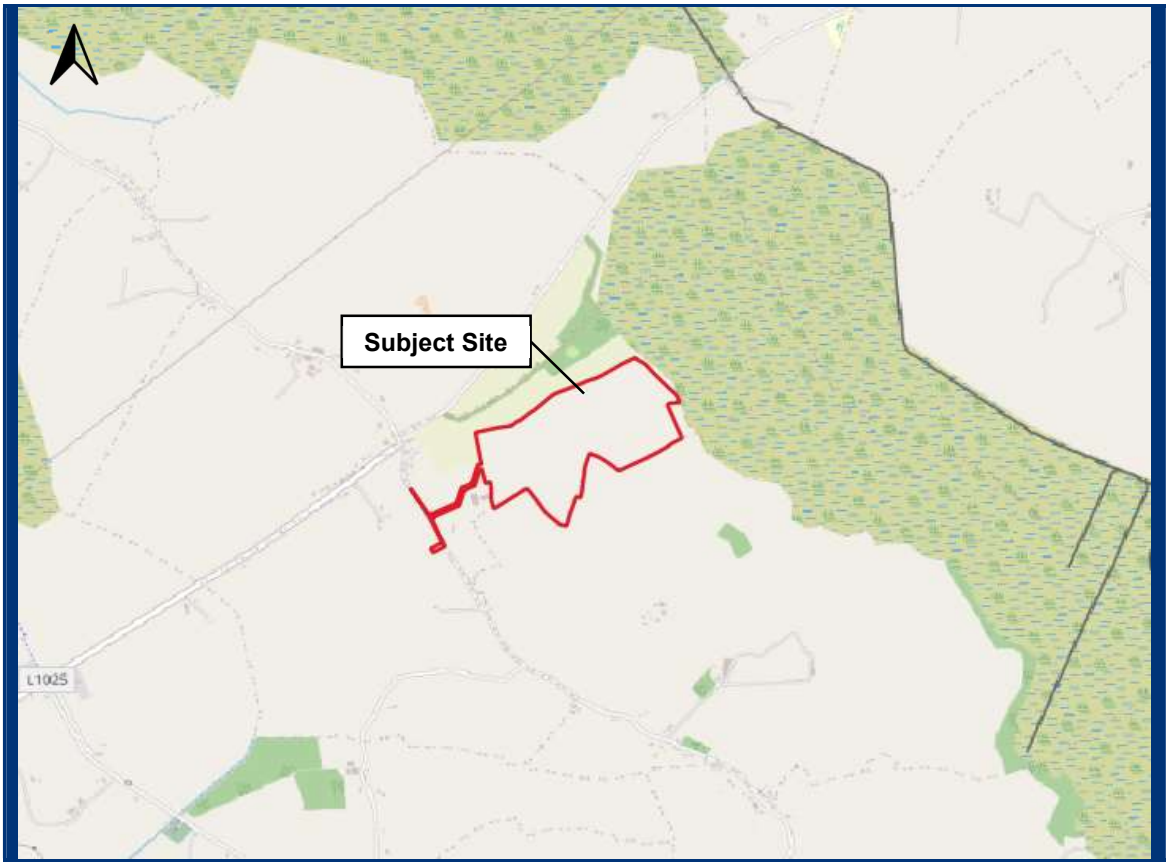


Figure 1. Site Location

4.2 The Proposal Site is currently occupied by agricultural fields, bound by hedgerows, shrubs and mature trees.

4.3 Vehicular and pedestrian access is via Derrygrogan Little Road adjacent to the southeast of the Proposal Site.

Surrounding Land Uses

4.4 Surrounding land uses comprise agricultural land and sparsely distributed residential properties and farm buildings. The L1025 road runs southeast of the Proposal Site.

4.5 The Silver River runs approximately 145m northwest of the site and is designated as a River within a Special Area of Conservation (SAC). The environmental constraints within the wider area are illustrated in Figure 2 below.

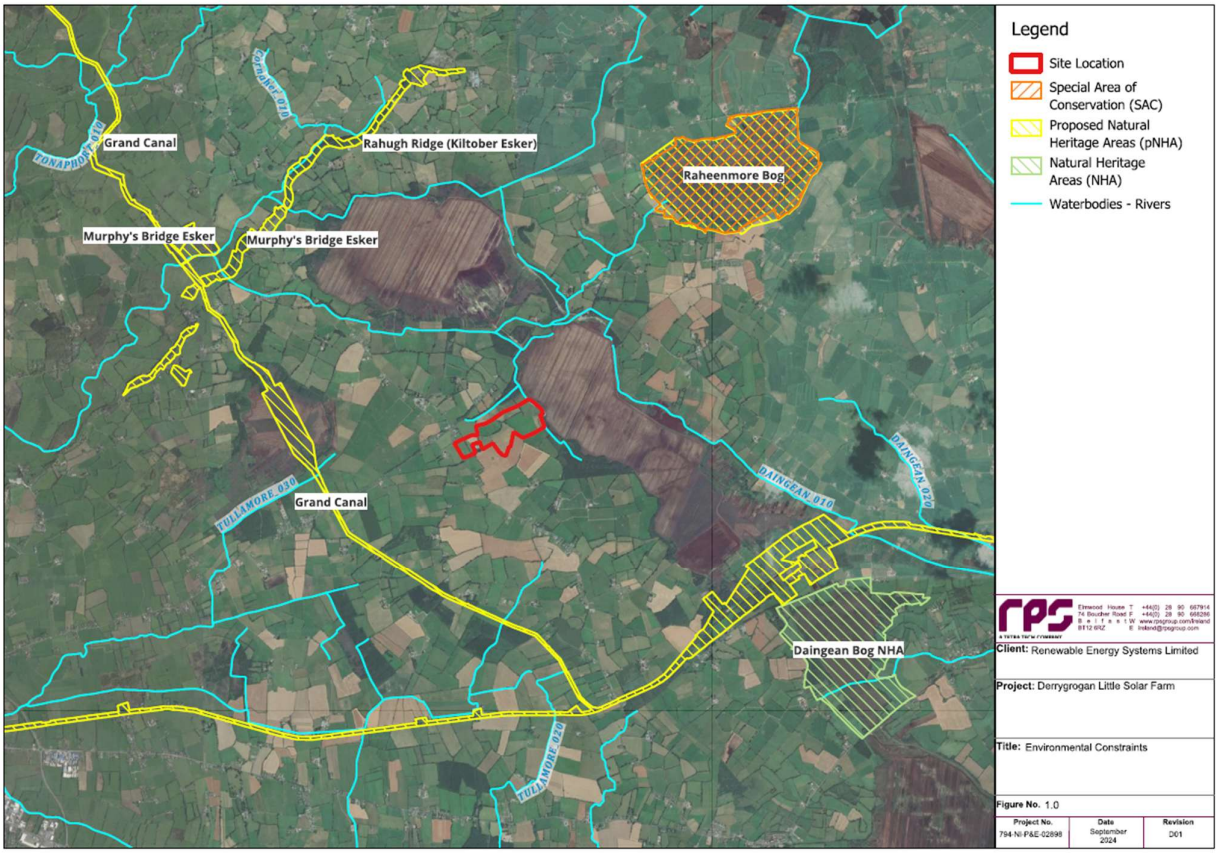


Figure 2. Environmental constraints

Topography

4.6 A topographic survey was completed by Orica Blast & Quarry Surveys Ltd in August 2024, reference RD130824, and indicates that levels generally fall from the south to the north, from a high point of 96.18 meters above datum upon the central southern boundary of the site to a low point of 84.95m meters above datum upon the central northern boundary, associated with the bottom of a watercourse bank along the site boundary.

4.7 Two on-site watercourses are present within the site. The first is located along the northern site boundary. Limited survey information indicates a level difference between top and bottom of bank levels of approximately 0.76m. The flow direction of the watercourse was unable to be ascertained by the topographical survey.

4.8 An on-site watercourse is noted within the far eastern extent of the site with steeply sloping banks. Survey information indicates a level difference between top and bottom of banks between 0.75 and 1.00m, with bottom of bank levels indicating the conveyance of flows to the east.

4.9 The topographic survey is located in Appendix A.

5 Proposed Development

5.1 The Proposed Development will consist of the construction of Photovoltaic (PV) panels mounted on metal frames, string inverters , transformer stations, hardstanding areas, new access tracks, underground cabling, perimeter fencing with CCTV cameras and access gate, temporary construction compound and all ancillary works.

5.2 The Proposed Development will occupy 10 fields across the Application Site. The Proposed Development will connect into the consented Derrygrogan Big solar PV development (planning reference 22/378) via Derrygrogan Little Road.

5.3 It is important to note the grid connection to the national network does not form part of this planning application. The Proposed Development plans are shown in Appendix B and can be summarised as follows:

- Solar arrays and string inverters on metal support structures or on concrete foundations if archaeological mitigation measures are required;
- 7 no. Low Voltage/Medium Voltage (LV/MV) Transformer Stations with associated hardstanding areas;
- Internal access track with two perimeter gates;
- 47 no. CCTV camera units;
- Site access via Derrygrogan Little Road with associated visibility splay;
- Security fencing incorporating timber posts and deer fencing;
- Cable trenching and backfilling;
- Temporary construction compound; and
- Structural landscape planting and ecological enhancement measures.

5.4 The Application Site will be accessed from a new access point off Derrygrogan Little to the south of the Application Site.

5.5 The Department of Department of Housing, Planning, Community and Local Government Flood Risk Management (FRM) Guidelines provide three land-use vulnerability categories, based on the type of proposed development. This provides information regarding appropriate development within each flood zone. The proposed type of development is not specifically mentioned within any of the three land use vulnerability categories outlined in The Planning System and Flood Risk Management Guidelines. Due to the solar panels being pile driven and raised above ground level, they can be classed as 'Water Compatible Development'. The access tracks can also be classed as 'Water Compatible Development' as long as they are not raised above ground level whilst the deer fencing used around the site perimeter can also be classed as 'Water Compatible Development'. All electrical infrastructure such as the transformer stations are classed as 'Essential Infrastructure'.

5.6 The Proposed Development is temporary and fully reversible; the land can be restored to its present state at the end of the facilities planned life.

5.7 The potential to provide surface water attenuation, including the use of Sustainable Drainage Systems (SuDS), has been considered as part of the preliminary design process (see Section 10 – Surface Water Management).

6 Hydrological Setting

Nearby Watercourses and Hydrology

6.1 Development Plans, available in Appendix B indicate two drainage ditches on site. These comprise of a ditch running from the central to the eastern boundary and a ditch running on the northern boundary. Environmental Protection Agency (EPA) Mapping indicates that Killmurry Drain is located east of the site boundary, running from the southeast to the northeast. This is hydraulically linked to a tributary of the Silver River (Puttaghan Ditch) approximately 145 m north of the site, running northeasterly through Killmurry bog approximately 95m north of the site. This converges with the main river approximately 5km northwest of the site.

