

7. LAND SOILS AND GEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

McCarthy Keville O’Sullivan (MKO), on behalf of Burkeway Homes Limited, has carried out an assessment of the potential impacts and associated effects of a proposed strategic housing development (SHD) consisting of 121 no. dwelling houses together with a crèche facility, associated outdoor play areas, car parking and open space amenity development and a public linear park along the Trusky Stream at Bearna, Co. Galway on the land, soil, and geological environment.

This chapter provides a baseline assessment of the environmental setting of the proposed development in terms of land, soils, and geology, and discusses the potential impacts that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to soils and geology are recommended and an assessment of residual impacts and significance of effects provided.

The objectives of the assessment are to:

- Produce a baseline study of the existing terrestrial environment (land, soil and geology) in the area of the proposed development;
- Identify likely significant effects of the proposed development on land, soil and geology during the construction phase and operational phase of each aspect of the development;
- Identify mitigation measures to avoid, remediate or reduce significant negative effects and,
- Assess significant residual effects and cumulative effects of each aspect of the proposed project cumulatively and in-combination with other developments.

7.1.2 Statement of Authority

This chapter of the EIAR was prepared by Michael Watson PGeo, Professional Geologist with assistance from Eoin Gilson.

Michael Watson completed an MA in Environmental Management at NUI, Maynooth in 1999. He is a professional geologist (PGeo) and full member of IEMA (MIEMA) as well as a Chartered Environmentalist (CEnv). Michael joined McCarthy Keville O’Sullivan Ltd. in 2014 having gained over 15 years’ experience in a Cork based environmental & hydrogeological consultancy firm. Eoin is an Environmental Scientist with MKO who took up his position in October 2018. Eoin holds a BSc (Hons) in Microbiology and a MSc (Hons) in Applied Environmental Science. On joining MKO Eoin has been involved on a range of renewable energy infrastructure projects, working as part of a large multi-disciplinary team to produce EIA Reports.

7.1.3 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the ‘EIA Directive’) as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- Planning and Development Acts 2000 to 2019 and the Planning and Development Regulations 2001 to 2019;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act, 2000, as amended;
- Planning and Development Regulations 2001 as amended including as amended by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law; and,
- The Heritage Act 1995, as amended.

7.1.4 Relevant Guidance

The land, soils and geology section of this EIAR is carried out in accordance with the ‘EIA Directive’ as amended by Directive 2014/52/EU and having regard where relevant to guidance contained in the following documents:

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements; and,
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

7.2 Assessment Methodology

7.2.1 Desk Study

A desk study of the site and the surrounding study area was largely completed in advance of undertaking a site walkover survey. The desk study involved collecting all the relevant geological data for the Proposed Development site and surrounding area. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Geological Survey of Ireland – Geological Heritage site mapping (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 14 (Geology of Galway Bay). Geological Survey of Ireland (GSI, 1994);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- General Soil Map of Ireland 2nd edition (www.epa.ie);

7.2.2 Site Investigations

Detailed walkover surveys and site inspection of the proposed development site and surrounding area was undertaken by Eoin Gilson of MKO on 27th August 2020 and Michael Watson on the 15th September 2020.

The objectives of the site inspection were to determine the topographic layout of the proposed site, to investigate the geological nature of the site including surface and subsurface. In addition to the general walkover, shallow excavations at the site show the soil, subsoil and bedrock profiles and there are numerous rock outcrops present.

7.2.3 Impact Assessment Methodology

Using information from the desk study and data from the site investigation, an estimation of the importance of the soil and geological environment within the study area is assessed using the criteria set out in Table 7-1 (NRA, 2008).

Table 7-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral Resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral Resource.

The statutory criteria for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and trans-frontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in EPA (2017) Glossary of Impacts as shown in Chapter 1 of this EIAR. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 7-2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the geology and morphology of the existing environment, as listed in Table 7-3.

Table 7-2 Additional Impact Characteristics.

