Technical Appendix 4 – Flood Risk Assessment and Drainage Impact Assessment

Coolshamrock 110kV Substation SID

18/09/2023

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EXECUTIVE SUMMARY

4.1. This Flood Risk and Drainage Impact Assessment has been carried out for a Strategic Infrastructure Development Application for a new 110kV Substation to feed into the existing Drumline-Ennis 110kV overhead line (OHL) circuit. The Substation and 110kV loop in infrastructure (consented under PA Ref: 22/586) is situated within the townland of Coolshamroge, Ennis, Co. Clare

4.2. The Preliminary Flood Risk Assessment, National Indicative Fluvial 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'.

4.3. 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. The access tracks can be classed as 'Water Compatible Development' as long as they are not raised above ground level, whilst the fencing can also be included. All electrical infrastructure such as the transformer are classed as 'Essential Infrastructure'.

4.4. In addition to fluvial and coastal flood risk, the PFRA map also indicates areas of flood risk due to pluvial sources. This indicates no areas of pluvial flooding within the Application Site. In addition, the topographical survey was analysed and due to the sloping land down to the watercourse, it is unlikely any surface water flooding will occur.

4.5. It is proposed to construct a network of rainwater harvesting tanks and a soakaway pit within the Application Site. The idea is to capture any overland flow in the SuDS device before infiltrating into the surrounding soils.

4.6. The underground piped system connects the Eirgrid building and IPP switchroom to rainwater harvesting tanks, which overflow into a soakaway pit. As the transformer will hold a volume of oil, the system will include a class 1 full retention separator. The soakaway pit and rainwater harvesting tanks will be designed to hold a total volume of 23m^3 with the detailed design of the structure being submitted to the council and ABP for review prior to the construction period.

4.7. A permanent toilet is proposed within the Eirgrid building and IPP switchroom and will be utilised by maintenance staff of the substation. Each toilet will be off grid toilet with a foul holding tank which will be emptied when required by an approved contractor.

4.8. Additional drainage measures to be implemented on-site include the following:

- Access Tracks and laydown areas: access tracks are to be unpaved and constructed from local stone, as outlined in the adjacent solar farm application (PA Ref: 22/586). Temporary swales or similar shall be utilised to collect runoff from access tracks with discharge to ground through percolation areas. Where swales are utilised, frequent

checks of dams formed from gravels and other excavated material should be undertaken;

4.9. The Flood Risk Assessment (FRA) and Drainage Impact Assessment (DIA) has therefore demonstrated that the Proposed Development will **not increase flood risk** away from the Application Site during the construction, operation, and decommissioning phases. The Proposed Development is therefore considered to be acceptable in planning policy terms.

INTRODUCTION

Background

4.10. Neo Environmental Ltd has been appointed by Renewable Energy Systems (RES) Ltd (the "Applicant") to undertake a Flood Risk and Drainage Impact Assessment ("FRA" and "DIA") for a Strategic Infrastructure Development ("SID") Application for a new 110kV Substation ("the Proposed Development") to feed into the existing Drumline-Ennis 110kV overhead line (OHL) circuit. The Substation and 110kV loop in infrastructure is situated within the townland of Coolshamroge, Ennis, Co. Clare ("the Application Site"). The Substation is to facilitate the Manusmore Solar Farm (**PA Ref: 20562**, the Manusmore Solar Farm Extension (**PA Ref: 21915**) and the Coolshamrock Solar Farm (**PA Ref: 22586**).

4.11. Please see **Figure 3, Volume 2** for the layout of the Proposed Development.

Development Description

4.12. Coolshamrock and Manusmore Solar Farms will feed into a new 110kV substation. The method of connection to the national grid for the new substation will be a looped connection into the existing Drumline – Ennis 110kV Circuit. 2 No. new OHL end towers will be constructed to facilitate connection to the existing OHL (see **Figure 3 and 11, Volume 2).** The application site will comprise of a 110/33kV substation which consists of 2 No. control buildings, a transformer compound, a high voltage (HV) switchgear compound, a customer MV compound and associated cabling. There is also 2. No underground 110kV cables, a cable access track and 2 No. overhead line towers.

4.13. The control buildings will consist of foundation works, block work, roofing, low voltage electrical fit out, medium voltage switchgear, cladding and building finishing works.

4.14. A power transformer, HV electrical equipment (4bays), lightning protection masts, communication mast, structural steel works, circuit breakers, current transformers, voltage transformers, busbars, surge arresters, cable sealing ends, disconnectors/earth switches, surge arrestors and post insulators will be installed in the Eirgrid HV Substation Compound.

4.15. The Customer MV Compound will consist of 2 No. capacitor banks, 1 No. reactor banks and associated circuit breakers (capacitor and reactor), 1 no. harmonic filter, resistor, pre-insertion resistor and 1 No. auxiliary transformer.

4.16. Palisade and concrete post and rail fencing will be erected around the compound for security/protection.

4.17. The 110kV loop in connection will connect the Drumline-Ennis 110kV overhead line (OHL) circuit to 2. Overhead line towers and 2. No associated 110kV underground cables and into

the HV compound infrastructure. There is a cable access which branches from the consent solar tracks (P22568) to provide access to the cables and towers

4.18. Please refer to **Figure 3, Volume 2** for the layout of the Proposed Development.

Site Description

4.19. The proposed Substation and 110kV loop in infrastructure is located within the townland of Coolshamroge, Ennis, Co. Clare. The proposed site is approximately 7km southeast of Ennis, 4.2km east of Clarecastle and 1.5km west of the smaller settlement Quin.

4.20. The Application Site in which the substation is proposed to be located comprises of 3 fields of relatively flat agricultural land. The Application site lies at an elevation of c. 26-31m AOD and covers a total area of c. 3.78 acres. The approximate Irish Grid Reference points (ITM) of the proposed substation are X 539777 and Y 674345. The proposed substation will be enclosed by palisade fencing. Access to the proposed substation will be from a private lane off an unnamed local road to the south which is the same entrance point as for the Coolshamrock Solar Farm (PA Ref:22586).