6.2 The River Daingean runs approximately 1.03km east of the site, running in a southeasterly direction.

6.3 Figure 2 displays the locations and flow direction of watercourses within 2km of the site.

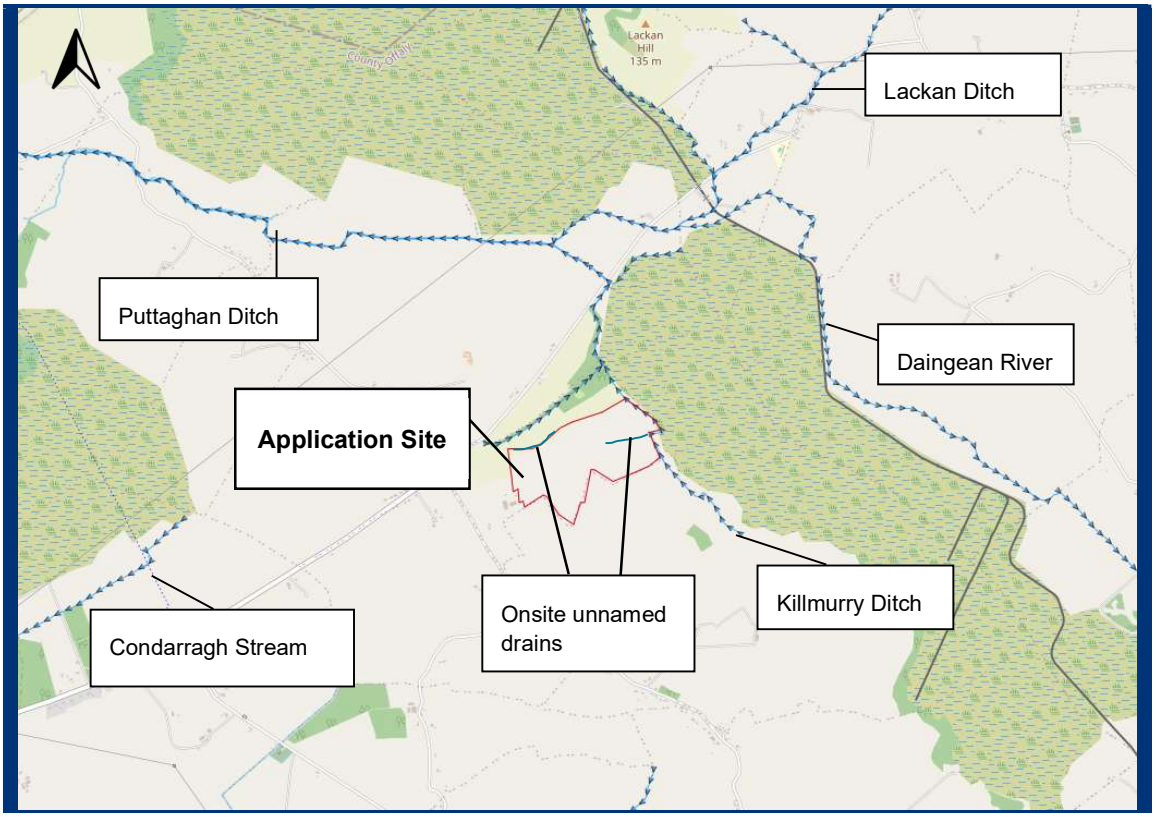


Figure 3. Locations and flow direction of watercourses

(Extracted from EPA river network)

6.4 No significant artificial watercourses / features (e.g. canals, reservoirs) have been identified within 1km of the Application Site. The Grand Canal is approximately 3.2km south of the Proposal Site.

6.5 The Application Site and the surrounding area lies within Hydrometric Area No. 25, Lower Shannon (Water Framework Directive) Catchment Area and within the Tullamore sub catchment 'SC_010'.

6.6 The Proposal Site is mostly within the Silver (Tullamore)_020 river sub basin. The west of the site is within the Tullamore_030 river sub basin.

Fluvial / Tidal Flood Risk Classification

6.7 In 2011, the OPW modelled flood risk from throughout Ireland via their Preliminary Flood Risk Assessment (PFRA) scheme. This identified 300 communities that were deemed to be at the greatest risk and were modelled in further details as part of the National Catchment Flood Risk Assessment and Management (CFRAM) Programme.

6.8 Additionally, the National Indicative Fluvial Mapping (NIFM) project, which was completed around 2012 provided a follow-up to the first cycle Preliminary Flood Risk Assessment (PFRA) and modelled indicative coastal and fluvial flood spatial data for additional areas that did not undergo further modelling under the CFRAM programme.

6.9 According CFRAM online mapping, the Application Site is outside of fluvial and coastal flood extents as shown in Figure 2. The Application Site is not deemed to be within an area for further assessment (AFA). The Application Site also remains outside of flood extents under both Mid-range and High-range future scenarios within CFRAM mapping.

6.10 Additionally, the Application Site is outside of fluvial and coastal NIFM mapping of flooding extents under present and climate change scenarios.

6.11 Therefore, the Application Site is wholly contained within Flood Zone C. As defined in County Offaly SFRA, this corresponds to an annual flooding probability of 0.1%.

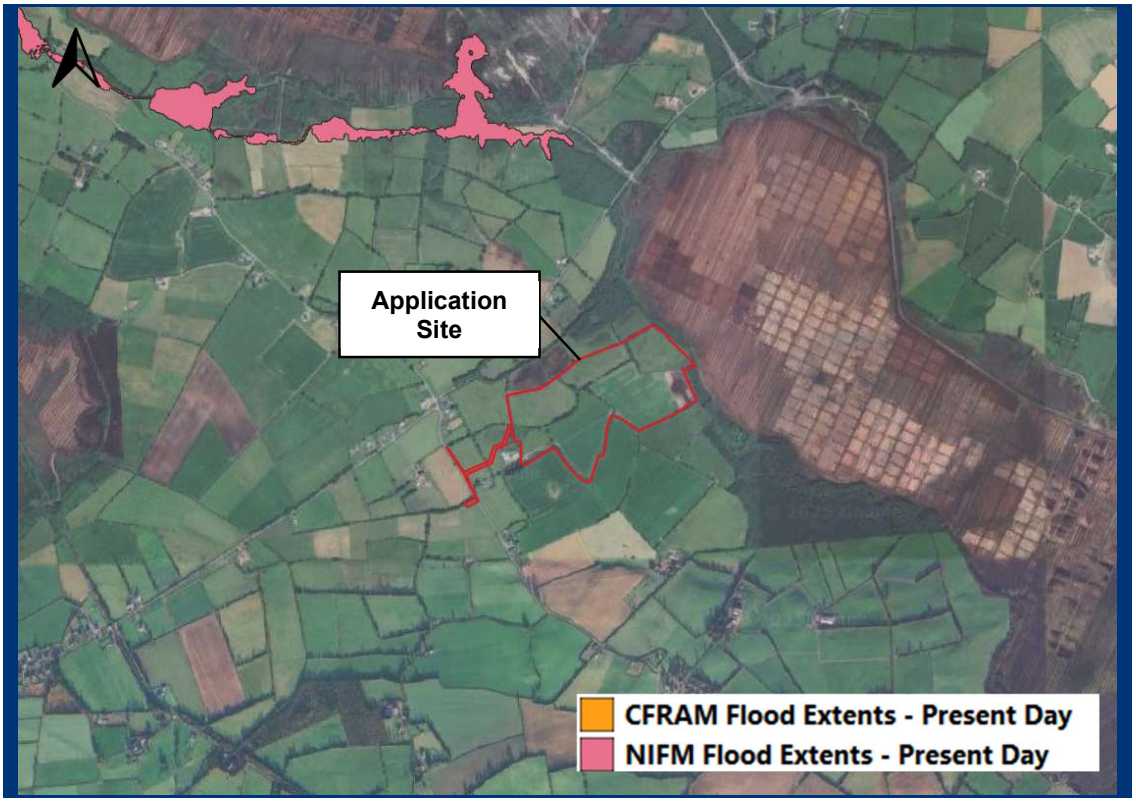


Figure 4. NIFM and CFRAM Flood mapping extents (present day scenario)

6.12 The OPW Past Flood Event Local Summary report has been downloaded from online data. This indicates that there are no records of past flooding events at the site. The nearest flood event is a recurring event approximately 1.6km from the site. This area is reported to have experienced flooding due to low-lying land. Given the significant distance from the Proposal Site it is not anticipated to be significant to the on-site risk.

Drainage and Flood Management Schemes

6.13 The eastern extent of the site is located within an area of benefitted land from the Arterial Drainage Scheme (ADS) as part of the Arterial Drainage Act (ADA). The purpose of the schemes was to improve land for agriculture and mitigate flooding by lowering water levels during the growing season. A number of drainage ditches within 2km north west of the site have been lowered as part of this scheme. The nearest is Puttaghan Ditch approximately 740m north (Brosna ADS).

6.14 From an analysis of the topographical survey, presented within Appendix A, the on-site ditch (drain) within the east of the site outfalls into the area of land noted to benefit from the ADS. It is assumed the on-site ditch (drain) has been artificially modified to lower bottom of the bank levels. It is unable to be ascertained where the ditch (drain) along the northern boundary of the site outflows. However, the boundary of the area of land noted to benefit from the ADS is located immediately adjacent east to the watercourse. The location of the ADS area and on-site ditches (drains) are presented within Figure 5.