Impact Characteristic	Degree/Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 7-3 Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	<p>Widespread permanent impact on:</p> <ul style="list-style-type: none"> ➤ The extent or morphology of a cSAC. ➤ Regionally important aquifers. ➤ Extents of floodplains. <p>Mitigation measures are unlikely to remove such impacts.</p>
Positive or Negative	Significant	<p>Local or widespread time dependent impacts on:</p> <ul style="list-style-type: none"> ➤ The extent or morphology of a cSAC / ecologically important area. ➤ A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). ➤ Extent of floodplains. <p>Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area,</p>

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
		Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	<p>Local time dependent impacts on:</p> <ul style="list-style-type: none"> ➤ The extent or morphology of a cSAC / NHA / ecologically important area. ➤ A minor hydrogeological feature. ➤ Extent of floodplains. <p>Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends</p>
Positive, Negative or Neutral	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Positive, Negative or Neutral	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

7.3 Existing Environment

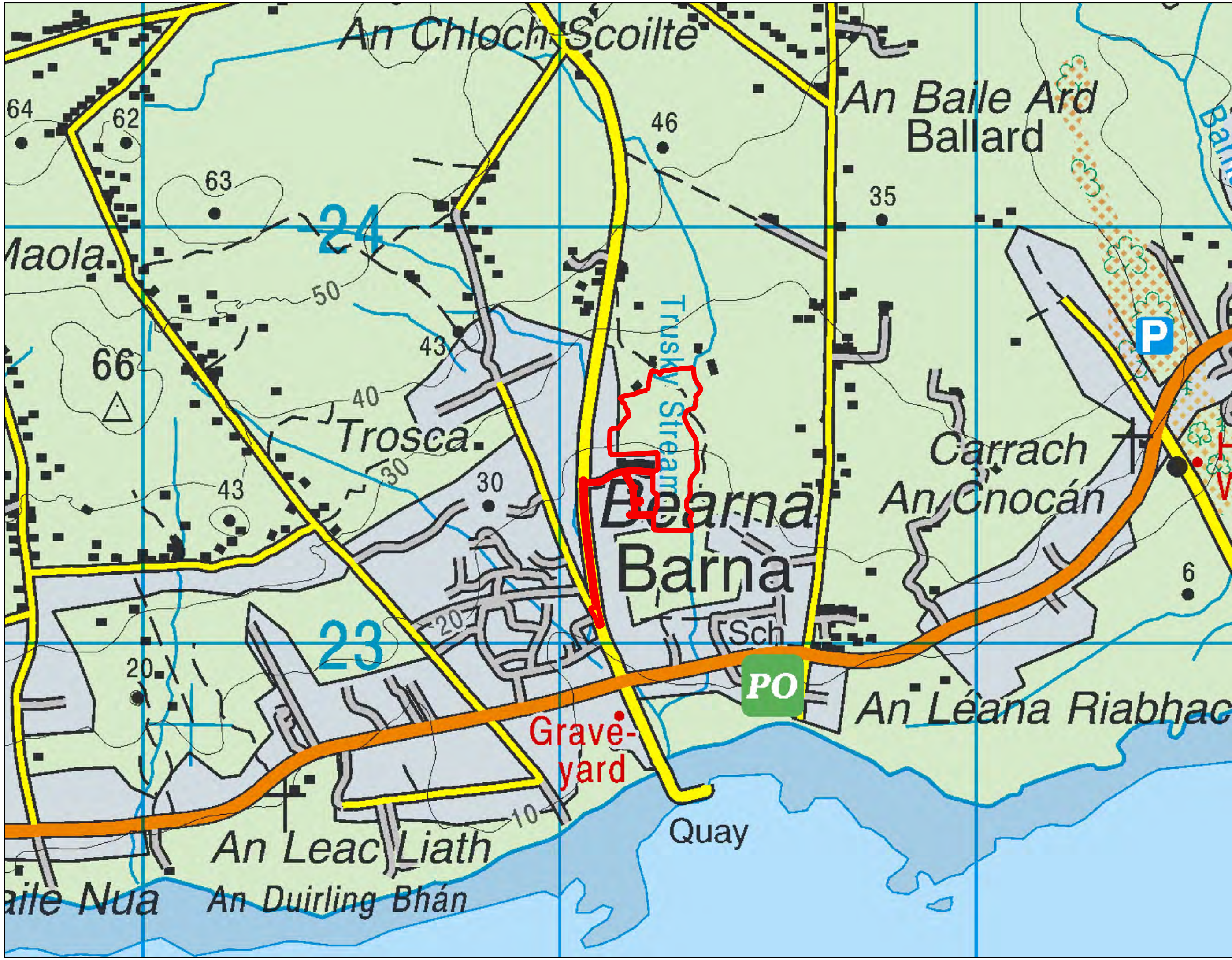
7.3.1 Site Description and Topography

The site area comprises approximately 5.38ha of land located within the townlands of Trusky East, Trusky West, Freeport and Ahaglugger, approximately 6km to the west of Galway City. The elevation of the site ranges between approximately 24m and 14.5m OD (metres above Ordnance Datum).