Scope of Report

4.21. The aim of this assessment is to identify the baseline geological and hydrological conditions of the site and surrounding area, to assess the potential impacts of the Proposed Development during the construction, operation, and decommissioning phases, to identify the risk of flooding at the proposed Application Site and to recommend mitigation measures where appropriate.

4.22. This Flood Risk Assessment has been prepared in accordance with 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities[1]' document, prepared by the Department of Environment, Heritage and Local Government (DoEHLG).

4.23. This report is supported by the following figures and appendices:

- Appendix 4A Figures:
  - Figure 4.1: Watercourses
  - Figure 4.2: Topographical Survey

[1] Department of Environment, Heritage and Local Government (2009) *The Planning System and Flood Risk Management: Guidelines for Planning Authorities.* Available at: http://www.opw.ie/media/Planning%20System%20and%20Flood%20Risk%20Management%20Guidelines.pdf

- Figure 4.3: Preliminary Flood Risk Assessment (PFRA) Map
- Figure 4.4: Outline SuDS Design

- Appendix 4B: Flow Report

Statement of Authority

4.24. This Flood Risk Assessment (FRA) has been produced by Michael McGhee of Neo Environmental. Having completed a civil engineering degree in 2012, Michael has worked on over 1GW of renewable development flood risk and drainage impact assessments across the UK and Ireland whilst working towards becoming a Chartered Engineer. Michael has over 8 years of environmental consultancy experience, mainly producing technical assessments for energy projects.

LEGISLATION

4.25. A review of relevant legislation has been conducted to ensure the Proposed Development complies with the following:

- EU Directive on the Assessment and Management of Flood Risks [2007/60/EC];
- The Water Framework Directive [2000/60/EC] (as amended);
- Planning and Development Act 2000 (as amended);
- The Water Policy Regulations (S.I. No. 722 of 2003);
- Surface Waters Regulations (S.I. No. 272 of 2009);
- Groundwater Regulations (S.I. No. 9 of 2010); and
- Environmental Protection Agency Acts, 1992 (as amended).

Review of County Development Plan Policy

Clare Development Plan 2023-2029

4.26. The Clare County Development Plan 2023-2029 (the "CDP"), presents an extensive list of policies regarding development management within the County. Of these policies, the following are considered relevant to this assessment.

Table 4 - 1: Clare CDP Flood Management Policies/Objectives

Planning Policy/Objective	Comment
CDP 2.6 *"To ensure development proposals have regard to the requirements of the SFRA and Flood Risk Management Guidelines; and where required are supported by an appropriately detailed hydrological assessment/ flood risk assessment."* *"To ensure that potential future flood information obtained/generated through the Development Management process is used to inform suitable adaptation requirements in line with the Guidelines for Planning Authorities on Flood Risk Management (DoECLG & OPW, 2009)."*	A Flood Risk Assessment has been undertaken in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities. Reference to the Strategic Flood Risk Assessment has been made throughout this report.

CDP 2.11 *"To ensure the implementation of Sustainable Drainage Systems (SuDS) and in particular, to ensure that all storm water generated in a new development is disposed of on-site or is attenuated and treated prior to discharge to an approved storm water system."*	A drainage impact assessment has been undertaken as part of this flood risk assessment.

Strategic Flood Risk Assessment for County Clare

4.27. The Strategic Flood Risk Assessment for County Clare[2] (SFRA) was produced in January 2017. The aim of the SFRA is to provide a broad assessment of all types of flood risk to inform strategic land-use planning decisions.

4.28. The SFRA has reviewed flood risk from fluvial, pluvial and groundwater sources. It also considers flooding from drainage systems, reservoirs, and canals as well as other artificial or man-made systems. The study has also identified residual risk associated with various flood alleviation schemes throughout the county.

4.29. There is no assessment of the lands within the Application Site.

Shannon Estuary North & Mal Bay Catchment (River Basin 27-28) - Flood Risk Management Plan[3]

4.30. The purpose of this plan is to set out the strategy, including a set of proposed measures, for the cost-effective and sustainable, long-term management of flood risk in the River Basin, including the areas where the flood risk has been determined as being potentially significant.

4.31. The plan identifies a number of communities in the catchment with potentially significant flood risk, of which Quin (approximately 1.7km to the east) is identified. There are no proposals for new flood risk schemes in Ennis as a flood relief scheme is already in place.

[2] Clare County Council (2017) Volume 10: *Strategic Flood Risk Assessment.* Available at: https://www.clarecoco.ie/planning/publications/clare-county-development-plan-2017-2023-volume-10-environmental-appraisal-of-the-plan-volume-10c-strategic-flood-risk-assessment-24143.pdf

[3] Office for Public Works (2018), Shannon Estuary North & Mal Bay Catchment (River Basin 27-28) - Flood Risk Management Plan, Available at https://s3-eu-west-1.amazonaws.com/docs.floodinfo.opw/floodinfo_docs/Final_FRMPs_For_Publication/FRMP_Final2018_RiverBasin_27_28.pdf

METHODOLOGY

4.32. Flood planning guidance for Ireland has been produced by the Department of Environment, Heritage and Local Government (now the Department of Housing, Planning, Community and Local Government) in 'The Planning System and Flood Risk Management Guidelines for Planning Authorities[4]' (the "FRM Guidelines") document. This FRA and DIA has been undertaken in accordance with these guidelines.

4.33. Flood planning policy aims to avoid inappropriate development in flood zones and instead direct it to areas of low risk by adopting a *sequential approach.* A developments vulnerability classification will define which flood zone it is permitted within, with only flood compatible development permitted in areas with a high probability of flooding, unless the development passes a justification test. This is to ensure that residual risks can be successfully managed and that there are no unacceptable impacts on adjacent land. The following indicators are typically used in assessing flood risk and are appropriate for site FRAs:

- Flood probability;
- Flood depth;
- Flood velocity;
- Rate and onset of flooding; and
- Development vulnerability.