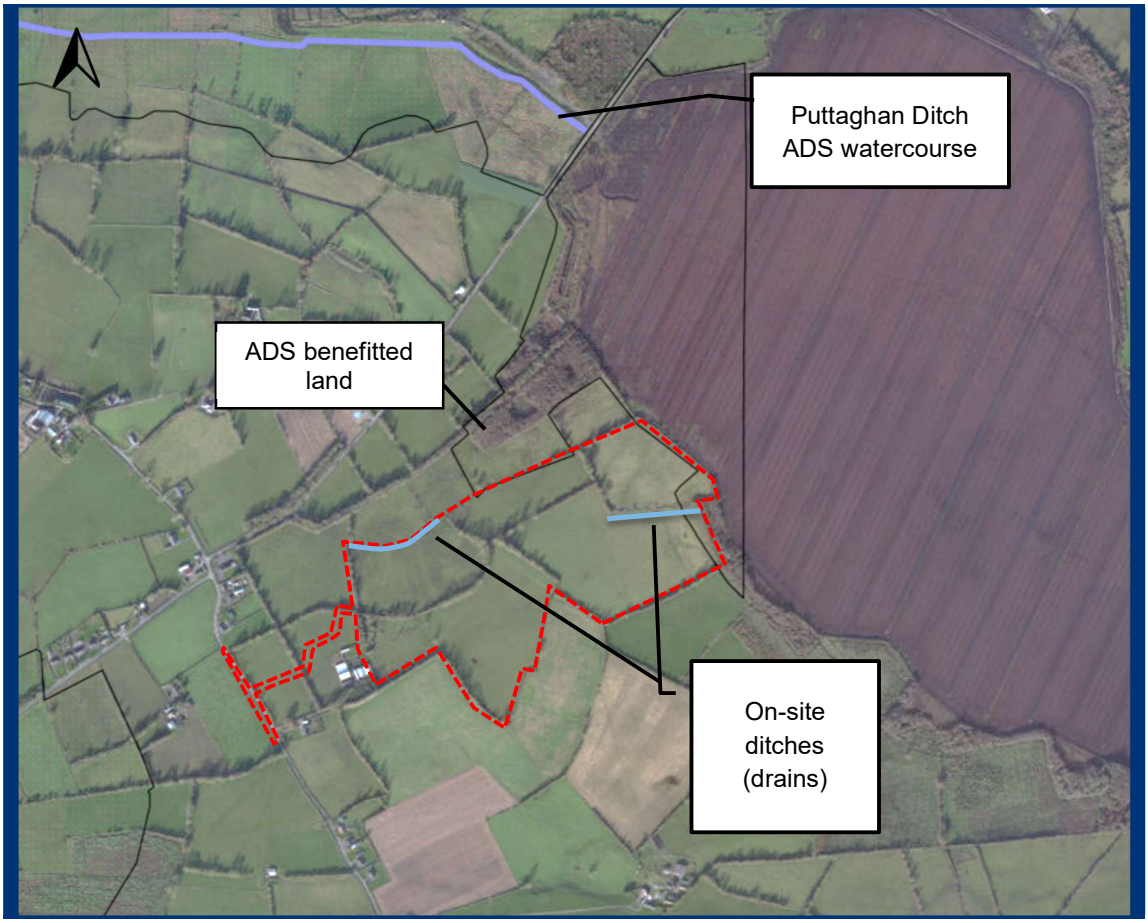


Figure 5. On-site ditches in proximity to ADS benefitted land

Surface Water (Pluvial) Flood Risk Classification

6.15 According to information provided by CFRAM mapping, the site is outside of the rainfall flooding extents. However, this mapping source is limited, as the OPW and Dublin City Council have only produced pluvial Flood Maps for urban areas, which are deemed to be at risk of surface water ponding.

6.16 County Offaly SFRA makes reference to modelled pluvial mapping within Appendix II, however, this data does not include the site location as part of the pluvial study. Access to site-specific data and any county-specific rainfall maps was requested, and RPS are awaiting a response.

6.17 Information from Geological Survey Ireland (GSI) provides Pluvial and fluvial flooding extents during the winter 2015/2016 flood event and was developed as a by-product of the historic groundwater flood map. The Application Site is not within an area that experienced flooding during this event.

Reservoir Flood Risk Classification

6.18 According to EPA mapping, the Application Site is not within an area at risk of reservoir flooding.

County Offaly Flood Risk Assessment

6.19 County Offaly SFRA (produced for the County Offaly Development Plan 2021-2027) was published in October 2021. This provides an overview of key concerns and ensures that flood risk is properly considered in land use planning and development decisions across the county.

6.20 The provision of flood protection measures can significantly reduce flood risk. However, the Ministerial Guidelines require that the presence of flood protection structures should be ignored in determining flood zones. This is because of risks relating to failure and severe flood events that exceed design capacity (the risk of severe events is exacerbated with climate change).

6.21 The Justification Test (including its various criteria) is required to be passed whereby highly vulnerable land uses are being proposed on undeveloped lands in Flood Zone A or whereby highly and/or less vulnerable land uses are being proposed on undeveloped lands in Flood Zone B.

6.22 Flood Zone Mapping is reported within Appendix II of the County Offaly SFRA report and was provided for review by OCC. The site is not shown to be located within a flood zone.

Shannon Upper & Lower River Basin (UOM25-26) - Flood Risk Management Plan

6.23 The 2018 Flood Risk Management Plan (FRMP) for the Shannon Upper and Lower catchment identifies various general measures applicable to County Offaly as part of the wider Shannon Upper and Lower catchment under “Measures Applicable for all Areas”.

6.24 A flood relief scheme has been implemented for Tullamore as described in Section 2.6.8. No additional measures specific to Tullamore are proposed. Of the Tullamore Flood Relief Scheme, the FRMP states that: *‘The Tullamore Scheme was initiated in 2008 and was constructed from 2012 to 2013. The Scheme comprises flood defence walls and embankments along the Tullamore River and the Barony Stream and provides protection against a 1% AEP (100 year) fluvial event for 100 properties’*

6.25 The Application Site is reported to benefit from the Tullamore Flood Relief Scheme.

7 Hydrogeological Setting

7.1 According to Geological Survey Ireland (GSI) mapping, the Application Site lies within the Geashill Groundwater Body (GWB) 10.

7.2 GSI mapping indicates that the site is situated in quaternary sediment of Till derived from limestones, underlain by bedrock visean limestone and calcareous shale.

7.3 The underlying bedrock aquifer is designated as a Locally Important Aquifer. This is defined as an Aquifer that is moderately productive only in local zones. The groundwater throughout site is classified as being moderately vulnerable.

7.4 Information from the GSI groundwater mapping indicates that the Application Site is not within an area that has been impacted by groundwater flooding.

7.5 According to mapping provided by the Environmental Protection Agency (EPA), there are no groundwater wells/springs located within the vicinity of the Application Site.

8 Flood Risk and Mitigation

8.1 The key sources of flooding that could potentially impact the site are discussed below:

Fluvial / Tidal Flooding

8.2 The National Indicative Flood Mapping and CFRAM flood maps present no areas within the Application Site identified as being at risk of flooding from fluvial or coastal events and therefore the Application Site is situated in 'Flood Zone C'.

8.3 The site is offered a degree of protection from an ADS.

8.4 According to the Preliminary Flood Risk Assessment undertaken by the OPW, the site is not considered to be within an area identified as being as potentially significant risk from flooding.

8.5 According to the Planning System and Flood Risk Management Guidelines, the proposed development structures are classified as ‘Water Compatible Development’ and ‘Essential Infrastructure’. These uses are considered appropriate development within Flood Zone C.

8.6 The site is considered to have a **low** risk of flooding from fluvial and tidal sources.

Flooding from Sewers

8.7 Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity.

8.8 Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity. Due to the greenfield nature of the site and rural surrounding area, no drainage or sewer infrastructure is expected to be present within or to the site’s immediate vicinity.

8.9 Private, non-adopted drainage infrastructure may be present within the study area however due to the nature of the development and its location above ground it is not expected to be affected by flooding from a private drainage network. In the event that flooding from this source does occur floodwater will drain according to local topographic gradients southwards away from site.

8.10 The site is considered to have a **low** risk of flooding from sewer sources.

Pluvial Flooding (Overland Flow)

8.11 This can occur during intense rainfall events, when water cannot soak into the ground or enter drainage systems.

8.12 According to information provided by PFRA mapping, the site is outside of rainfall flooding extents. However, this mapping source appears to be limited to urban areas.

8.13 County Offaly SFRA refers to modelled pluvial mapping that is available in Appendix II which was provided by OCC in October 2025. No surface water data for the site was included within mapping, and OCC confirmed within a telephone conversation that they held no site-specific surface water flood risk information in regards to the site.

8.14 From the topographical survey presented within Appendix A, the site slopes steeply from south to north towards on-site watercourses within the eastern extent and along the northern boundary of the site. The watercourse within the eastern extent of the site is assumed to drain to ADS benefitted land. As a result, surface water flow pathways may be present within the site alongside isolated areas of low-level surface water ponding within localised topographical depressions.

8.15 In terms of mitigation development has been steered to at least 5m from the banks of the on-site watercourses. An access road is proposed to cross the watercourse within the east of the site, and watercourse crossings are to be appropriately designed following pre-construction site investigation works to ensure current flow conveyance is maintained and to ensure flood risk is not increased as a result of development. Where relevant, consents will also be applied for prior to the commencement of construction to ensure construction works within proximity to ordinary watercourses are consented by Offaly County Council / the EPA.

8.16 It is expected solar PV modules will be raised a minimum of 500mm above ground levels and this will provide a degree of flood resistance to flood depths of up to 500 mm. It is also expected transformer stations will be raised on concrete plinths. This will provide the site a degree of protection from surface water runoff.

8.17 There is a residual flood risk arising from additional surface water runoff during the operational and maintenance phase resulting from an increase of impermeable areas within the Application Site.

8.18 Surface water runoff during this phase will be mitigation via the Drainage Strategy (Section 9) and has been prepared for the Proposed Development to ensure surface water flood risk is not increased as a result of additional impermeable areas.

8.19 The Application Site is considered to have a **low** risk of flooding from pluvial sources.

Groundwater Flooding

8.20 This can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures.

8.21 GSI mapping indicates that the Application Site is not within an area that has been impacted by groundwater flooding.

8.22 The Application Site is considered to have a **low** risk of flooding from groundwater sources.

Other Sources

8.23 There is a limited risk of flooding occurring as a result of a break in a water main. While no water supply infrastructure has not been identified on-site, their lack of presence has unable to be confirmed.

8.24 The risk of flooding associated with reservoirs, canals and other artificial structures is considered to be **low** given the absence of any such structures in the Application Sites vicinity.

Event Exceedance

8.25 The mitigation measures proposed as part of the development scheme are considered appropriate to help mitigate against event exceedance scenarios.

9 Drainage Strategy

Introduction

9.1 To demonstrate that all forms of flooding have been considered as required by the NPF a conceptual surface water strategy has been developed. The aim of including this strategy as part of the FRA is so that it can easily be demonstrated that the Proposed Development will not adversely affect the surface water regime in the area and that overall, the current situation will be improved.

9.2 The CFRAM Mapping and Guidance advises that a 20% climate change allowance should be applied during a Mid-Range Scenario. The proposed drainage strategy is designed to accommodate the 1 in 100 year plus 20% climate change design storm event.

Greenfield Runoff Rates

9.3 The greenfield nature of the Application Site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site.

9.4 Greenfield runoff rates for the site have been calculated using the calculations for 1ha using the IH124 Method. The calculation has been included for reference within Appendix C and outputs are summarised within Table 2.