In general, the site undulates with a general fall from the north (+24.0m AOD) to the southeast (+14.5m AOD), with levels along the western boundary typically +22.5m AOD to +15.1m AOD. The Trusky stream is immediately east of the site’s boundary, which is similarly graded, from north to south. The site is bounded by improved agricultural grassland to the north and east and residential housing to the west and south.

Bedrock is close to surface over much of the site, particularly in the centre of the site where rock outcrops are visible and thin soils evident. There are numerous field boundaries, acid grasslands, scrub, dense bracken and soil and stone likely associated with some shallow excavations that occurred in the past. The Galway Granite underlying bedrock is evident at numerous rock outcrops as well as the disturbed ground areas and stockpiles.

A site location map is shown as Figure 7-1. A site photograph is included as Plate 7-1.



Map Legend
 Site Boundary

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Site Location

Project Title
Burkway Bearná SHD

Drawn By SC	Checked By MW
Project No. 190450-a	Drawing No. Fig 7.1
Scale 1:8000	Date 30.09.2020

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Plate 7.1 Site photograph

7.3.2 Soils and Subsoils

According to GSI mapping (www.gsi.ie), the site is underlain by Shallow well drained mineral (AminSW) in the south and east of the site, with Peaty poorly drained mineral (AminPDPT) found to the west of the site and Shallow, rocky, peaty/non- peaty mineral complexes (AminSRPT) found to the north of the site. The areas surrounding the site are all mapped as having similar soils, with areas of made ground at the edge of Galway city and some areas of Raise peat to the north west of the site in the Moycullen hills.

The mapped subsoil type (www.gsi.ie) for the proposed site indicate that the site is predominantly underlain by Bedrock outcrop or subcrop with a small area of Till derived from granites to the west. The local subsoils map is shown as Figure 7-2

The walkover survey confirmed the GSI classifications for soils and subsoils as shown on Plate 7.2



Plate 7.2- Thin Mineral Soil over Weathered Granite

7.3.3 Bedrock Geology

Based on the GSI bedrock map of the region, the Proposed Development site is underlain by Megacrystic-Porphyritic Granite (Galway Granite) which is described as Monzogranite, mafic, megacrystic. The Megacrystic-Porphyritic Granite Formation is classified by the GSI as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones.

A bedrock geology map of the area is attached as Figure 7-3

The walkover survey confirmed the GSI classifications for bedrock as shown on Plate 7.3



Plate 7.3– Weathered Bedrock (Galway Granite)

7.3.4 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites within the proposed development area. The closest geological heritage site is Knocknagreana (GY084), which is located approximately 3 kilometres west of the site at its closed point and is described as Rocky outcrops and a boulder beach along a coastal section

The Proposed Development is not located in any Natura 2000 designated sites (European Ecologically designated sites). However, the site is located approximately 0.9 kilometres north of the Galway Bay Complex Special Area of Conservation (SAC), 1.3 kilometres north Inner Galway Bay Special Protection Area (SPA) and approximately 6.3 kilometres to the southwest of the Lough Corrib Special Area of Conservation (SAC). A designated sites map is included as Figure 7-4.

7.3.5 Soil Contamination

There are no known areas of soil or ground contamination on the site. During the site walkovers, no areas of potential contamination concern were identified. Any material on the site is generally excavated rock material consistent with the local geology. There is some spoil and bare ground which is recolonising which comprises soil and stone.