4.34. Flood Risk Assessments are required to "*assess all types of flood risk for a new development. FRAs identify the sources of flood risk, the effects of climate change on this, the impact of the development, the effectiveness of flood mitigation and management measures and the residual risks that remain after those measures are put in place. Must be carried out in all areas where flood risk have been identified but level of detail will differ if SFRA at development plan level has been carried out."*[5]

4.35. An assessment of how surface water runoff will be managed should also be addressed within any FRA. Drainage is a material consideration at the planning stage of a development and due consideration must be given to the impact of the Proposed Development on the catchment area. This includes an assessment of potential for both flood risk and pollution. Surface water

[4] Department of Environment, Heritage and Local Government (2009) *The Planning System and Flood Risk Management.* Available at: http://www.opw.ie/media/Planning%20System%20and%20Flood%20Risk%20Management%20Guidelines.pdf

[5] Department of Environment, Heritage and Local Government (2009) The Planning System and Flood Risk Management. Available at: http://www.opw.ie/media/Planning%20System%20and%20Flood%20Risk%20Management%20Guidelines.pdf

runoff may need to be assessed in all flood zones. The FRA should demonstrate that the surface water drainage system takes account of Sustainable Drainage Systems (SuDS) principles.

4.36. In the FRM Guidelines, the likelihood of a flood occurring is established through the identification of Flood Zones which indicate a high, moderate, or low risk of flooding from fluvial or tidal sources, as defined as follows:

- *Flood Zone A* - Where the probability of flooding is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding and 0.5% AEP or 1 in 200 for coastal flooding) and where a wide range of receptors would be vulnerable;
- *Flood Zone B* - Where the probability of flooding is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding); and
- *Flood Zone C* - Where the probability of flooding is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding).

4.37. The FRM Guidelines provide three land-use vulnerability categories, based on the type of proposed development, which are detailed as follow:

- Highly vulnerable development, which include:
  - Garda, ambulance and fire stations and command centres required to be operational during flooding;
  - Hospitals;
  - Emergency access and egress points;
  - Schools;
  - Dwelling houses, student halls of residence and hostels;
  - Residential institutions such as residential care homes, children's homes and social services homes;
  - Caravans and mobile home parks;
  - Dwelling houses designed, constructed or adapted for the elderly or other people with impaired mobility; and
  - Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment,

and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.), in the event of flooding.

- Less vulnerable development, which include:
  - Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions;
  - Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
  - Land and buildings used for agriculture and forestry;
  - Waste treatment (except landfill and hazardous waste);
  - Mineral working and processing; and
  - Local transport infrastructure.
- Water compatible development, which include:
  - Flood control infrastructure;
  - Docks, marinas and wharves;
  - Navigation facilities;
  - Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;
  - Water-based recreationand tourism (excluding sleeping accommodation);
  - Lifeguard and coastguard stations;
  - Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and
  - Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Table 4 - 2: Matrix of Vulnerability versus Flood Zone

Zone	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (Including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

4.38. Where proposed development requires a Justification Test, this must be undertaken to determine if the development can be justified.

4.39. The Justification Test has been designed to assess the appropriateness of such developments. The test is comprised of two processes: The Plan-making Justification Test and the Development Management Justification Test. The latter is used at the planning application stage where it is intended to develop land that is at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be considered inappropriate for that land.

4.40. The FRM Guidelines recommend a staged approach to flood risk assessment. The stages of appraisal and assessment are as follows:

- Stage 1 Flood Risk Identification: *"to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation."*
- Stage 2 Initial Flood Risk Assessment: "*to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. The extent of the risk of flooding should be assessed which may involve preparing indicative flood zone maps. Where existing river or coastal models exist, these should be used broadly to assess the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures*"; and
- Stage 3 Detailed Flood Risk Assessment: *"to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impact on flood risk elsewhere and of the effectiveness of*

any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model of the river or coastal cell across a wide enough area to appreciate the catchment wide impacts and hydrological processes involved."

4.41. This report contains the first stage of the flood risk assessment, 'Stage 1 – Flood Risk Identification', in accordance with the FRM Guidelines. The basic requirements for a FRA are outlined within the FRM Guidelines as follows:

- An examination of the current and historical drainage patterns;
- A concept drawing of the development proposal;
- A brief summary of how the drainage design provides SuDS techniques or complies with any drainage strategy for the area identified in the SFRA;
- Summary of SuDS to be incorporated;
- The soil classification for the site;
- Calculations showing the pre-development peak runoff flow rate for the critical rainfall event and the storage volumes to restrict the runoff to greenfield levels.

4.42. A site walkover survey was also undertaken in order to identify hydrological, geological, flood risk and drainage features within the Application Site. A record of the surrounding watercourse network can be seen in Figure 4.1 of Appendix 4A.

BASELINE CONDITIONS

4.43. This section presents the information gathered on the existing topographical, geological, hydrological, and hydrogeological conditions of the Application Site and its immediate surroundings.

Topography

4.44. A topographical survey was undertaken at the Application Site (see **Figure 4.2 Appendix 4A**). The lowest point within the Application Site of 25.65m AOD is located on the western boundary of the Application Site. The high point at 31.64m AOD is located on the cable access track. Generally, the Application Site slopes gently to the west.

Geology & Soil

4.45. The geological conditions of the Application Site were identified utilising the Geological Survey of Ireland ("GSI") Spatial Resources online geological mapping[6] system. It is underlain by Tubber Formation which consists of Crinoidal and cherty limestone and dolomite.

4.46. There are no Bedrock Boreholes located within the proposed Application Site, or within close proximity.

Geo-Hazards

4.47. According to the GSI on-line mapping, the classification for landslide susceptibility for this site is **low**. There are presently no records of geo-hazards such as landslides within or in close proximity to the Application Site.