Table 2. Equivalent Greenfield Runoff Rates (based on a 1 hectare area)

Return Period	Greenfield Runoff Rate (l/s/ha)
Q1	2.5
QBAR	2.9
Q30	4.8
Q100	5.7

Proposed Surface Water Drainage

Consideration of Drainage Hierarchy

9.5 The CIRIA SuDS Manual (C753) advises the following hierarchy for the disposal of surface water;

1. Infiltration
2. Discharge to surface waters
3. Discharge to a surface water sewer, highway drain or another drainage system

4. Discharge to a combined sewer.

9.6 The drainage hierarchy has been considered as follows.

Infiltrated to ground

9.7 The site is underlain by Till derived from limestones, underlain by bedrock visean limestone and calcareous shale. Infiltration is proposed for the transformers, and the access track should be comprised of permeable gravel, which will allow water to infiltrate the underlying ground under greenfield rates.

Discharged to a Surface Water Body

9.8 Since it is proposed to use infiltration to manage surface water, discharging to a surface water body has not been considered.

Discharged to a Surface Water Sewer

9.9 Since it is proposed to use infiltration to manage surface water discharge to a surface sewer has not been considered.

Discharged to a Combined Sewer

9.10 Since it is proposed to use infiltration to manage surface water discharge to a combined sewer has not been considered.

Drainage Strategy

9.11 A description of the drainage strategy for the proposed development is provided below. The Drainage Strategy drawing is presented within Appendix D.

LV/MV Transformers

9.12 There will be 7no. LV/MV Transformers on the Proposal Site that could potentially give rise to a total of 103.53 m^2 of new impermeable surfaces (approximately 14.79m^2 for each LV/MV Transformers).

9.13 In order to attenuate flows from the 1 in 100-year + 20% climate change event, each LV/MV Transformers is to be placed adjacent to a 14.79m^2, 300mm deep gravel infiltration trench with a 30% void ratio, each providing 1.3 m^3 of surface water attenuation.

9.14 What would otherwise be topsoil will be replaced by gravel, which has 30% more porosity and storage capacity than the existing topsoil would have. Surface water storage volume calculations are presented within Appendix E and were undertaken using rainfall data provided by the Irish Meteorological Service. All designs are subject to detailed design.

9.15 Due to the small size of the units, and the widespread nature of their locations across the development, it is impractical to connect them into a drainage scheme also given the proposed gravel infiltration trenches would have a betterment on porosity. Water runoff from these buildings will slowly drain into the underlying geology through infiltration. Each transformer may have an associated 1.5 m width walkway (if required) on either side. However, these will be a permeable structure and not considered to impede drainage.

Solar Arrays

9.16 The majority of the solar farm will be occupied by solar arrays. Although arrays have a large land take, the actual ground impact is negligible. The only intrusion will be from the pile-driven posts. Posts are made of galvanised steel and are not solid poles. Traditional fixed solar arrays have a surface area ground impact in the range of $0.0012m^2$ – $0.0014m^2$. There are 12 posts per half table and 24 posts per full table.

9.17 Based on this, if a $0.0014m^2$ area is assumed per post, the total solar farm ground impact would be 69 m^2 on a 24.59 ha (245,900 m^2) Site. This means that what covers the majority of the land as "development" will have a ground impact on 0.028% of the Application Site.

9.18 As a result of the construction of the solar panels, some rainfall will be intercepted by the surface of the arrays before reaching ground level. Intercepted rainfall will either run down the face of the panels and drip onto the ground or will be lost due to evaporation. Without mitigation, there is a risk of erosion on the ground on which rainwater drips. This could then result in the formation of rivulets which could increase the speed at which runoff discharges from the Site. Where possible, reasonably spaced interceptor channels can be placed between panel arrays. This will be investigated and incorporated at detailed design stage if required.

Access Tracks

9.19 The surfacing of access tracks is subject to detailed design. The access tracks should be constructed using permeable gravel, to ensure surface water can infiltrate into the ground. The access tracks will be permeable and a swale will be proposed, if required.

Pollution Mitigation

9.20 Surface water run-off should be managed by SuDS that are designed to attenuate flows and to avoid water quality impacts downstream. To demonstrate that surface water arising from the development will be appropriately treated prior to discharge, the Simple Index Approach, as outlined within the SuDS Manual (CIRIA C753) has been followed.

9.21 As stated in the SuDS Manual 2015 (C753), the risk posed by surface water runoff to the receiving environment is a function of:

- the pollution hazard at a particular site (i.e. the *pollutant source*)
- the effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels, groundwater (i.e. the *pollutant pathway*)
- the sensitivity of the receiving environment (i.e. the *environmental receptor*).

9.22 The pollution hazard level for this type of development is 'low'. This type of development has identified pollutant hazard indices as per The SuDS Manual (CIRIA C753) Table 26.2 and 26.3 are outlined in Table 3 and below.

Table 3. Mitigation Indices

	Total Suspended Solids	Metals	Hydrocarbons
Proposed Land Uses			

Other roofs (typically commercial/industrial roofs)	0.3	0.2	0.05
Mitigation			
Gravel Infiltration Trench	0.4	0.4	0.4

9.23 As illustrated in Table 3, the identified mitigation indices (the SuDS Manual, CIRIA C753, Table 26.2 and 26.3) of the proposed gravel infiltration trench exceed the maximum anticipated pollutant hazard indices for 'other roofs'. This confirms that surface water arising from the Proposed Development will receive an appropriate level of treatment in advance of discharge from the Proposal Site.

Event Exceedance

9.24 The proposed surface water drainage strategy provides storage up to the 1 in 100 year plus 20% climate change event. In an event exceeding this magnitude, the resulting above-ground flooding will be confined to temporary shallow flooding of the on-site track network and will not affect the infrastructure on site or significantly increase flood risk to off-site locations. Event exceedance planning will be undertaken as part of the final design process. A Flow Exceedance Plan is presented within Appendix F.

Maintenance and Adoption

9.25 Tables 4 and 5, below, indicate the envisaged maintenance activities associated with the gravel infiltration trench and land/ground cover, along with the approximate frequency with which they should be completed.

During detailed design, this should be developed into a formal inspection and maintenance programme to ensure the optimum operation of the surface water drainage features are maintained for the lifetime of the development. Additional tasks or varied maintenance frequency may be instructed by the maintenance company to suit requirements. This will prevent the increased risk of flooding both on and off-site in accordance with the NPF.

Table 4. Infiltration Trench Maintenance Plan

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly, or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect gravel for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from gravel	Six monthly, or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the gravel (if applicable), using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required

Table 5. Land/ground cover Maintenance Plan

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Litter/debris removal	Monthly
	Manage vegetation	Monthly at start, then as required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly or as required
	Weed killing	Monthly during growing season or as required
	Burn out fence lines	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth (wildflower mix meadows), alter plant type to better suit conditions if required.	As required
Remedial Actions	Repair erosion or other damage by reseeding wildflower mix meadows.	As required

10 Sequential Test and Justification Test

Sequential Test

10.1 The FRM Guidelines state that the sequential approach is a key tool *"in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding".* The entirety of the Proposal Site lies outside the flood extent, i.e. within the Flood Zone C area and therefore, the Proposed Development does not require a justification test. A Drainage Impact Assessment has been undertaken to propose a surface water management plan as per the sequential approach.

The Justification Test

10.2 The FRM guidelines advises that 'Essential Infrastructure' can be considered appropriate in Flood Zone C following satisfactory application of the Justification Test. The Justification Test aims to ensure that more vulnerable property types are not allocated to areas at high risk of flooding. For the Exception Test to be passed:

a. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared;

b. A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

10.3 With reference to point (b) above, this FRA demonstrates that the development will be safe, without increasing flood risk elsewhere, and will reduce flood risk overall given the reduction in surface water runoff following redevelopment.

10.4 It is considered that the development passes the Justification Test.

11 Summary and Conclusions

11.1 The aim of the FRA is to outline the potential for the site to be impacted by flooding, the potential impacts of the development on flooding both onsite and in the vicinity, and the proposed measures which can be incorporated into the development to mitigate the identified risks. The report has been prepared in accordance with the guidance detailed in the NPF. Reference has also been made to the CIRIA SuDS manual (C753) and the County Offaly Development Plan.

11.2 The potential flood risks to the site, and the measures proposed to mitigate the identified risks, are summarised in Table 6.

Table 6. Proposed mitigation

Source of Flooding	Identified Risk			Mitigation Proposed	Residual Risk		
	L	M	H		L	M	H
Fluvial	✓			N/A	✓		
Tidal	✓			N/A	✓		
Sewers	✓			N/A	✓		
Pluvial		✓		The proposed on-site drainage solution will be suitable to attenuate flows up to and including the 1 in 100 year + 20% climate change rainfall event.	✓		
Groundwater	✓				✓		
Other Sources (e.g. reservoirs, water mains)	✓				✓		

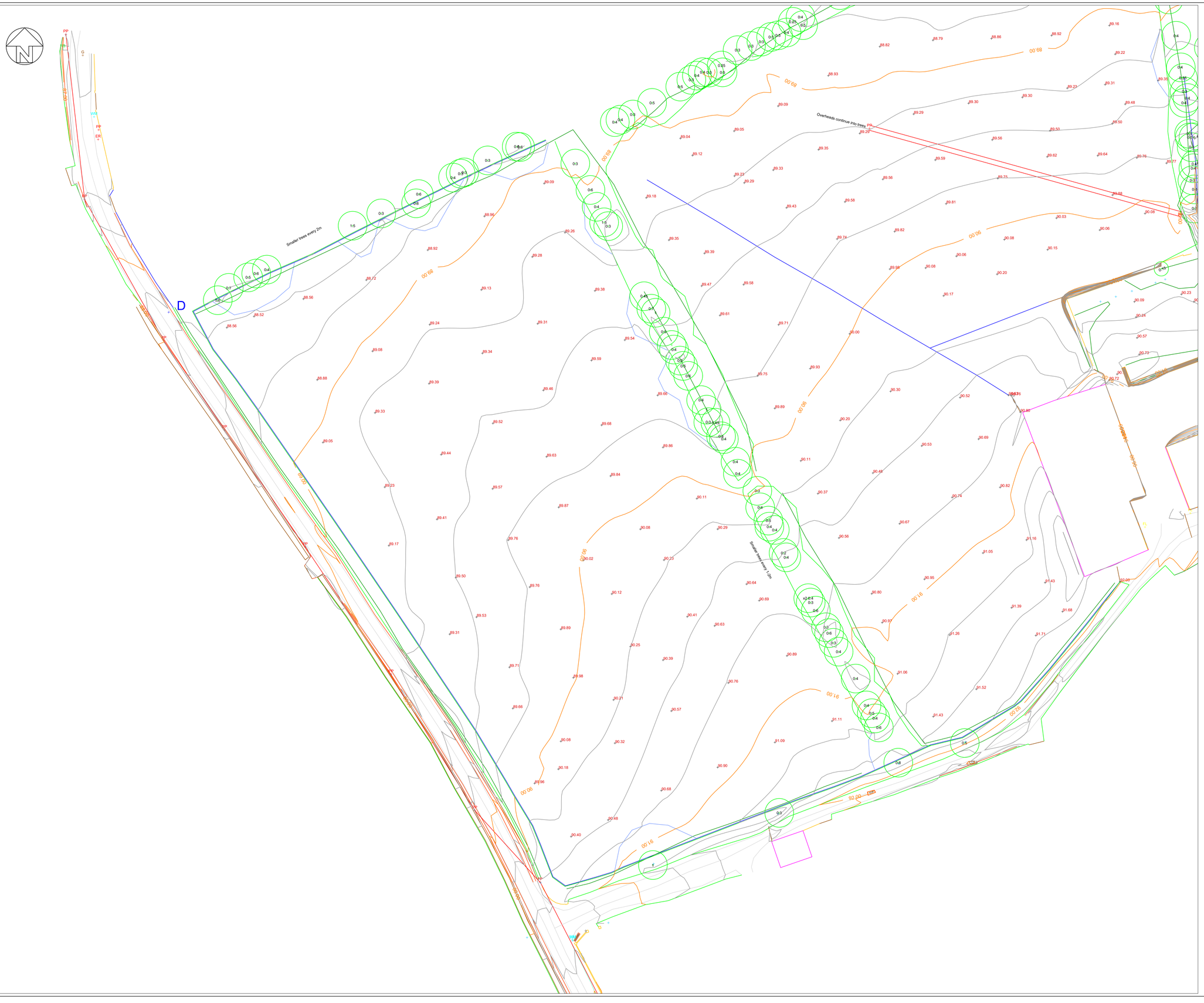
11.3 The Proposal Site is entirely within Flood Zone C. The Proposed Development structures are classified as 'Water Compatible Development' and 'Essential Infrastructure'. These uses are considered appropriate development within Flood Zone C under the Planning System and Flood Risk Management Guidelines.