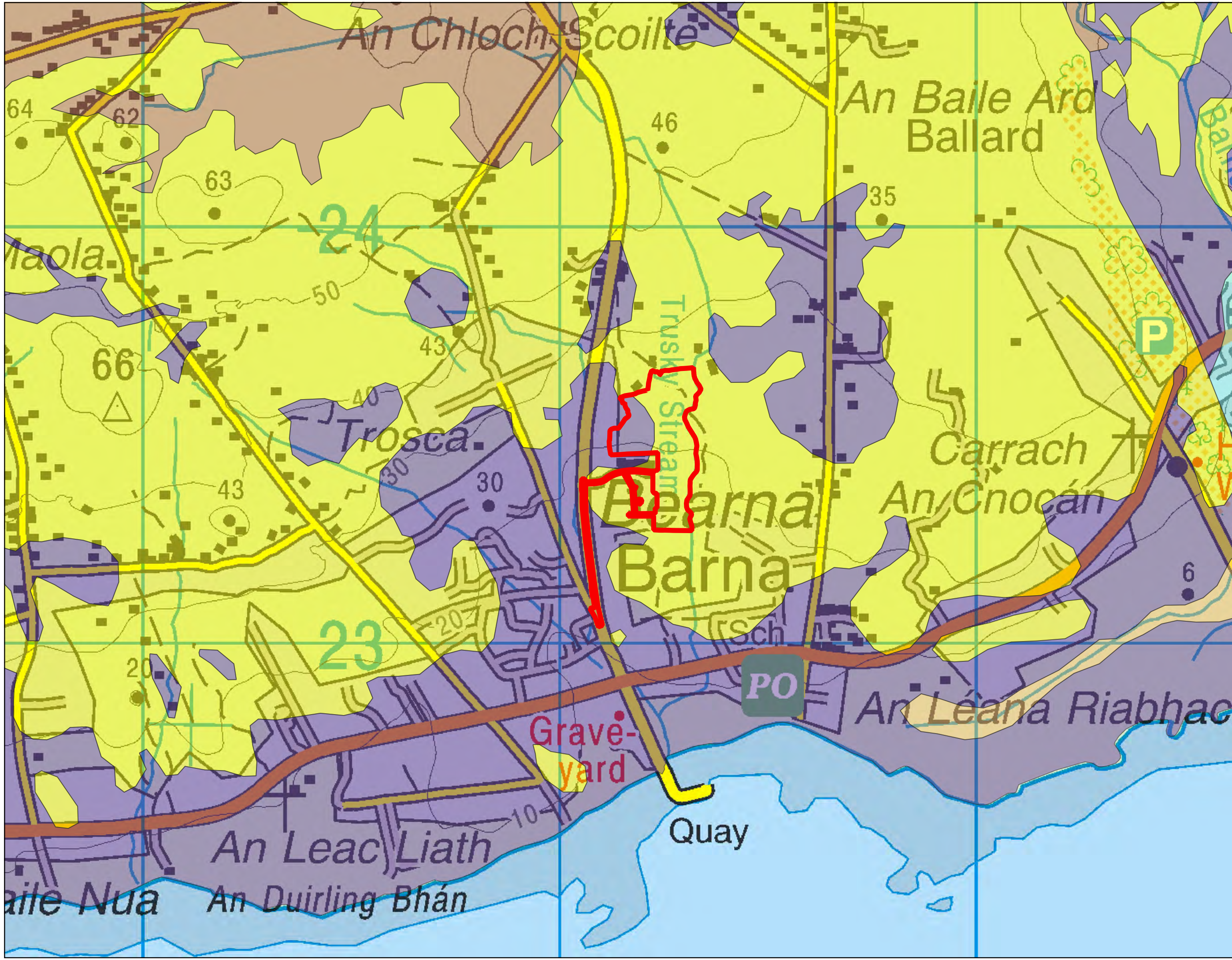
According to the EPA online mapping (<http://gis.epa.ie>), there are no licensed waste facilities on or within the immediate environs of the proposed development site.

There are no historic mines at or in the immediate vicinity of the site that could potentially have contaminated tailings.

7.3.6 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer shows no quarries within the proposed development area. The active 2-mile Ditch Quarry quarry is located ~ 11 km northeast of the site.


The GSI online Aggregate Potential Mapping Database shows that the proposed development site is not located within an area mapped as being of Very High or High granular aggregate potential (i.e. potential for gravel reserves).



Map Legend

- Site Boundary
- Local Subsoils
 - Alluvium
 - Blanket Peat
 - Cutover Peat
 - Man Made
 - Bedrock at Surface
 - Granite Till
 - Water


