

Appendix A.1.11

Lackagh Quarry Layout

A.1.11

Galway County Council
N6 Galway City Ring Road
Lackagh Quarry: Material
Deposition Assessment

GCCR-4.04-03-4.23

Issue 1 | 30 August 2019

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 233985



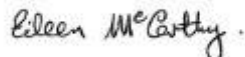
Ove Arup & Partners Ireland Ltd

Arup
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

ARUP

Document verification

ARUP

Job title		N6 Galway City Ring Road		Job number		233985	
Document title		Lackagh Quarry: Material Deposition Assessment		File reference			
Document ref		GCRR-4.04-03-4.23					
Revision	Date	Filename	GCOB_4-03-03-4.23 Lackagh Quarry MDA Requirements I1.docx				
Issue 1	30 Aug 2019	Description	Issue 1				
			Prepared by	Checked by	Approved by		
		Name	Juli Crowley	Mary Hurley	Eileen McCarthy		
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					
Issue Document verification with document							<input checked="" type="checkbox"/>

Contents

	Page	
1	Introduction	1
2	Overview of Material Deposition Areas	2
	2.1 Overview of material for placement	2
	2.2 Material Deposition Areas	2
3	Lackagh Quarry Deposition Assessment	3
	3.1 Overview of Lackagh Quarry material placement	3
	3.2 Review of Lackagh Quarry Material Deposition Areas	5
	3.3 Volumetric Summary	16
4	Blast damaged slope stability solutions	18
	4.1 Direct Solution	18
	4.2 Indirect Solution	18
	4.3 Summary	20
5	Ecological Habitat Compensation	21
6	Conclusions and Recommendations	24
	6.1 Material generated for placement	24
	6.2 Material Deposition Area Capacity	24
	6.3 Recommendations	25
	6.4 Particular Commitments	28
7	References	32

Annexes

Annex 1

Lackagh Quarry Layout - Drawings

Annex 2

Material Deposition Areas Baseline Report

1 Introduction

This Appendix A.1.11 has been prepared to address the specific query raised in item 1h of the Request for Further Information (RFI) from An Bord Pleanála (ABP). It is an extraction from the Material Deposition Areas Baseline Report which is included in Annex 2 to this Appendix A.1.11. It also documents the review undertaken of the Material Deposition Areas (MDAs) required for the proposed road development at Lackagh Quarry. Full details of the design requirements for the MDAs throughout the proposed road development is included in Annex 2 to this Appendix A.1.11.

The MDAs at Lackagh Quarry are designed to provide stability to the existing blast damaged rock face and thereby prevent encroachment on the Lough Corrib cSAC including Annex I habitat and to facilitate the creation of compensatory ecological habitat. The creation of MDAs to the north of the proposed road development within Lackagh Quarry is limited to the north western area, as the north eastern area is used to mitigate potential impacts on Peregrine Falcon.

Earthworks material generated during construction and surplus to the fill requirement of the proposed road development has been assessed for suitability for beneficial re-use on site in Material Deposition Areas (MDAs) within the proposed development boundary. Material not suitable for placement in MDAs for example hazardous material will be appropriately disposed of offsite.

Approximately **366,000m³** material will be generated for placement in MDAs across the whole length of the proposed road development.

All excavated material, excluding a small potential volume of hazardous material, will be re-used as construction fill and material deposition minimising the loss of solid geology. Material surplus to the construction of the proposed road itself will be placed in locations that were selected to satisfy the necessary engineering, environmental, landscape and safety requirements for the proposed road development. These MDA locations were assessed by the various environmental specialists including ecological, landscape & visual, geotechnical, hydrogeological and hydrological specialists to complete an environmental assessment of the deposition of material.

The objective of this report is:

- to present an overview of the deposition material across the proposed road development
- to present an overview of the deposition assessment for Lackagh Quarry including:
 - Overview of material deposition areas within Lackagh Quarry as presented in the EIAR
 - Review the material deposition plan areas, volumes presented in the EIAR
 - Present a modified solution for each Material Deposition Area within Lackagh Quarry where feasible
- to summarise findings and make recommendations

2 Overview of Material Deposition Areas

2.1 Overview of material for placement

Approximately **366,000m³** of material will be generated during the construction of the proposed road development that is surplus to the fill requirement and can be used for placement in MDAs. This deposition material can be grouped into two material type categories:

1. **Peat, approximately 76,000m³** – This material is unsuitable for road construction and is typically present over the granite bedrock on the western extents of the proposed road development. The thickness of peat is typically between 0.5 – 1.0m. According to Cl. 601.2 of the NRA SRW Series 600, peat is a Class U1 material which is unacceptable and must be removed from beneath the proposed road development
2. **U1, Non-Hazardous Material, approximately 290,000m³** – This material consists of topsoil, materials from swamps, marshes and bogs, made ground comprised of man-made materials, argillaceous rock and calcite, logs, stumps and perishable material, materials in a frozen condition, clay having a liquid limit determined in accordance with BS 1377 : Part 2, exceeding 80 or plasticity index determined in accordance with BS 1377 : Part 2, exceeding 55, material susceptible to spontaneous combustion and non-hazardous materials other than those classified as acceptable

2.1.1 Material Bulking

No account for material bulking from in-situ to placed volume is included in the generated material volume of **366,000m³** (presented above). Bulking occurs when soil or rock is excavated, for example 1m³ of soil or rock in-situ in the ground does not translate to 1 m³ in a lorry or placed and compacted on site.

Given the nature of U1 material, which is unsuitable for road construction, compaction may be challenging. Typically, bulking factors depend on material type and size and can range from 10-15% for granular material, 20-40% for cohesive material, 25-45% for peat and 30-80% for rock depending on the size (gravel to boulders). Assuming a general bulking factor of 30% the deposition volumes equate to:

- 76,000m³ of Peat bulked = **98,800m³**
- 290,000m³ of in-situ U1, Non-Hazardous Material bulked = **377,000m³**
- **Total volume: 475,800m³**

2.2 Material Deposition Areas

These MDAs were assessed by the ecological, landscape & visual, geotechnical, hydrogeological and hydrological specialists to complete an environmental assessment of deposition of material. The material deposition assessment

considered the suitability of the placement of Peat and U1, Non-Hazardous Material and each area was designated as a U1 receptor only or as a peat and U1 receptor.

As outlined in Chapter 11, Hydrology, of the EIAR a total of 32 site areas that have been identified as potential material deposition areas along the route of the proposed road development. Four locations of these MDAs are located in Lackagh Quarry.

The allowable and available MDA capacity exceeds the volume of material surplus to the construction of the proposed road. This allows for:

- an increase / decrease in volume of a material type during construction
- contractor design requirements based on the available material (stability assessment)
- contractor programme flexibility, placing material in an efficient manner

The calculated allowable capacity of the 32 MDAs is:

- **of Peat – approximately 98,800m³**
- **of U1 Non-Hazardous Material – approximately 738,000m³**

Of the 32 MDA locations, four are located within Lackagh Quarry. These locations were identified for the creation of ecological habitat compensation, to provide stability to the existing blast damaged rock face and to prevent encroachment on the Lough Corrib cSAC including areas of Annex I habitat. The creation of MDAs to the north of the proposed road development within Lackagh Quarry is limited to the north western area, as the north eastern area is used to mitigate potential impacts on Peregrine Falcon.

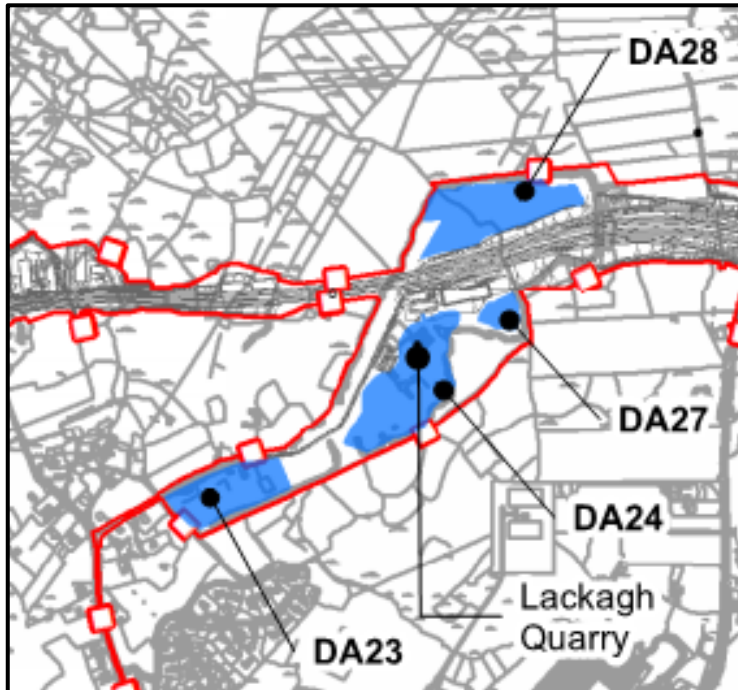
The total volume of material required for the four MDAs within Lackagh Quarry is 236,800m³ of which 51,800m³ is peat and 185,000m³ is U1 material.