11.4 The Proposal Site has a low to moderate risk of surface water flooding. The proposed surface water drainage strategy will control surface water runoff from the transformers and associated areas of hardstanding. The areas will be stored within gravel infiltration trenches, and disposed of via infiltration up to and including the 1 in 100 year + 20% climate change rainfall event.

11.5 Overall, it has been demonstrated that the Proposed Development would be safe, without increasing flood risk elsewhere, and that a positive reduction in flood risk would be achieved through the inclusion of onsite drainage features.

Appendices

Appendix A Topographic Survey



Notes

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National Grid

Legend

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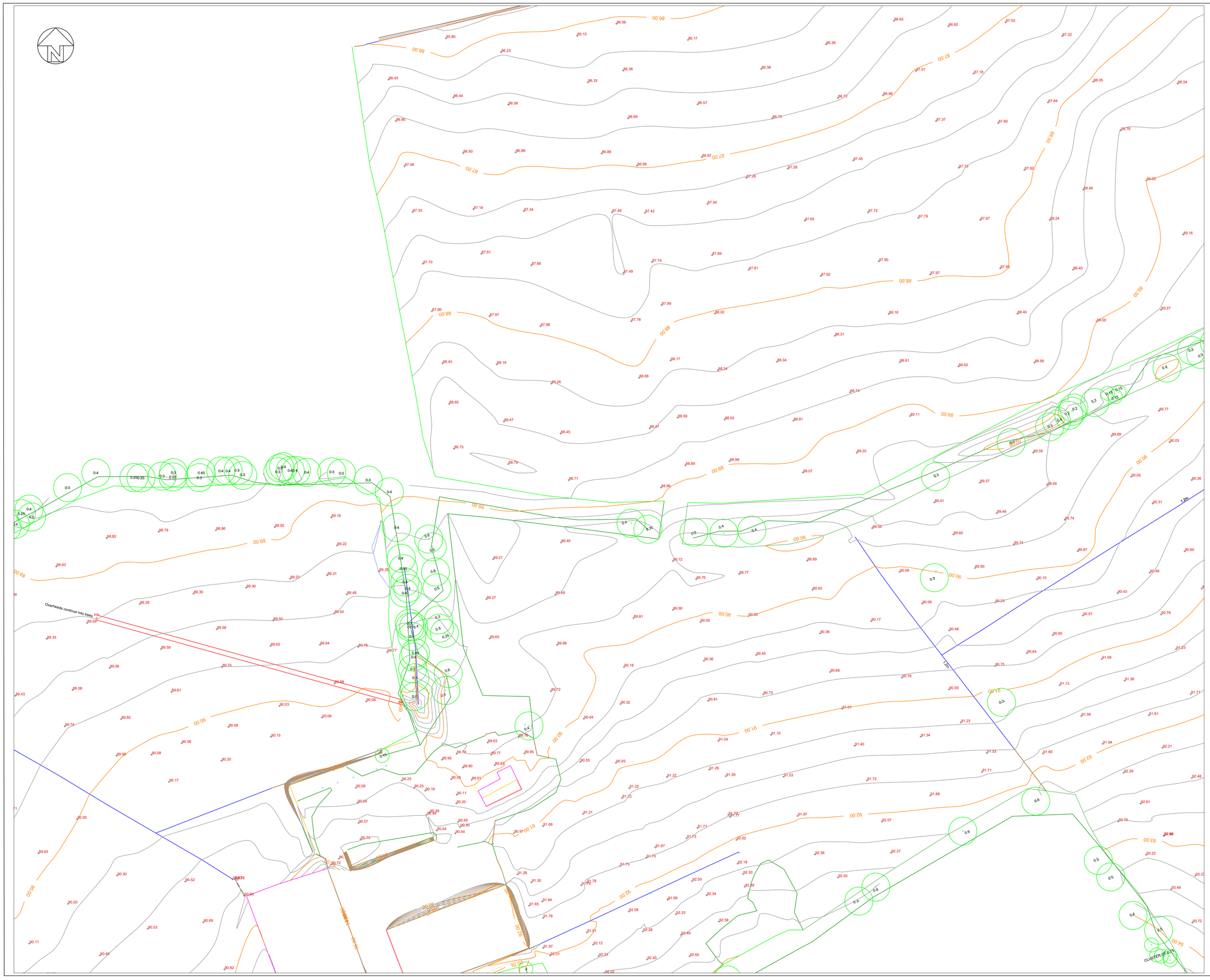

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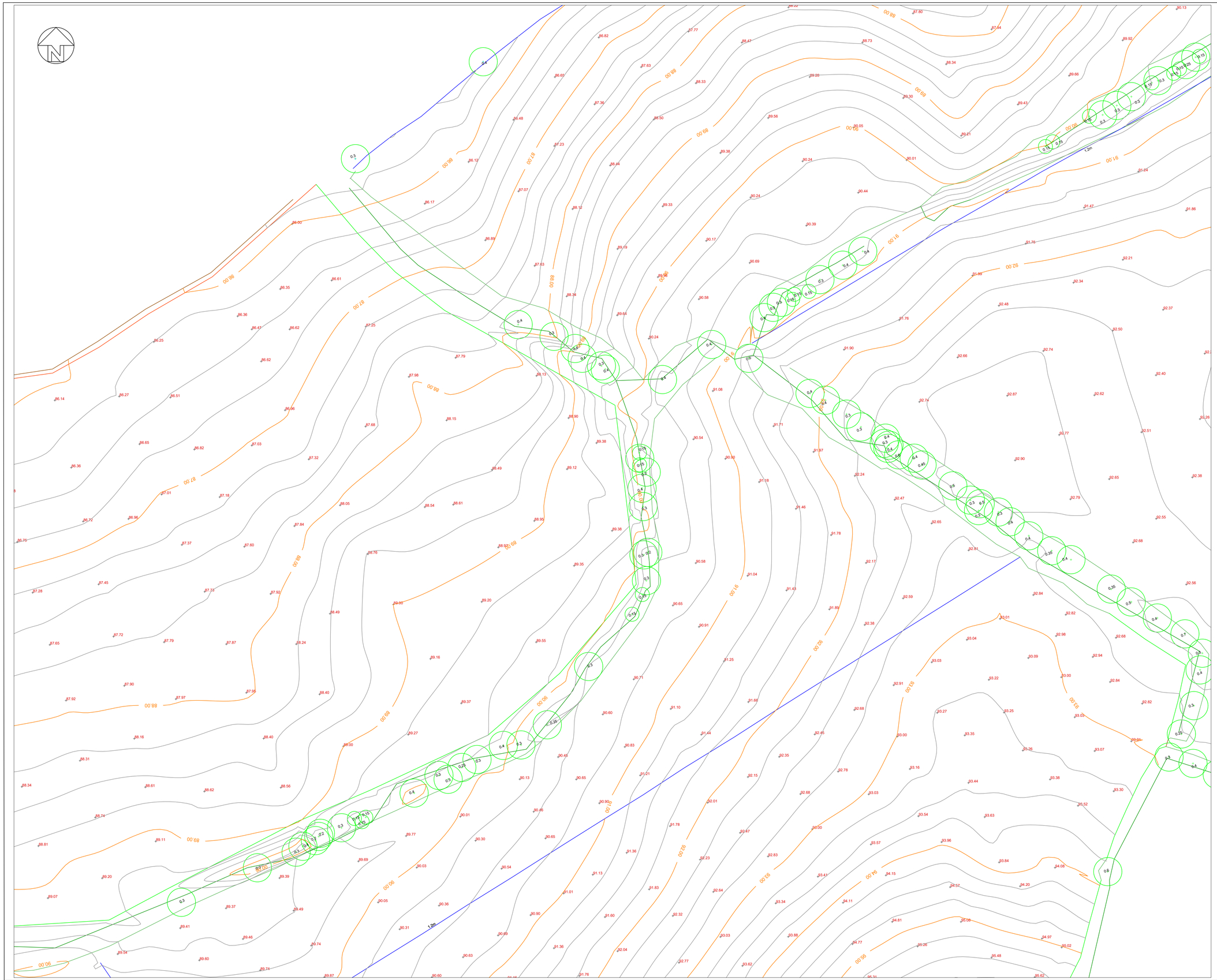