Geological Heritage

4.48. The GSI on-line mapping was reviewed to identify sites of geological heritage within the Application Site and surrounding area. There is no evidence of any site in the immediate area of the Application Site which could be considered suitable for protection.

[6] GSI Spatial Resources Online Map., Available at http://dcenr.maps.arcgis.com/apps/MapSeries/?appid=a30af518e87a4c0ab2fbde2aaac3c228

Soil

4.49. Different soil types have different capabilities for absorbing water, the efficiency of which is dependent upon their structure and infiltration capacity. The GSI interactive map has been utilised to obtain Teagasc soil data. The Application Site mostly has bedrock at surface (BminSW – Shallow well drained mineral (Mainly Basic)) derived from mainly non-calcareous parent materials. A southern section of the Application Site is underlain by Limestone Till (BminDW – Deep well drained mineral (Mainly basic)) derived from mainly calcareous parent materials.

4.50. According to the Wallingford Procedure 'Winter Rain Acceptance Potential' (WRAP) map[7], the soil classification for the site is Class 3. This soil class has a Standard Percentage Runoff (SPR) of 0.4 and should provide limited opportunity for infiltration. Prior to the detailed drainage design stage, which should be conditioned as part of any planning consent, infiltration testing will be undertaken in accordance with BRE 365[1]. Should infiltration drainage not be appropriate, the drainage design will need be altered and discharge locations agreed with a revised limiting discharge rate appropriate to the drainage design. A limiting discharge rate of 2l/s would seem appropriate; however, this will be agreed with the council/ABP post consent when the detailed drainage design is being undertaken.

Hydrology

4.51. According to the Environmental Protection Agency (EPA) Map[8] the proposed Application Site and the surrounding area lies within Hydrometric Area No. 27, Shannon Estuary North (Water Framework Directive) Catchment Area and within the Rine sub catchment 'SC_010'.

4.52. The Application Site is wholly contained within the Manusmore_010 river sub basin.

Local River Network

4.53. The Carrowmeer Watercourse is located approximately 0.5km northwest of the Application Site and flows west before converging with the Manusmore Stream approximately 0.7km west of the Application Site. The Manusmore Stream flows south and joins the Rine River approximately 2.5km southwest of the Application Site. The whole of the Application Site is within the catchment of the Rine River.

[7] UK Sustainable Drainage and Guidance Tools. Greenfield Runoff Estimation for the Sites. Available at: http://www.uksuds.com/greenfieldrunoff_js.htm

8Environmental Protection Agency. EPA Map Viewer. Available at: http://gis.epa.ie/Envision

Internal Watercourses

4.54. There are no field drains within the Application Site, the gradients will convey the surface water to the Manusmore Stream via the local network of field drains and drainage networks outside the Application Site.

Flood Zone Classification

4.55. In 2011, the OPW developed Preliminary Flood Risk Assessment (PFRA) maps as part of the National Catchment Flood Risk Assessment and Management (CFRAM) Programme to illustrate areas affected by flooding from pluvial and fluvial sources, as well as groundwater flood extents and identified areas that required further investigation. The Application Site was not chosen as an area which required further investigation and therefore the PFRA and NIFM maps are the source which should define the flood zone.

4.56. The PFRA (**Appendix 4A: Figure 4.3**) and NIFM Maps show that there is no risk of fluvial or coastal flooding within the Application Site and therefore it is wholly contained within Flood Zone C.

Historic Flooding

4.57. The National Flood Hazard Mapping[9] did not identify any flood events within close proximity to the proposed Application Site. A review of 'floodmaps.ie' did not identify any flood events at the Application Site from any significant watercourse.

4.58. The SFRA document has also not identified any historic flood events within close proximity to the Application Site.

Hydrogeology

4.59. According to the GSI map, the Application Site lies within the Ennis Groundwater Body (GWB) [10].

4.60. The Ennis GWB is elongated in a N-S direction and is about 34 km long. It is about 20 km wide in the northern part, narrowing to about 8 km in the south. In general, the ground is 10- 40m AOD, and flat-lying to gently undulating. In the lower part of the GWB, the Fergus River has a very low gradient of 0.0009 (K.T. Cullen & Co., 2001). Ground elevation within the GWB ranges from sea level to just over 120m AOD. The highest ground occurs along the western boundary,

[9] *OPW National Flood Hazard Mapping*. Available at: http://www.floods.ie/View/Default.aspx

[10] GSI. Ennis GWB: Summary of Initial characterisation. Available at: https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/GWB/EnnisGWB.pdf

at the contact with the Namurian rocks of the Craggaunboy GWB. The northern limit of the GWB is marked by the change in slope to the upland karst area of the Burren GWB. This occurs at approximately 60m AOD. Drainage is good, except in the very lowest areas next to the estuary. There are a number of sinking streams and rivers in the area.

4.61. According to the GSI the recharge mechanisms of the Ennis GWB are as follows:

"Both point and diffuse recharge occur in this GWB. Swallow holes and collapse features provide the means for point recharge. Linear/ point recharge occurs along river reaches and where rivers sink underground. Surface water draining off the low permeability Namurian rocks to the west of this GWB sinks into the aquifers of this GWB. Diffuse recharge will occur over the entire GWB via rainfall percolating through the subsoil. The lack of surface drainage in several parts of this GWB indicates that potential recharge readily percolates into the groundwater system. In low-lying areas with a high water table in this highly transmissive aquifer, there can be some rejected recharge, i.e. a proportion of the effective rainfall is rejected due to lack of storage space in the aquifer. During winter, the 'drainage system' of the aquifer can be overwhelmed by the volume of rainfall, and flooding is common in the area around and to the south of Ennis."

4.62. The underlying bedrock aquifer at the Application Site is considered by GSI to be regionally important and covers an area of 341km^2.