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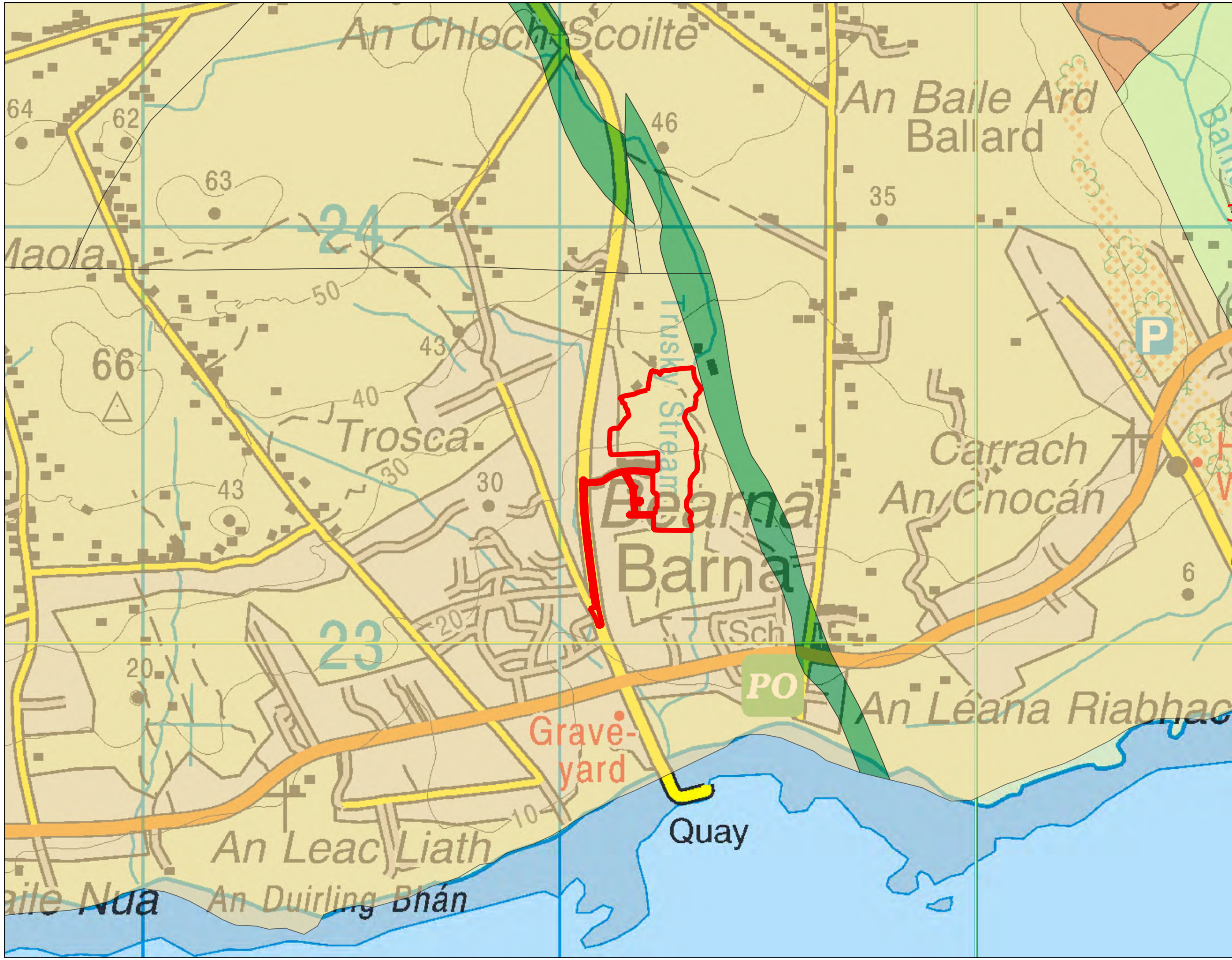


Local Subsoils

Project Title
Burkeway Bearná SHD

Drawn By SC	Checked By MW
Project No. 190450-a	Drawing No. Fig 7.2
Scale 1:8000	Date 30.09.2020


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Map Legend

- Site Boundary
- Local Bedrock
 - Complex zone with dioritic enclaves
 - Megacrystic pink/grey monzogranite
 - Monzogranite, mafic, megacrystic
 - Non-porphyrific syenogranite; pink
 - Fine grained foliated granite
 - Undifferentiated