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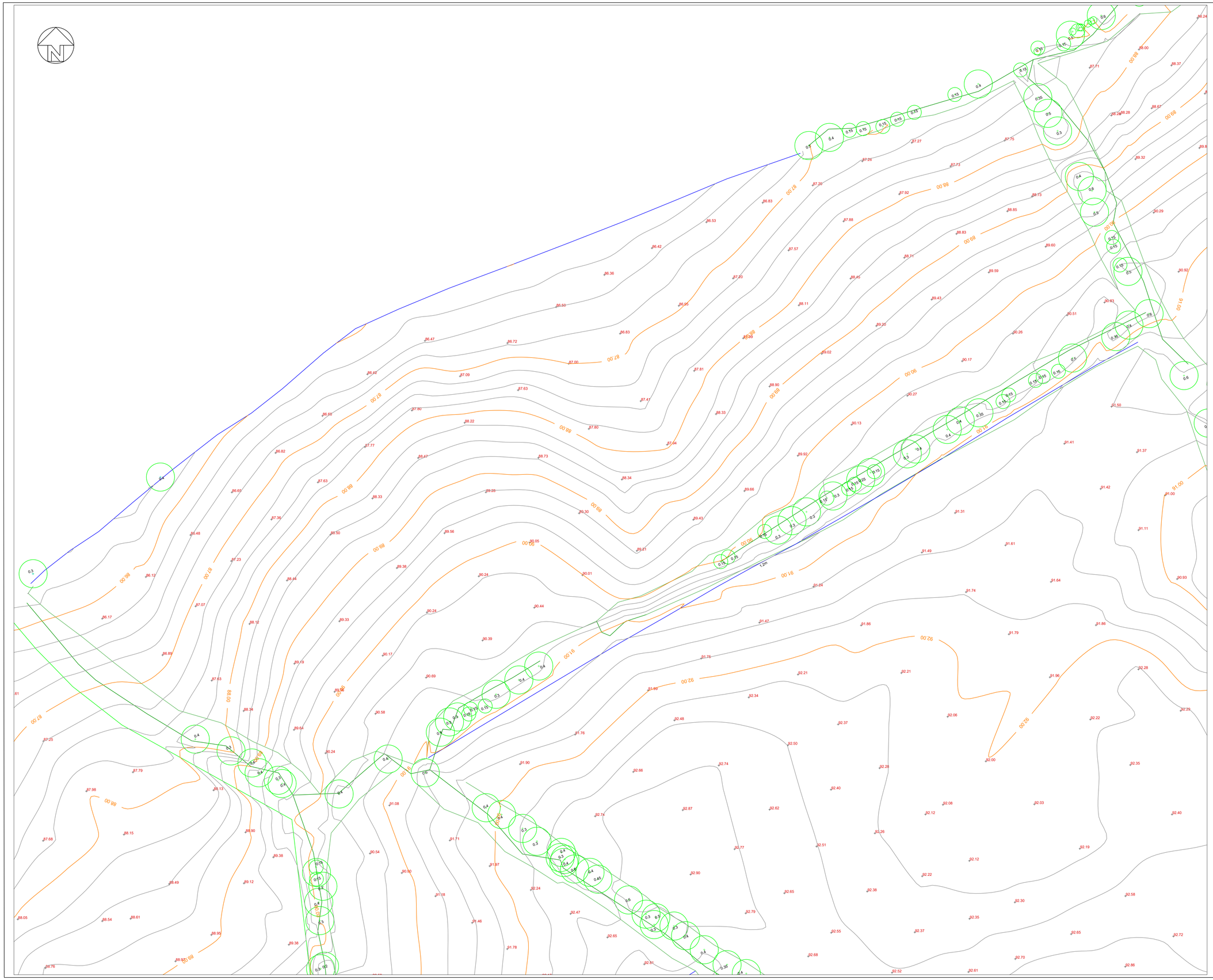

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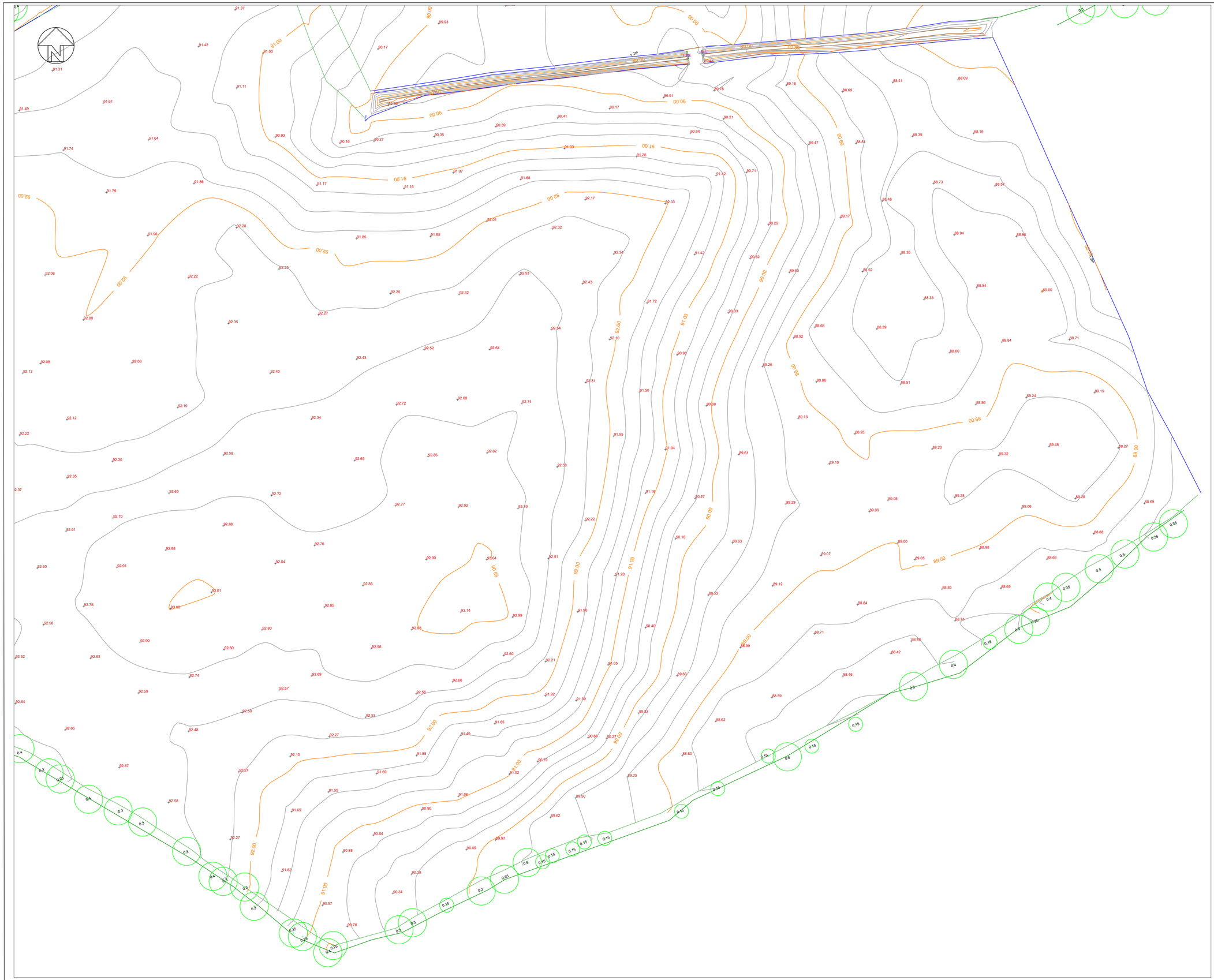
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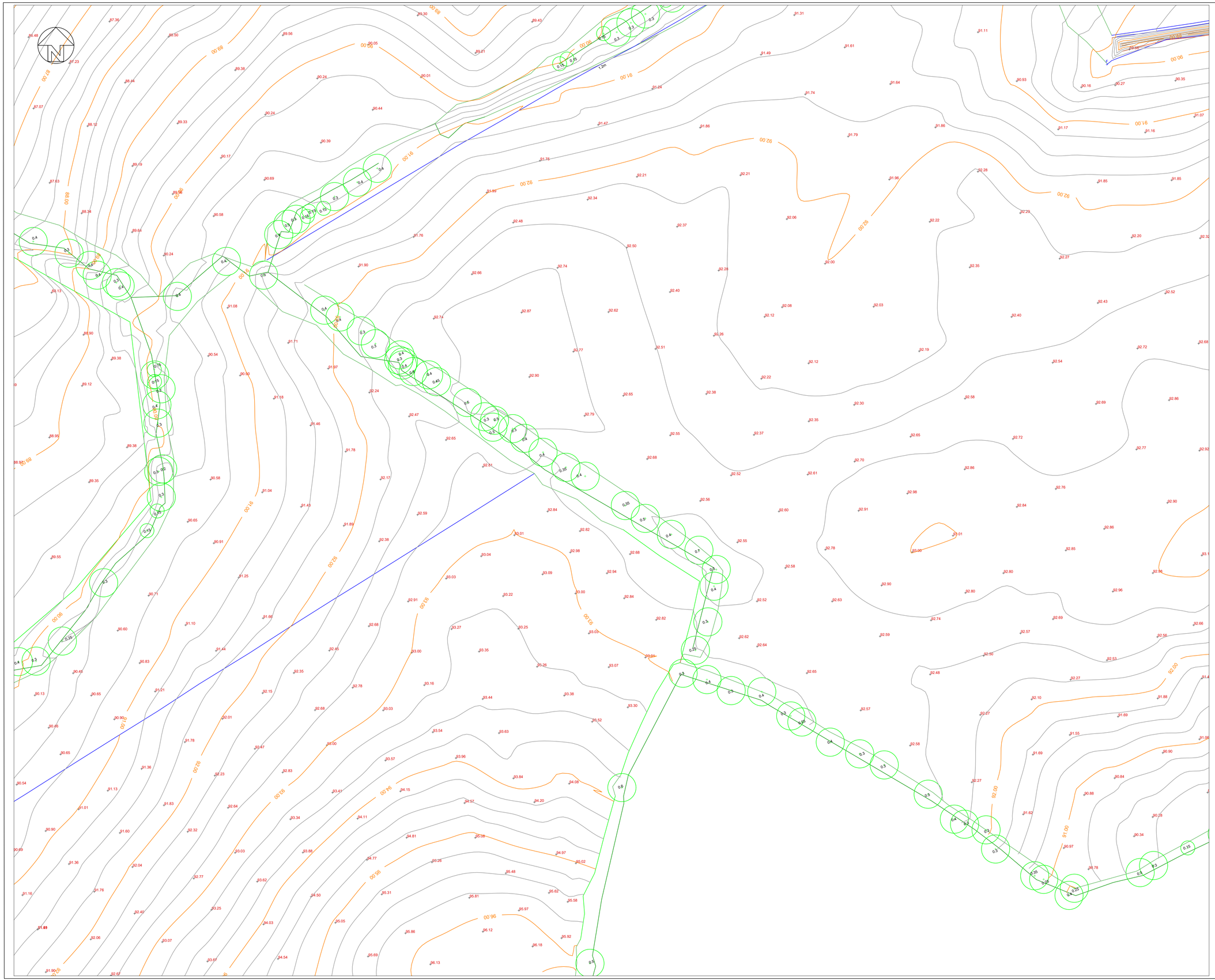