4.63. There are a number of groundwater wells and springs surrounding the Application Site, however none were noted on the site visit within the site boundary. The sensitivity of this area from impacts of contamination will be high. During the operational stage of the Proposed Development, there will be a **negligible risk of contamination** due to the nature of a substation. Any risks will come from the construction stage and an outline Construction and Environmental Management Plan (OCEMP) has been submitted alongside this application in order to reduce any potential impact on the environment during the construction and decommissioning phases of the Proposed Development (see **Technical Appendix 6: Volume 3**).

Groundwater Vulnerability

4.64. Groundwater Vulnerability refers to the intrinsic geological and hydrogeological characteristics that determine the ease at which groundwater may be contaminated by human activities. The more vulnerable the groundwater is, the more easily it can be contaminated by surface water. The GSI Groundwater Vulnerability maps are based upon the type and thickness of subsoils, and the presence of karst features.

4.65. According to the GSI map, the groundwater vulnerability across the Application Site is considered to be a mixture of 'Extreme', and 'Karst'. There is also no Karst data records held in the GSI Spatial Resources online geological mapping.

4.66. The subsoil permeability is classed as 'Not Mapped'. Therefore, the vulnerability rating has been used to determine the thickness of up to 3m.

Table 4 - 3: GSI Vulnerability Rating (Groundwater Protection Schemes, DELG/GSI/EPA, 1999[11])

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type and Thickness)			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Medium Permeability (sandy subsoil)	Low Permeability (Clayey subsoil, slay, peat)	(Sand/gravel aquifers only)	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

11 DELG. EPA/GSI (1999) Protection Schemes Guidelines. Available at: https://www.gsi.ie/Programmes/Groundwater/Projects/Protection+Schemes+Guidelines.htm

FLOOD RISK ASSESSMENT

Flooding Mechanisms

4.67. 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.*"

Fluvial and Coastal Flood Risk

4.68. The PFRA, NIFM 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'.

4.69. The proposed type of development is specified as Highly Vulnerable Development category outlined in The Planning System and Flood Risk Management Guidelines. Using the matrix of vulnerability versus flood zone in **Table 4-2**, this type of development in this location is deemed appropriate.

Pluvial Flood Risk

4.70. The FRA Guidelines further state the planning implications of development in each flood zone. For Flood Zone C, it states:

"Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations".

4.71. In addition to fluvial and coastal flood risk, the PFRA map (see **Figure 4.3: Appendix 4A**) also indicates areas of flood risk due to pluvial sources. This indicates no areas of pluvial flooding within the Application Site. In addition, the topographical survey was analysed and due to the sloping land down to the watercourse, it is unlikely any surface water flooding will occur.

Groundwater Flood Risk

4.72. Groundwater flooding is a "hidden" risk that is often difficult to distinguish from other types of flooding. For example, rising groundwater often forms in low-lying areas which are also susceptible to the accumulation of surface water.

4.73. GSI developed groundwater flood maps for Ireland as part of the 2016-2019 GWFlood project[12]. This mapping does not show any groundwater flooding close to or within the Application Site.

4.74. Local groundwater levels often respond to water levels within nearby watercourses. As there is little pluvial flood risk to the Application Site, with pluvial flooding due to slight ponding at minor depressions on the ground, groundwater flooding is unlikely to be a significant risk.

4.75. Based on the above, the risk of flooding from groundwater for the part of the Application Site outside the predicted floodplain is likely to be **low**.

Sequential Approach Summary

4.76. 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.*"

4.77. All essential infrastructure 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.

Site Access Point

4.78. The access point will be the one used for the adjacent solar development (**Planning Ref:22586**) and any surface water will be diverted into the site, rather than onto the public road.

[12] GSI Groundwater Flood maps. Available at: https://www.floodinfo.ie/map/floodmaps/#

DRAINAGE IMPACT ASSESSMENT

Introduction

4.79. The Planning System and Flood Risk Management Guidelines[13] recognise that surface water arising from a developed site should, as far as is practicable, be managed to mimic the surface water flows arising from the site prior to the Proposed Development, while reducing the flood risk to the Application Site itself and elsewhere.

Methodology

Catchment Characteristics

4.80. Catchment characteristics were obtained from HR Wallingford UK Sustainable Drainage Greenfield Runoff Estimation Tool and Surface Water storage tool.[14] Catchment sizes were measured using ArcGIS and catchment boundaries were produced based on the site-specific contours.

Greenfield Runoff and Stormwater Storage

4.81. Greenfield runoff rates and stormwater storage requirements have been obtained using the following tools:

- HR Wallingford UK Sustainable Drainage Greenfield Runoff Estimation Tool (using IH124[15] methodology due to the small-scale nature of the catchment).
- Flow – Causeway Drainage design software (using IH124[16] methodology due to the small-scale nature of the catchment).
- The areas of permeable and impermeable surfaces have been estimated and are based upon the Proposed Development layout (**Figure 3 of Volume 2: Planning Application Drawings** for the layout of the Proposed Development).

[13] Department of the Environment, Heritage and Local Government (2009) *The Planning System and Flood Risk Management Guidelines for Planning Authorities.* Available at: http://www.environ.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C21709%2Cen.pdf

[14] HR Wallingford. Available at: http://www.uksuds.com/drainage-calculation-tools/surface-water-storage

[15] Institute of Hydrology (1994). *Flood estimation for small catchments. Report No IH124*, Wallingford.

[16] Institute of Hydrology (1994). *Flood estimation for small catchments. Report No IH124*, Wallingford.

4.82. Where applicable, the surface water drainage criteria from the Greater Dublin Strategic Drainage Study (GDSDS)[17] was applied.

Greenfield Runoff rates

4.83. The IH124 methodology is used for calculating the Greenfield runoff rates. This is recommended by the Institute of Hydrology for catchments below 200ha.[18]

4.84. The GDSDS[19] states that the IH124 method is an accepted method used for determining peak flow rates for small catchments.