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Local Bedrock

Project Title
Burkway Bearná SHD

Drawn By: SC Checked By: MW

Project No.: 190450-a Drawing No.: Fig 7.3

Scale: 1:8000 Date: 30.09.2020

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Local Bedrock

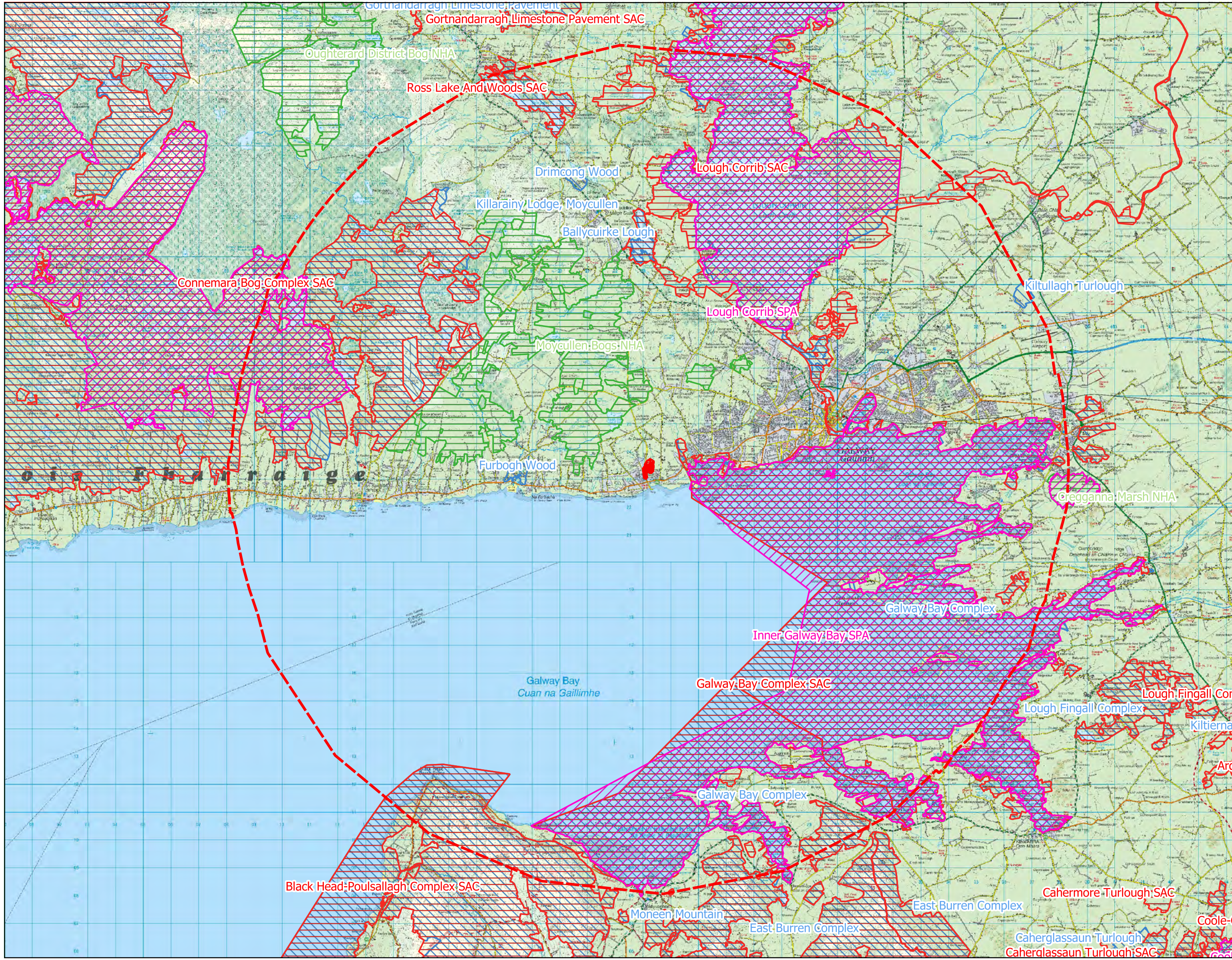
Project Title
Burkway Bearná SHD

Drawn By: SC Checked By: MW

Project No.: 190450-a Drawing No.: Fig 7.3


Scale: 1:8000 Date: 30.09.2020

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Map Legend

- Site Boundary
- 15KM Buffer
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- Natural Heritage Area (NHA)
- Proposed Natural Heritage Area (pNHA)




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Designate Sites

Project Title
Burkeway Bearná SHD

Drawn By SC	Checked By MW
Project No. 190450-a	Drawing No. Fig 7.4
Scale 1:120000	Date 30.09.2020



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Characteristics of the Proposed Development

The proposed development is described in full in Chapter 4 and will generally comprise the following:

A strategic housing development (SHD) consisting of 121 no. dwelling houses together with a crèche facility, associated outdoor play areas, car parking and open space amenity development and a public linear park along the Trusky Stream located at Trusky East, Bearna, Co. Galway

The proposed development will typically require minor alteration of ground levels to ensure it is at an adequate level for the proposed surface water drainage and foul water drainage. Detailed drawings in respect ground levels can be seen at Appendix 4-1 to this EIAR. Excavation of soil and subsoil will be required for the proposed development in preparation for the construction of building foundations and in the preparation of a suitable sub-formation for road construction, trenching for foul and drainage water infrastructure and other services.