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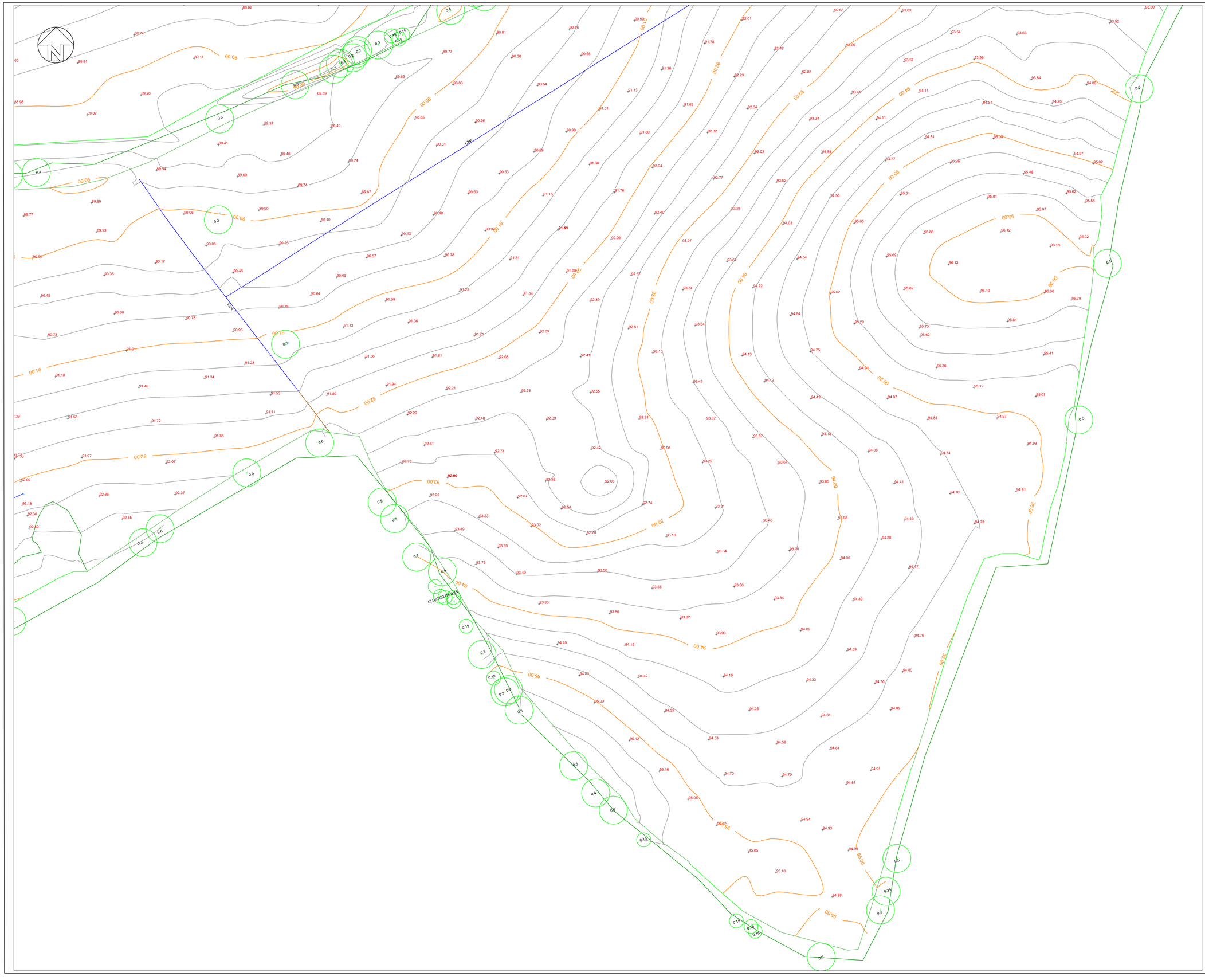

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Scale 1:500 @ A1	Date 13th August 2024
Drawing No. RD130824/A1/9	
Revision 0	

Notes

Elevations in metres to OS Datum
National Grid

Legend

Air Valve	AV
Bollard	BO
BT Cabinet	BTC
BT Manhole (Square)	BT
BT Pole	BTP
Bus Stop	BS
Camera Pole	CP
Control Box	CB
Earth Rod	ER
Fire Hydrant	FH
Fire Hydrant Marker	FHM
Gas Cover	GC
Gully	G
Gully (Side)	GS
Inspection Cover	IC
Light Pole	LP
Litter Bin	BIN
Mail Box	MB
Manhole (Circular)	MHC
Manhole (Square	MHS
NIE Cabinet	EC
NIE MH	EMHS
Permanent Ground Marker	A, B, etc
Phone Box	PB
Post	PO
Power Pole	PP
Road Bollard (Illuminated)	RB
Sign (Road)	RS
Sign (Streetname)	SN
Sign (Other)	S
Roads Service Cabinet	RSC
Roads Service MH	RSM
Stop Valve	SV
Traffic Light	TL
Traffic MHS	TMH
Uplight	UL
Virgin Media Cover	VM
Virgin Media Cabinet	VMC
Water Meter	WM

No.	Revision	Drg by	Chk by

Drg by KS	Chk by CT	App by NQ

RPS

Derrygrogan Solar Farm

ORICA BQS

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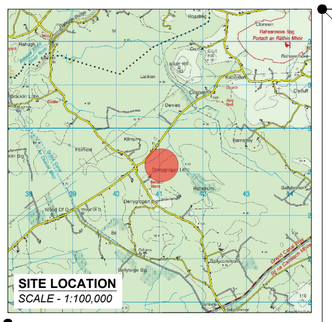
Scale 1:500 @ A1	Date 13th August 2024
Drawing No. RD130824/A1/10	
Revision 0	

Appendix B Development Plans



X - 640529
Y - 729575

X - 641608
Y - 729575

X - 640348
Y - 729394

X - 640348
Y - 728575

X - 641608
Y - 728575

<ita>Doire Uí Ghruagáin Beag</ita>
Derrygrogan Little

KEY:

LANDLORD'S PROPERTY
(INSIDE EDGE OF LINE DENOTES BOUNDARY)

SITE BOUNDARY
(OUTSIDE EDGE OF LINE DENOTES BOUNDARY)

SITE LOCATION - NOT TO SCALE

Produced by: Francesco Ghergo

Renewable Energy Systems Ltd
Registered Office: Beaufort Court,
Egg Farm Lane, Kings Langley,
Hertfordshire WD4 8LR

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
1	FG	EB	RB	2025-07-16	First Issue

PURPOSE: PERMITTING	COORDINATES: IRENET95 ITM
SCALE: 1:2,500 @ A2	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

PROJECT TITLE
DERRYGROGAN LITTLE

DRAWING TITLE
FIGURE 1
SITE BOUNDARY MAP

RES DRAWING NUMBER	REV
05554-RES-LAY-DR-PT-001	1

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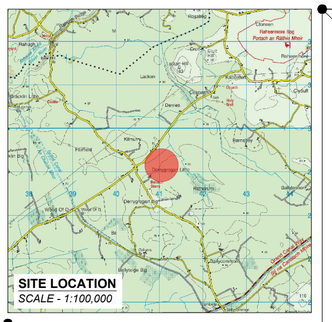

X - 640529
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X - 640348
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X - 640348
Y - 728575

X - 641608
Y - 728575

<ita>Doire Uí Ghruagáin Beag</ita>
Derrygrogan Little

KEY:

SITE BOUNDARY
(OUTSIDE EDGE OF LINE DENOTES BOUNDARY)

SITE LOCATION - NOT TO SCALE

Produced by: Francesco Ghergo

Renewable Energy Systems Ltd
Registered Office: Beaufort Court,
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Hertfordshire WD4 8LR

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
1	FG	EB	RB	2025-05-16	First Issue

PURPOSE: PERMITTING	COORDINATES: IRENET95 ITM
SCALE: 1:2,500 @ A2	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

PROJECT TITLE
DERRYGROGAN LITTLE

DRAWING TITLE
FIGURE 2
SITE LOCATION PLAN

RES DRAWING NUMBER	REV
05554-RES-LAY-DR-PT-002	1

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Appendix C Greenfield Runoff Calculations

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	13/10/2025
Calculated by	MK
Reference	Derrygrogan Little
Model version	2.2.1

Location

Site name	Derrygrogan Little
Site location	

Site easting (Irish Grid)	241053
Site northing (Irish Grid)	229107
Site easting (Irish Transverse Mercator)	640995
Site northing (Irish Transverse Mercator)	729135

Site details

Total site area (ha)	ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	1051 mm		1051
How should SPR be derived?	WRAP soil type		
WRAP soil type	2		2
SPR	0.3		
QBar (IH124) (l/s)	2.9 l/s		

Growth curve factors

	My value		Map value
Hydrological region	13		13
1 year growth factor	0.85		
2 year growth factor	0.95		
10 year growth factor	1.4		
30 year growth factor	1.65		
100 year growth factor	1.95		
200 year growth factor	2.15		