Calculating storage estimates

4.85. The storage estimates are calculated using the inputs below:

- Return Period
- Climate Change
- Impermeable Area
- Peak Discharge

4.86. The return period and climate change are combined with the Flood Studies Report (FSR) parameters and storm durations to generate the rainfall used. The result from these calculations is the attenuation storage required for the Application Site as a result of the additional runoff generated by the Proposed Development.

Site and Project Descriptions

4.87. The area of the Eirgrid part of the substation is approximately 95.0m x 89.0m, whilst the customer station and transformer compound is approximately 30.0m x 56.9m. The majority of the compound will be made up of crushed aggregate which will be compacted to create a surface, however, will still have permeable properties and rainwater will soak into the ground beneath at the same rate that it presently does.

---

[17] *Greater Dublin Strategic Drainage Study* (2005). Accessed at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drainage-services/new-development-policy

[18] Institute of Hydrology (1994). *Flood estimation for small catchments*. *Report No IH124*, Wallingford.

[19] Greater Dublin Strategic Drainage Study (2005). *Volume 2 Chapter 6 – Storm water Drainage Design*. Available at: http://www.dublincity.ie/sites/default/files/content//WaterWasteEnvironment/WasteWater/Drainage/GreaterDublinStrategicDrainageStudy/Documents/Vol%202%20-%20Chapter%206%20-%20Stormwater%20Drainage%20Design.pdf

4.88. The main areas of impermeable development are outlined within **Table 4-4**, however there are other small areas of impermeable development which are much smaller areas and wouldn't require being included in the formal drainage regime. To cater for these areas, a betterment factor of 20% has been included in the calculations.

Table 4 - 4: Extent of less permeable areas created by the Proposed Development

Building	Total Area (m^2)
1 x Transformer Station 10.0m x 5.5m	55.0
1 x Eirgrid Substation 25.0m x 18.0m	450.0
IPP Switchroom 10.0m x 14.0m	140.0
Total Impermeable Area	645.0
Application Site Area (m^2)	15,282

4.89. In its current greenfield state, the Application Site is considered to be 100% undeveloped. As a result of the Proposed Development, the extent of hardstanding introduced will be approximately 645.0m^2 or 4.2% of the total site area.

Existing Drainage Arrangements

Existing Runoff Rates

4.90. The existing runoff rates and hydrological characteristics of the Proposed Development are detailed in **Table 4-5** below (there are no hardstanding areas on the site at present).

Table 4 - 5: Pre-Development Greenfield runoff rates.

Site Make Up	Green Field
Greenfield Method	IH124
Positively Drained Area (ha)	0.065
SAAR (mm)	1154
Soil Index	3
Standard Percentage Runoff	0.4

Region	Ireland
	Runoff rate (l/s)
QBar	0.4
1 year	0.3
1 in 30 year	0.6
1 in 100 year	0.8

4.91. The limiting discharge rate will be the QBar greenfield rate, as detailed in Table 4-5.

Post Development Runoff Rate

4.92. The surface water runoff rate resulting from the Proposed Development has been based on the areas of hardstanding introduced, which will have a lower permeability than the existing greenfield composition.

4.93. Surface water runoff was derived using the Modified Rational Method as outlined within the methodology.

4.94. Using this approach, the runoff rate for the 1-in-100-year, 360-minute storm event, inclusive of the 20% climate change allowance would be a combined 13m^3, across the three site areas, if left unmanaged.

Proposed Drainage Arrangements

4.95. The SuDS Manual[20] is the current best practice guidance on the use of SuDS. It promotes the use of a hierarchical approach to managing runoff. This approach is outlined below:

- 1. Prevention - Preventing runoff by reducing impermeable areas.
- 2. Source Control - Effective control of runoff at or very near its source.

20 CIRIA (2015). Report C753, The SuDS Manual

- 3. Site Control- Planned management of water in a local area or site.
- 4. Regional Control - Designing a system that can efficiently manage the runoff from a site, or several sites.

4.96. The use of SuDS is generally accepted to have greater benefits than conventional drainage systems and these include:[21]

- Manage runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding
- Provide opportunities for using runoff where it falls
- Protect or enhance water quality (reducing pollution from runoff)
- Protect natural flow regimes in watercourses
- Are sympathetic to the environment and the needs of the local community
- Provide an attractive habitat for wildlife in urban watercourses
- Provide opportunities for evapotranspiration from vegetation and surface water
- Encourage natural groundwater/aquifer recharge (where appropriate)

4.97. The surface water drainage strategy for the Proposed Development seeks to provide a sustainable and integrated surface water management scheme for the whole Application Site and aims to ensure no increase in downstream flood risk by managing discharges from the Proposed Development to the local water environment in a controlled manner.

4.98. To comply with current policies, guidance and best practice, the volume and quality of surface water runoff discharged off-site from the Proposed Development at this Application Site will need to be controlled using SuDS.

4.99. In compliance with the above, the drainage strategy has been developed to meet the following key principles;

- Mimic existing (greenfield) drainage arrangements as far as possible;
- Avoid increases in the greenfield rate, volume and frequency of offsite discharge;

21 Susdrain. Sustainable drainage. Accessed http://www.susdrain.org/delivering-suds/using-suds/background/sustainable-drainage.html

- Avoid significant deterioration in water quality of discharges and no detrimental impact in downstream water quality;
- Achieve the above criteria for all storms up to and including the 100-year event; and
- Incorporate an allowance for climate change (20%).

Indicative Surface Water Storage Requirements

4.100. Indicative storm water storage volumes have been estimated using Causeway's Drainage Design Flow software. The storage calculations include up to the critical storm 100-year return period event (including a 20% allowance for climate change) and the design limits discharge rates back to greenfield runoff rates. The results are enclosed in **Appendix 4B.** These are estimated from the new surfaces added to the Proposed Development.