3 Lackagh Quarry Deposition Assessment

There are four Material Deposition Areas (MDAs) within Lackagh Quarry as presented in Figure 7.302 and Table 11.27 of Chapter 11, Hydrology of the EIAR, namely DA23, DA24, DA27 and DA28, which are discussed in more detail.

3.1 Overview of Lackagh Quarry material placement

The location of these areas is presented in **Figure 3.1** below (which is extracted from Figures 7.302 of the EIAR) and details of each are presented in **Table 3.1**.

Figure 3.1: Lackagh Quarry Material Deposition

The MDAs in Lackagh Quarry were identified for the following reasons:

- DA23: To facilitate the creation of ecological habitat compensation
- DA24: To provide stability to the existing blast damaged rock face and to facilitate habitat compensation
- DA27: To provide stability to the existing blast damaged rock face
- DA28: To provide stability to the existing blast damaged rock face and thereby prevent encroachment on the Lough Corrib cSAC including areas of Annex I habitat. The north eastern portion of this area is used to mitigate potential impacts on Peregrine Falcon.

Table 3.1: Summary of initial assessment of material deposition area details and requirements

Number	Approx. Chainage	Area (ha)	Approx. Capacity (m ³)	Material designation	Construction / Design Specific Requirement
DA23	11+000	1.727	45,000	Peat with U1 bunds	Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA24	11+350	2.936	200,000	U1 with Peat placed in U1 bunds at higher levels	Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA27	11+550	0.346	27,000	U1 with granular drainage layers	Drainage layer to +17.7mOD required, a filter separator (e.g. geotextile is required between the horizontal interface between the drainage layer and general fill to prevent migration of fines sediment). Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA28	11+650	2.4	250,000	U1 with granular drainage layers	Drainage layer to +17.7mOD required, a filter separator (e.g. geotextile is required between the horizontal interface between the drainage layer and general fill to prevent migration of fines sediment). Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR

The total volume of these four MDAs is 522,000m³. These volumes are further assessed in **Section 3.2** below.

3.2 Review of Lackagh Quarry Material Deposition Areas

As above in **Section 2.2** there is scope to refine the MDA as outlined in the EIAR. A number of factors influence the MDA plan area, geometry, composition including the requirements for MDA slope stability, blast damaged slope stability, ecological habitat compensation and maintenance. Considering these factors, the MDAs were reviewed and a modified MDA layout was developed whilst ensuring that the original four criteria for their development was satisfied.

This section of the report presents details of the Material Deposition Areas as presented in the EIAR, outlines proposed modifications for each MDA within Lackagh Quarry and based on a 3D model calculates the estimated capacity of each area. This assessment was completed in Civil 3D (a 3D software that can determine the volume of material placement between an existing surface and a proposed surface).