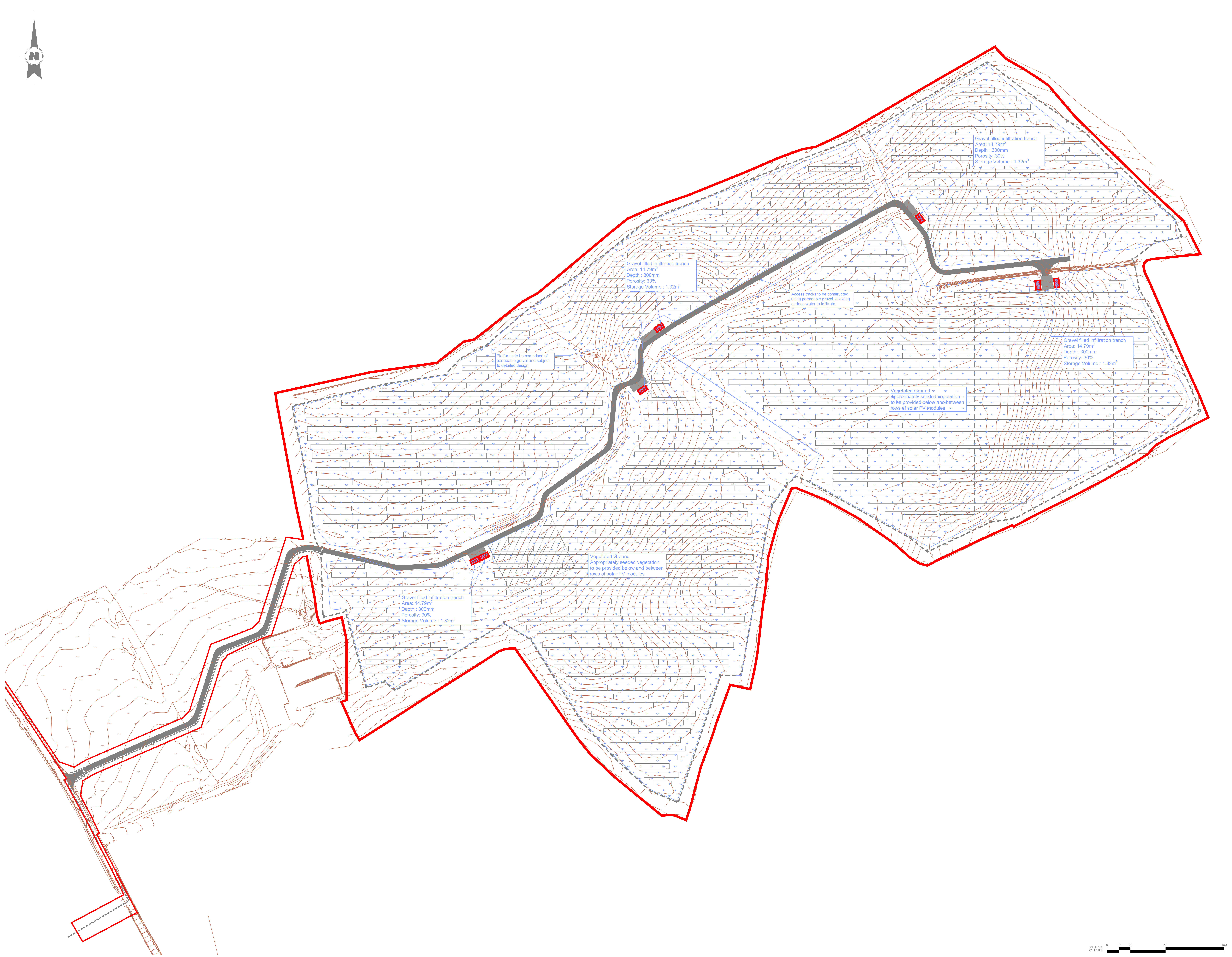
Results

Method	IH124	
Flow rate 1 year (l/s)	2.5	l/s
Flow rate 2 year (l/s)	2.8	l/s
Flow rate 10 years (l/s)	4.1	l/s
Flow rate 30 years (l/s)	4.8	l/s
Flow rate 100 years (l/s)	5.7	l/s
Flow rate 200 years (l/s)	6.3	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Appendix D Surface Water Drainage Strategy Drawing



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Notes
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3. This drawing should be read in conjunction with all other relevant drawings and specifications.

PRELIMINARY
SUBJECT TO DETAILED DESIGN

This drawing illustrates a sketch proposal only and as such is subject to detailed site investigation including ground conditions/contaminants, drainage, design and planning/density negotiations. The layout maybe based upon an enlargement of an OS sheet or other small scale plans and its accuracy will need to be verified by Survey. Full risk analysis under the CDM Regulations has not been undertaken.

KEY

Gravel Filled Infiltration Trench
Seeded vegetation
MW Transformer Areas

Rev	Description	By	Ckd	Date
P02	Revised to internal client comment	AM	JH	26.11.25
P01	First Issue.	MK	JH	16.10.25

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Client RES

Project Derrygrogan Little Solar Farm

Title Conceptual Drainage Strategy

Status	Scale	Date Created
Preliminary	1:1000 @A1	16.10.25
Task Team Manager	Information Author	Task Information Manager
JM	MK	JH

Document Number
20832-RPS-HDG-XX-DR-D-0500

RPS Project Number 794-ENV-HYD-20832
Revision P04

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Appendix E Surface Water Storage Volume Calculations

Surface water storage volume design tool

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is recommended that the total storage volume for the site is distributed across the site using multiple SuDS and that hydraulic modelling software is used to undertake and finalise the detailed design of the drainage system.

Project details

Date	16/10/2025
Calculated by	MK
Reference	Derrygrogan little
Model version	2.2.1

Location

Site name	Derry Grogan
Site location	

Site easting (Irish Grid)	241055
Site northing (Irish Grid)	229072
Site easting (Irish Transverse Mercator)	640997
Site northing (Irish Transverse Mercator)	729100

Site areas

Total site area (ha)	0.01	ha

Roof area

Total roof area (ha)		ha
Contributing roof area (ha)		ha
Non-contributing roof area (ha)	0	ha

Paved area

Total paved area (ha)	0.01	ha
Contributing paved area (ha)	0.01	ha
Non-contributing paved area (ha)	0	ha

Grass / vegetated area

Total grass / vegetated area (ha)		ha
Contributing grass / vegetated area (ha)		ha
Non-contributing grass / vegetated area (ha)	0	ha

Total area

Total contributing area (ha)	0.01	ha

Contributing areas with urban creep allowance

Urban creep allowance factor	+0% (no creep)

Storage design parameters

Storage base shape	Rectangular / square	
Storage base length to width ratio	3:1	
Storage design depth (m)	0.5	m
Storage side slope (1 in x)	1 in 3	
Storage voids ratio (%)	100% (all voids)	
Storage volume design return period (years)	1:100 years	

Discharge flow rate from the site

Method

Type of site	Greenfield
Specify the method	IH124

IH124

	My value		Map/default value
SAAR (mm)	1051 mm		1051
How should SPR be derived?	WRAP soil type		
WRAP soil type	2		2
SPR	0.3		
Total area for greenfield runoff calculation (ha)	0.01 ha		0.01
QBar (l/s)	0.03 l/s		
Hydrological region	13		13
Return period (years)	Qbar (1:2.3 years)		
Growth curve factor	1		
Flow rate (IH124) (l/s)	0.03 l/s		

Final discharge rate

Runoff calculation method	IH124
Design flow rate (l/s)	0.03 l/s

Blockage risk

Specify the method	Orifice diameter
Minimum orifice diameter to prevent blockage (mm)	1 mm

	My value		Calculated value
Design orifice diameter (mm)	10 mm		10
Flow rate of orifice (l/s)	0.15 l/s		

Rainfall and runoff

Rainfall input type	Generic rainfall CSV file
	design_rainfall_grid.csv
Climate change allowance factor	120%

Model results

- **Maximum discharge flow rate:** 0.1 (l/s)
- **Outflow orifice diameter:** 10 (mm)
- **Storage base length:** 2.3 (m)
- **Storage base width:** 0.8 (m)
- **Storage base area:** 1.7 (m^2)
- **Storage total volume:** 4.5 (m^3)
- **Storage total water volume:** 4.5 (m^3)
- **Storm return periods run:** 1, 2, 5, 10, 30, 100, 120 (years)
- **Storm durations run:** 15, 30, 60, 120, 180, 240, 360, 540, 720, 900, 1080, 1440, 1800, 2160, 2880 (minutes)

Return Period (years)	Critical Duration (minutes)	Peak Flow Rate (l/s)	Max Depth (m)	Max water volume (m^3)	Max storage volume (m^3)
1	360	0.1	0.24	1.1	1.1
2	360	0.1	0.26	1.3	1.3
5	360	0.1	0.33	1.9	1.9
10	360	0.1	0.36	2.4	2.4
30	360	0.1	0.43	3.3	3.3
100	**360**	**0.1**	**0.50**	**4.5**	**4.5**
120	360	0.1	0.51	4.8	4.8

Please note runoff estimation and storage volume estimation are subject to uncertainty. Storage volume results are therefore reported to the nearest 1 m^3 value, unless storage volumes are less than 10 m^3, in which case, storage volumes are provided to 1 decimal place.

Disclaimer

Appendix A - Rainfall Depths

Rainfall depths (mm) with climate change

Duration (minutes)	Duration (hours)	1 years	2 years	5 years	10 years	30 years	100 years	120 years
15	0.25	6.96	8.04	11.64	14.28	19.44	26.88	28.20
30	0.5	9.00	10.32	14.64	18.00	24.12	32.88	34.44
60	1	11.76	13.32	18.60	22.56	29.88	40.08	41.88
120	2	15.24	17.16	23.52	28.32	37.08	48.96	51.12
180	3	17.64	19.92	27.12	32.40	42.00	55.08	57.36
240	4	19.68	22.20	29.88	35.64	45.84	59.88	62.28
360	6	22.92	25.68	34.32	40.68	51.96	67.32	69.96
540	9	26.64	29.76	39.48	46.56	58.92	75.60	78.48
720	12	29.64	33.12	43.56	51.12	64.44	82.20	85.20
900	15	31.68	35.40	50.04	54.24	68.16	87.00	89.64
1080	18	34.56	38.40	52.20	58.44	73.08	92.40	95.76
1440	24	38.52	42.60	55.20	64.20	79.92	100.44	103.92
1800	30	46.68	51.12	64.80	74.40	90.96	112.08	115.68
2160	36	49.68	54.84	70.44	79.32	94.92	116.52	120.96
2880	48	53.76	58.68	73.44	83.76	101.16	123.36	127.08

Rainfall depths (mm) without climate change

Duration (minutes)	Duration (hours)	1 years	2 years	5 years	10 years	30 years	100 years	120 years
15	0.25	5.80	6.70	9.70	11.90	16.20	22.40	23.50
30	0.5	7.50	8.60	12.20	15.00	20.10	27.40	28.70
60	1	9.80	11.10	15.50	18.80	24.90	33.40	34.90
120	2	12.70	14.30	19.60	23.60	30.90	40.80	42.60
180	3	14.70	16.60	22.60	27.00	35.00	45.90	47.80
240	4	16.40	18.50	24.90	29.70	38.20	49.90	51.90
360	6	19.10	21.40	28.60	33.90	43.30	56.10	58.30
540	9	22.20	24.80	32.90	38.80	49.10	63.00	65.40
720	12	24.70	27.60	36.30	42.60	53.70	68.50	71.00
900	15	26.40	29.50	41.70	45.20	56.80	72.50	74.70
1080	18	28.80	32.00	43.50	48.70	60.90	77.00	79.80
1440	24	32.10	35.50	46.00	53.50	66.60	83.70	86.60
1800	30	38.90	42.60	54.00	62.00	75.80	93.40	96.40
2160	36	41.40	45.70	58.70	66.10	79.10	97.10	100.80
2880	48	44.80	48.90	61.20	69.80	84.30	102.80	105.90

Appendix F Exceedance event drawing

Notes

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PRELIMINARY

SUBJECT TO DETAILED DESIGN

KEY

Indicative Flow Direction

Rev	Description	By	Ckd	Date
P01	First Issue.	MK	JH	16.10.25

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Client: RES

Project: Derrygrogan Little Solar Farm

Title: Flow Exceedance Plan

Status	Scale	Date Created
Preliminary	1:1000 @ A0	16.10.25

Task Team Manager	Information Author	Task Information Manager
JM	MK	JH

Document Number: 20832-RPS-HDG-XX-DR-D-0510

RPS Project Number: 794-ENV-HYD-20832

Revision: P01

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