Surface Water Drainage

The surface water drainage system will consist of a gravity sewer network that will convey runoff from the roofs and paved areas of the development to outfall manholes, which will discharge at controlled flow rates to the Trusky stream. Discharge will be limited to the greenfield equivalent, QBARRURAL, runoff rate. This will be achieved using a Hydro-Brake flow restrictor prior to discharging to the Trusky stream. Temporary underground attenuation will also be provided at two separate locations in the form of underground cellular storage units. Silt traps will be provided for upstream of the attenuation tanks. Surface water will pass through petrol interceptors prior to discharging from the site. Discharge will be directed through gravel infiltration beds, as recommended by Inland Fisheries Ireland prior to discharge to the Trusky Stream.

Water Supply

Water supply to the site will be via connection to the adjacent public (Irish Water) watermain.

Wastewater Infrastructure

Wastewater from the proposed development will be collected via a new wastewater network for the development and directed to the local municipal wastewater treatment plants for treatment via the sewage collection network. In addition, the existing Cnoc Fraoigh residential estate will be connected to the wastewater network for the proposed development via a new pump station and rising main.

The existing wastewater treatment plant (wwtp) for the Cnoc Fraoigh development will be decommissioned. The existing Cnoc Fraoigh wastewater network will be maintained and connected to the wastewater network of the proposed development via a new pump station and rising main. Wastewater from both the proposed development (121 residential units) and the existing Cnoc Fraoigh development (21 residential units) will be connected to the existing public sewer via a new wastewater line to be installed along the L-1321.

Potential Impacts of the Proposed Development

Do Nothing Scenario

The use of the proposed development site for rough grazing by livestock would continue. The impact to the topsoil from compaction and poaching of soft ground from the presence of livestock would continue as a result of the Do-Nothing Scenario. The potential impacts are imperceptible.

7.5.2 Potential impacts and Mitigation Measures – Construction Stage

The likely impacts of the construction stage of the proposed residential development are considered below and mitigation measures that will be put in place to eliminate or reduce them are described below.

7.5.2.1 Subsoil Excavation and Bedrock Excavation

Excavation of soil, subsoil and bedrock will be required for site levelling, for the installation of foundations for the access roads, carpark and buildings, and service trenching. It is estimated that approximately 15,235 m³ of aggregate may be imported for building works. This will result in a permanent relocation of soil, subsoil and rock at most excavation locations. The bedrock at the site can be classified as of “Low” importance, and the soil and subsoil deposits at the site could be classified as of “Low” importance as neither are unique and are abundant in the wider landscape.

Mechanism: Extraction/excavation.

Receptor: Land, topsoil, subsoil and bedrock.

Pre-Mitigation Potential Impact: Negative, slight/moderate, direct, likely, permanent impact on soil, subsoil and bedrock.

Mitigation Measures

- Excavated (existing) overburden material will be reused on site, where possible;
- A minimal volume of topsoil and subsoil will be removed to allow for infrastructural work to take place due to optimisation of the layout by mitigation by design; and,
- Construction of service trenching, and surface water attenuation features will generate excess material, and all excess material will be used locally within the site for achieving building formation levels and landscaping.

Residual Impact Assessment: Due to the shallow nature of the excavations, the design measure to reuse excavated materials onsite and the ‘low’ value of the soil and rock resource the magnitude of the effect is considered to be a negative, direct, slight, likely, permanent impact on topsoil, subsoils and bedrock.

7.5.2.2 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk. The accumulation of spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects on the geological and water environment.

Pathway: Topsoil, subsoil and bedrock pore space.

Receptor: Topsoil, subsoil and bedrock.

Pre-Mitigation Potential Impact: Negative, direct, slight, short term, unlikely impact on topsoil, subsoils and bedrock.

Proposed Mitigation Measures

- All plant and machinery will be serviced before being mobilised to site;
- No plant maintenance will be completed on site, any broken down plant will be removed from site to be fixed;
- Refuelling will be completed in a controlled manner using drip trays at all times;
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water;
- Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores;
- Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored;
- Ancillary equipment such as hoses and pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on-site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment.

Highest standards of site management will be maintained, and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the site to ensure that they are operating safely and effectively as well as having responsibility for the implementation of Emergency Procedures for spill control measures..

Residual Impact Assessment: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. The measures identified above to mitigate the risk of spills and leaks, will be applied during the construction phase. The residual effect is assessed as - Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock.