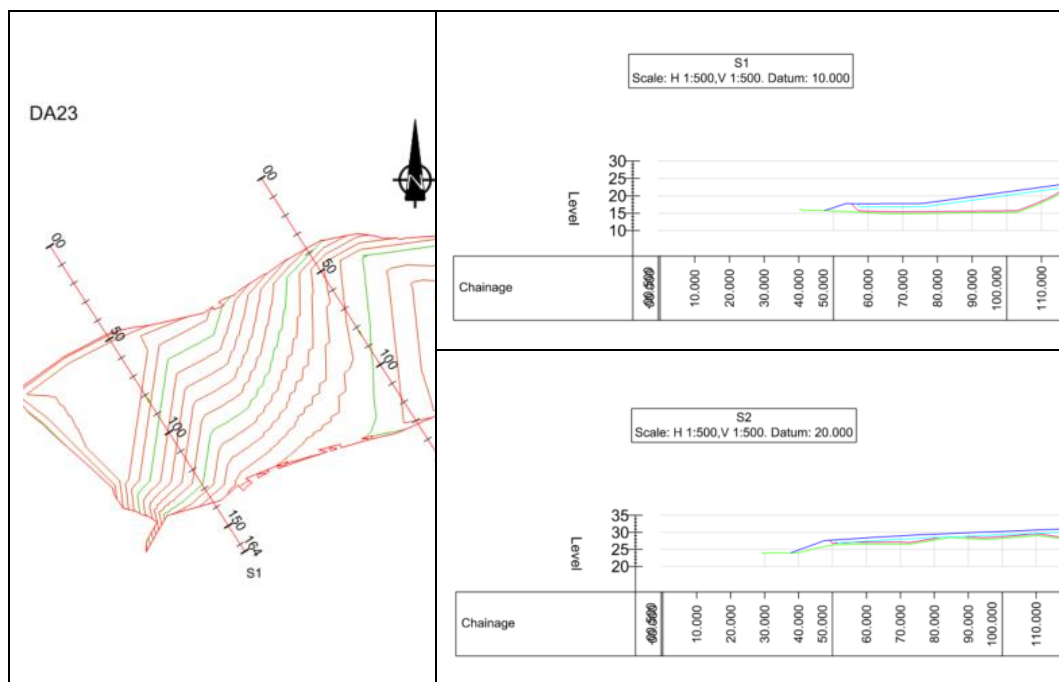
3.2.1 DA23

3.2.1.1 Area Details (2018)

DA23 is located at the entrance to Lackagh Quarry. The area is generally flat and surrounded by a bund to the south of the placement area. Peat and U1 material is proposed at this location.

An earthworks assessment was completed in Civil 3D. This assessment concluded that 45,000m³ of material can be placed in this area of which 12,000m³ will be peat. A plan and cross sections of area DA23 is presented in **Figure 3.2** below.

Figure 3.2: DA23 Plan and Cross Sections



3.2.1.2 Proposed MDA Modifications for DA23 (2019)

This location is proposed to facilitate ecological habitat compensation, it is not required for engineering requirements (for example blast damaged slope stability). As a result, if an alternative location for ecological habitat compensation is identified, DA23 could be removed as there is sufficient U1 material capacity across the proposed road development's MDAs for deposition material.

3.2.2 DA 24

3.2.2.1 Area Details (2018)

DA24 is located further east from the entrance to Lackagh Quarry. This location has the largest MDA footprint within the quarry. Peat and U1 material is proposed at this location.

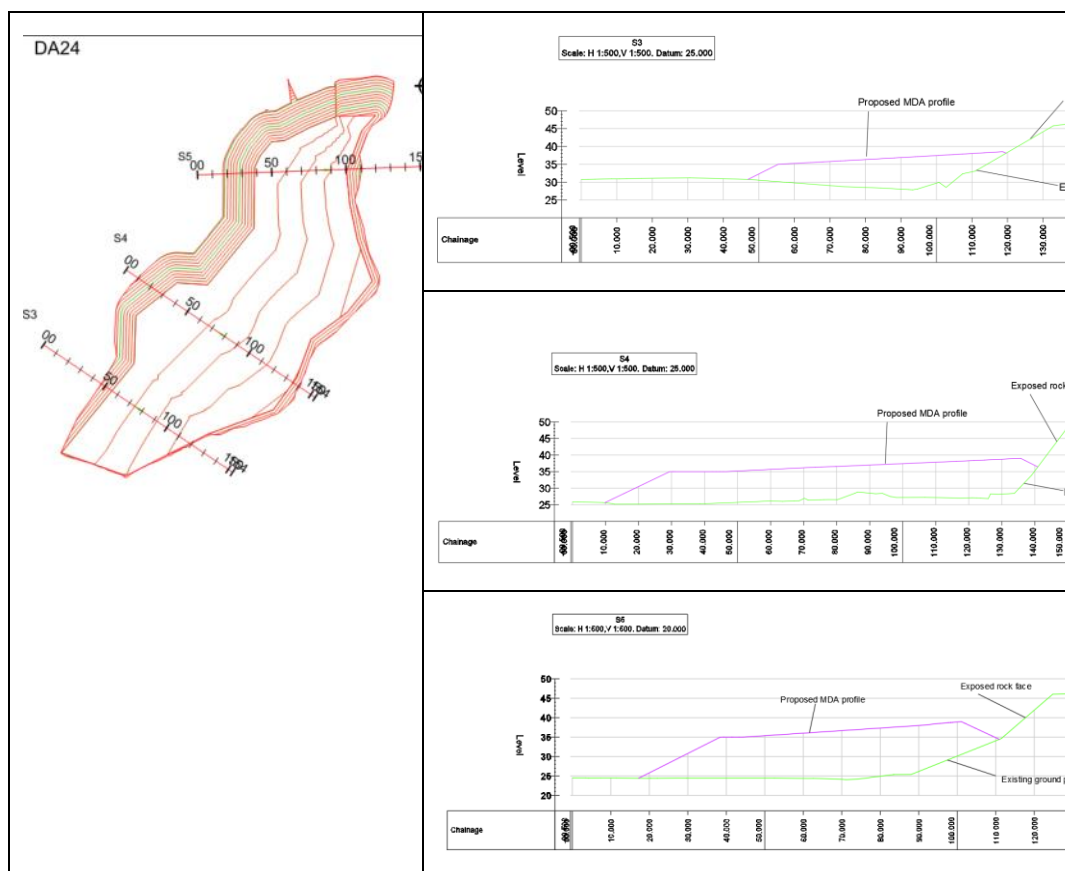
The earthworks assessment completed in Civil 3D concluded that 190,000m³ of material can be placed in this area, of which 40,000m³ is peat. A plan and cross sections of area DA24 is presented in **Figure 3.3**.