- Attenuation storage limits the rate of surface runoff discharge from the Proposed Development to match the pre-development greenfield runoff rates;
- All storage calculations have been given a climate change allowance factor of 20% that has been added to the rain depths.
- A betterment allowance of 20% has been included.

Table 4 - 6: Storage Estimates

Storage Estimates	
Return Period (years)	100 years
Climate Change (%)	20
Impermeable Area (ha)	0.065
Peak Discharge (l/s)	0.4
Total storage Requirement (m^3)	$23m^3$

Proposed Drainage Strategy

4.101. It is proposed to construct a network of rainwater harvesting tanks and a soakaway pit within the Application Site. The idea is to capture any overland flow in the SuDS device before infiltrating into the surrounding soils.

4.102. The underground piped system connects the Eirgrid building and IPP switchroom to rainwater harvesting tanks, which overflow into a soakaway pit. As the transformer will hold a volume

of oil, the system will include a class 1 full retention separator. The soakaway pit and rainwater harvesting tanks will be designed to hold a total volume of 23m^3 with the detailed design of the structure being submitted to the council and ABP for review prior to the construction period.

4.103. A permanent toilet is proposed within the Eirgrid building and IPP switchroom and will be utilised by maintenance staff of substation. Each toilet will be off grid toilet with a foul holding tank which will be emptied when required by an approved contractor.

4.104. Additional drainage measures to be implemented on-site include the following:

- Access Tracks and laydown areas: access tracks are to be unpaved and constructed from local stone. Temporary swales or similar shall be utilised to collect runoff from access tracks with discharge to ground through percolation areas. Where swales are utilised, frequent checks of dams formed from gravels and other excavated material should be undertaken;

Designing for Exceedance Events

4.105. Overland flow routes will not be altered by the construction of the Proposed Development as it is not proposed to significantly vary ground levels. The outline drainage design has been designed so that flooding will not occur for up to and including the 1-in-100-year storm event (including 20% climate change consideration).

4.106. Should an exceedance of this 1 in 100-year critical storm event occur, surface water will flow the same way as at present, into the surrounding fields. There are no sensitive receptors near to the SuDS schemes and therefore it is unlikely that any would be affected in an exceedance event.

Long Term Maintenance of SuDS

4.107. The long-term management and maintenance of the proposed SuDS will be the responsibility of the site owner and/or operators. These responsibilities include:

Soakaway Pit

- Litter/debris removal
- Grass cutting and removal of cuttings
- Clearing of inlets, culverts and outlets from debris and sediment
- Repair of eroded or damaged areas.

SUMMARY & CONCLUSIONS

4.108. The FRA and DIA requirements are set out by the Department of Environment, Heritage and Local Government in 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' document.

4.109. The Guidance aims to avoid inappropriate development in flood zones and instead direct it to areas of low risk by adopting a sequential approach.

4.110. The Preliminary Flood Risk Assessment, NIFM 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'.

4.111. 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. The access tracks can be classed as 'Water Compatible Development' as long as they are not raised above ground level, whilst the fencing can also be included. All electrical infrastructure such as the transformer are classed as 'Essential Infrastructure'.

4.112. In addition to fluvial and coastal flood risk, the PFRA map also indicates areas of flood risk due to pluvial sources. This indicates no areas of pluvial flooding within the Application Site. In addition, the topographical survey was analysed and due to the sloping land down to the watercourse, it is unlikely any surface water flooding will occur.

4.113. It is proposed to construct a network of rainwater harvesting tanks and a soakaway pit within the Application Site. The idea is to capture any overland flow in the SuDS device before infiltrating into the surrounding soils.

4.114. The underground piped system connects the Eirgrid building and IPP switchroom to rainwater harvesting tanks, which overflow into a soakaway pit. As the transformer will hold a volume of oil, the system will include a class 1 full retention separator. The soakaway pit and rainwater harvesting tanks will be designed to hold a total volume of 23m^3 with the detailed design of the structure being submitted to the council and ABP for review prior to the construction period.

4.115. A permanent toilet is proposed within the Eirgrid building and IPP switchroom and will be utilised by maintenance staff of substation. Each toilet will be off grid toilet with a foul holding tank which will be emptied when required by an approved contractor.

4.116. Additional drainage measures to be implemented on-site include the following:

- Access Tracks and laydown areas: access tracks are to be unpaved and constructed from local stone. Temporary swales or similar shall be utilised to collect runoff from access tracks with discharge to ground through percolation areas. Where swales are

utilised, frequent checks of dams formed from gravels and other excavated material should be undertaken;

4.117. The FRA and DIA has therefore demonstrated that the Proposed Development will **not increase flood risk** away from the Application Site during the construction, operation, and decommissioning phases. The Proposed Development is therefore considered to be acceptable in planning policy terms.

APPENDICES

Appendix 4A: Figures

- Figure 4.1: Watercourses;
- Figure 4.2: Topographical Survey;
- Figure 4.3: Preliminary Flood Risk Assessment (PFRA) Map;
- Figure 4.4: Outline SuDS Design.

Appendix 4B: Flow Output

Appendix 4A

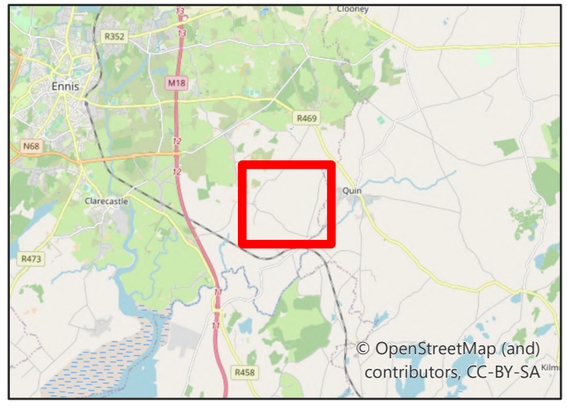
Coolshamrock SID
Watercourses
Figure 4.1