7.5.2.3 Soil and Subsoil Compaction

Unintended soil and subsoil compaction is due to inadvertent construction traffic on the development site. Soil compaction leads to bulk density of the soil increasing and the total porosity decreasing which can pose a risk to site drainage due to the lower level of ground permeability on the site. The soils and subsoils on site are thin and have minimal effect on the drainage regime at the site. The majority of the soil and subsoil at the site will be subject to excavation and movement however a portion of the site, along the Trusky stream will not be developed and so soils and subsoils along this section, proposed as a linear park will be maintained and enhanced. .

Mechanism: Excavation / handling / storage.

Receptor: Land, topsoil, subsoil.

Pre-Mitigation Potential Impact: Negative, direct, imperceptible, likely impact on topsoil and subsoils.

Proposed Mitigation Measures

The underlying in-situ soils and subsoils will be subject to a certain amount of compaction, but this will be unavoidable.

Any infill material/landscaping that is required will be placed and levelled in appropriate lift thicknesses to ensure the material is not over compacted thereby retaining its drainage properties. This will be relevant along the proposed linear park and landscaped areas of the site.

Residual Impact Assessment: Negative, slight, direct, likely impact on topsoil and subsoils.

7.5.2.4 Geological impact on local Designated Sites

Mechanism: Excavation / handling / storage of soil/subsoils.

Receptor: Land, topsoil, subsoil and associated designated sites.

Potential Impact: None, no direct excavation or development of any local designated sites are proposed. No indirect impacts on Designated Sites are anticipated.

Residual Impact

None.

7.5.3 Potential Impacts and Mitigation Measures – Operational Stage

Due to the nature of the proposed development, no impacts on soils and geology are anticipated during the operational phase. The operational stage of the residential development consists of the typical activities in a residential area and will not involve further disturbance to the topsoil, subsoils and geology of the area.

No cumulative impacts on the land, soils and geology environment are envisaged during the operational stage.

7.5.4 Assessment of Potential Impacts on Human Health

Potential health effects arise mainly through the potential for soil and ground contamination. Residential developments are not a recognized source of significant potential pollution and so the potential for effects during the construction and operational phases are imperceptible. Hydrocarbons will be used onsite during construction. However, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice mitigation measures. The potential residual impacts associated with soil or ground contamination and subsequent health effects are imperceptible.

7.5.5 Cumulative effects resulting from Interactions between various elements of the proposed development

The interaction of the various elements of the proposed development was considered and assessed in this EIAR with regards land, soils and geology. The potential for each individual element of the proposed development on its own to result in significant effects on land, soils and geology was considered in the impact assessment. The entire project including the interactions between all its elements was also considered and assessed for its potential to result in significant effects on geological receptors in the impact assessment presented. The complex interactions between the requirement for site grading and the requirement to protect the Trusky Stream, human health, and other receptors were taken into account for the entire project and any impacts avoided through a series of mitigation

measures that were fully described. The management and handling of potentially harmful materials across the entire project was assessed with mitigation proposed and described fully.

All interactions between the various elements of the project were considered and assessed both individually and cumulatively within this chapter. Where necessary, mitigation was employed to ensure that no cumulative effects will arise as a result of the interaction of the various elements of the development with one another.

7.5.6 Cumulative In-combination Effects

The potential cumulative effects of the proposed development in combination with the other projects described in Chapter 15 of this report have been considered in terms of impacts on land, soils and geology. Where appropriate the application documentation, EIAR and NIS have been reviewed to inform the assessment. There are no active quarries, major earthworks, or other associated activities which could impact upon the soils and geological environment adjacent the proposed development site.

The proposed N6 Galway City Ring road will require significant earthworks throughout its length. However, the scale of the proposed earthworks at the Proposed Development site is negligible in the context of the other projects within and around the City and so the potential cumulative effects are considered imperceptible.

With the implementation of mitigation measures for the proposed development as outlined above, no significant cumulative impacts on land, soils and geology environment are anticipated during the construction or operation phases of the proposed development in combination with other developments. Potential cumulative impact will be permanent, imperceptible, and neutral.

7.5.7 Conclusion

Excavation of topsoil, subsoil and bedrock will be required for site levelling and for the installation of drainage and services (wastewater, water supply, electricity, etc.) infrastructure. This will result in a permanent relocation and removal of subsoil and bedrock at most excavation locations. Due to the nature of the site topography and geology it will be possible to reuse cut material as fill which minimises the need to remove all excavated materials. Excess material will be used for reinstatement and landscaping works around the site at the end of the construction phase also.

Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods. Measures to prevent subsoil erosion during excavation and reinstatement will be undertaken to prevent water quality impacts.

No significant impacts on land, soil and geology will occur.

No significant cumulative impacts on land, soil and geology will occur due to the proposed development.