For the current layout additional slope stability/health and safety solutions may be required for the exposed rock face above the placement level. These solutions are discussed in more detail in **Section 4** and include:

- Rock bolt, rock dowel, steel mesh and sprayed concrete combination - Direct solution
- Rock trap, fence and exclusion zone combination - Indirect solution

These systems would be designed to the relevant design standards to protect/stabilise the exposed rock face.

Figure 3.3: DA24 Plan and Cross Sections



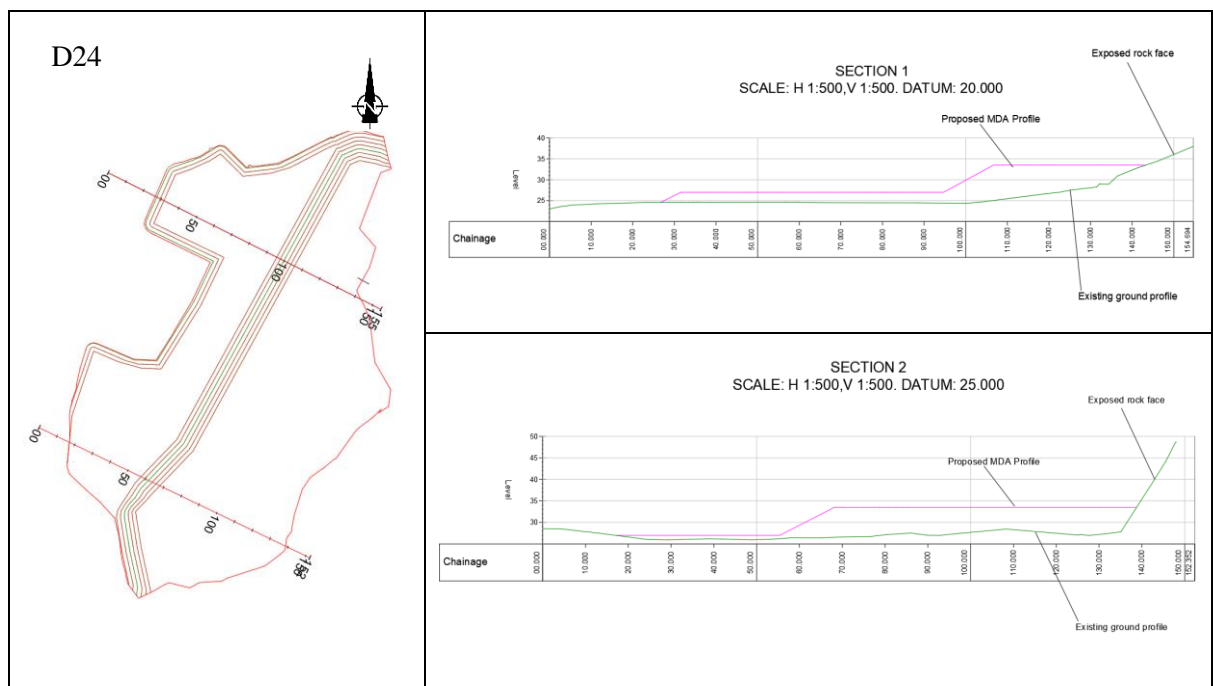
3.2.2.2 Proposed MDA Modifications for DA24 (2019)