Key

- Development Boundary
- Watercourses

0 0.25 0.5 1 Kilometers

Neo Office Address:
Johnstown Business Centre, Johnstown House, Naas, Co. Kildare



Date: 19/01/2023
Drawn By: Tom Saddington
Scale (A3): 1:8,000
Drawing No: NEO00848/013I/A

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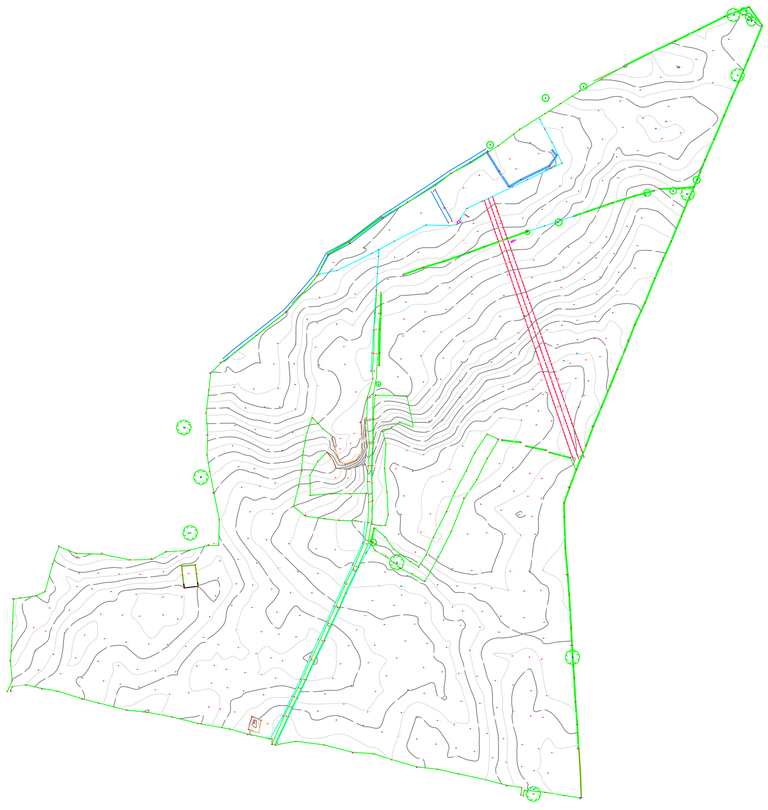

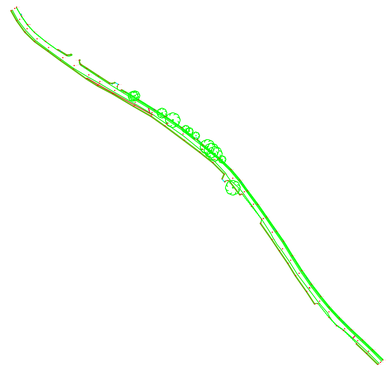

Drawn By: Jamie McGhee
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Ver.	Date	Comments
A	04/04/2022	

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Project:	Coolshamrock Solar Farm
Client:	RES
Drawing:	Topographical Survey
Project No.:	NEO00848
Drawing No. :	NEO00848_013I_A Figure 4.2
Drawn: JM	**Checked:** MM **Approved:** PN
Scale:	1:2,500 @ A1 **Revision:**
Date:	04 April 2022 A

Coolshamrock SID
PFRA Map
Figure 4.3

Key

Development Boundary

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

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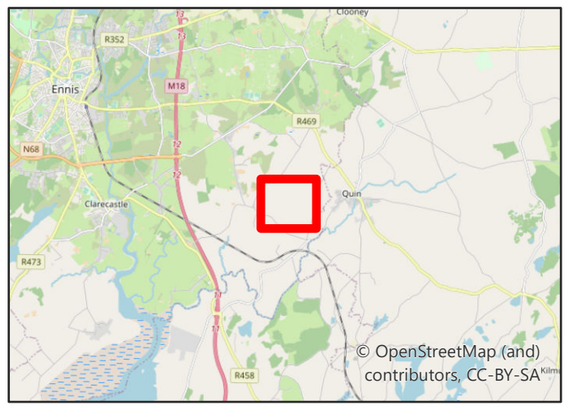

Date: 19/01/2023
Drawn By: Tom Saddington
Scale (A3): 1:5,000
Drawing No: NEO00848/012I/A

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FOUL WATER HOLDING TANK

RAINWATER HARVESTING TANK

CLASS 1 FULL RETENTION SEPARATOR

Key

- PLANNING APPLICATION BOUNDARY (OUTSIDE EDGE OF LINE DENOTES BOUNDARY)
- CABLE ACCESS TRACK
- UNDERGROUND CABLES ROUTE
- PROPOSED TOWER
- SUBSTATION SITE
- FIRE ENGINE TURNING SPACE
- UNDERGROUND PIPE
- SOAKAWAY PIT

OSi Sheet Numbers:

4381-B
4381-D
4382-A
4382-C
4381
4382

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B	30/08/2023	Design Amendments
A	04/04/2023	

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Project: Coolshamrock SID
Client: RES

Drawing: Outline SuDs Design

Project No.: NEO00848
Drawing No. : NEO00848_015I_B Figure 4.4

Drawn: JM **Checked:** MM **Approved:** PN

Scale: 1:500 @ A1 **Revision:** B
Date: 30 August 2023

Appendix 4B – Flow Report

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	14.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	14.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	0.3
Summer CV	0.750	30 year (l/s)	0.6
Winter CV	0.840	100 year (l/s)	0.8
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +20% 360 minute (m³)	13

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.065	Betterment (%)	20
SAAR (mm)	1154	QBar	0.4
Soil Index	3	Q 1 year (l/s)	0.3
SPR	0.40	Q 30 year (l/s)	0.6
Region	11	Q 100 year (l/s)	0.8
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	20
Positively Drained Area (ha)	0.065	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	20
SPR	0.40	PR	0.435
CWI	125.385	Runoff Volume (m³)	13

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