This location is proposed to facilitate ecological habitat compensation and for engineering requirements to stabilise blast damaged slope stability. An alternative solution for DA24 includes a reduced footprint, contained peat placement in flat areas and ecological habitat compensation included on the surfaces. Plan and cross section of the proposed solution is presented in the **Figure 3.4** below.

The earthworks assessment completed of the modified layout in Civil 3D concluded that 67,000m³ of material can be placed in this area, of which 37,000m³ is peat. This layout is attainable with the addition of an alternative location for ecological habitat compensation and peat material. This area has been identified as DA25, refer to **Section 3.2.2.3**.

Similar to the other deposition areas with an exposed rock face above the placed material in DA24, additional slope stability/health and safety solutions may be required for the exposed rock face. The recommended solution is the direct solution and includes, rock bolt, rock dowel, steel mesh and sprayed concrete combination.

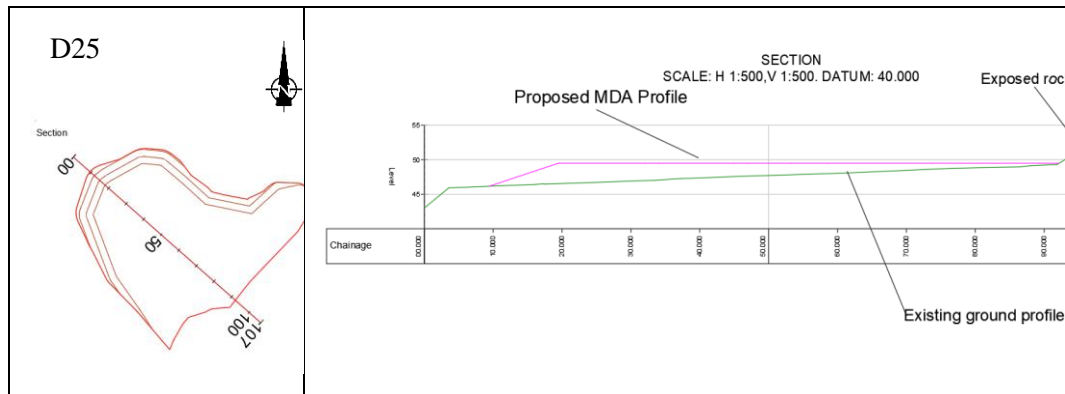
Figure 3.4: Modified DA24 Plan and Cross Sections



3.2.2.3 Proposed new MDA DA25 (2019)

This location is a new location and is proposed to facilitate the creation of ecological habitat compensation. This area will contain peat placement in flat areas, U1 material on the base and surrounding bunds and compensatory ecological habitat on the flat surfaces. Plan and cross section of the proposed solution is presented in the **Figure 3.5** below.

The earthworks assessment completed of the additional MDA layout in Civil 3D concluded that 6,500m³ of material can be placed in this area, of which 3,000m³ is peat.

Figure 3.5: Additional DA25 Plan and Cross Sections

3.2.3 DA27

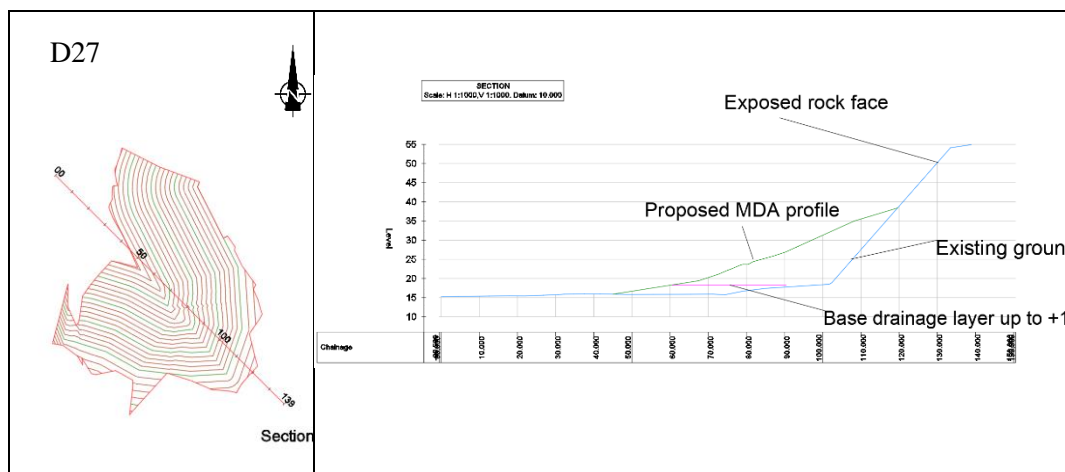
3.2.3.1 Area Details (2018)

This location is directly south of the proposed road in Lackagh Quarry and has the smallest Material Deposition Area footprint within the quarry.

The earthworks assessment completed in Civil 3D concluded that 27,000m³ of material can be placed in this area, all of which is drainage material and U1 material. There is no peat proposed at this location. As per the EIAR free draining granular material is required within Lackagh Quarry up to **+17.7mOD**, to maintain the quarry natural drainage system. Refer to **Figure 3.6** below for a plan and cross section.

The exposed rock face above the placed material, may require additional slope stability/health and safety solutions including:

- Rock bolt, rock dowel, steel mesh and sprayed concrete combination - Direct solution
- Rock trap, fence and exclusion zone combination - Indirect solution

Figure 3.6: DA27 Plan and Cross Sections

3.2.3.2 Proposed MDA Modifications for DA27 (2019)

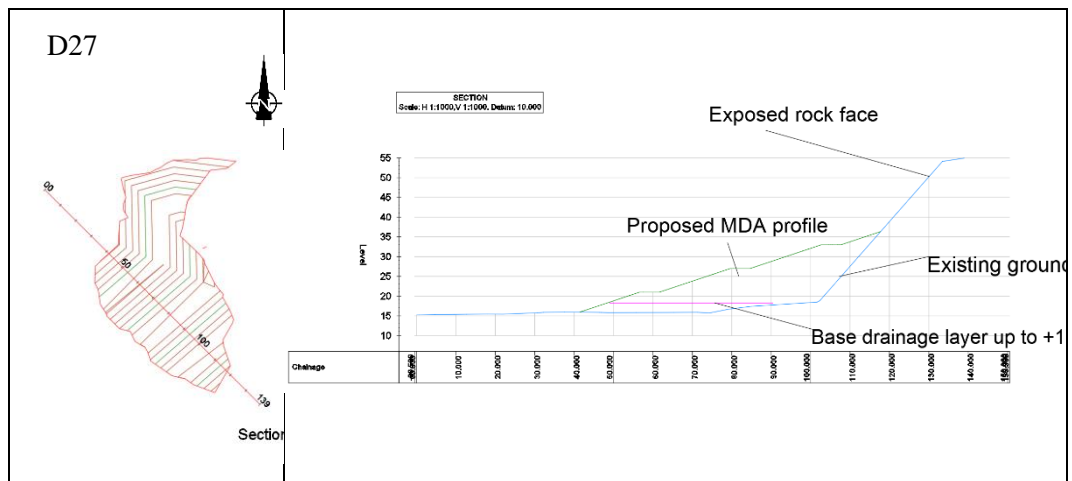
This location is proposed to stabilise existing blast damaged rock face within Lackagh Quarry. This area was not identified as an area for the creation of ecological habitat compensation. Access is limited to this area in the long-term scenario.

An alternative solution for DA27 takes into consideration the drainage pond located to the north east of DA27. This includes a reduced footprint with deeper volumes of deposition (including stabilisation layers) on the surfaces. Plan and cross section of the proposed solution is presented in the **Figure 3.7** below.

The total volume of material placed in this area is estimated as 19,500m³, with 2,800m³ as drainage layer up to +17.7mOD. The drainage layer material has potential to be acquired on site as U1 material but this is not guaranteed as this material has particular characteristic requirements to permit free drainage.

Again, any exposed rock face above the placed material, may require additional slope stability/health and safety solutions described above in **Section 3.2.2.2**.

Figure 3.7: Modified DA27 Plan and Cross Sections



3.2.4 DA28

3.2.4.1 Area Details (2018)

Material Deposition Area DA28 is the largest placement area with respect to material placement volume.

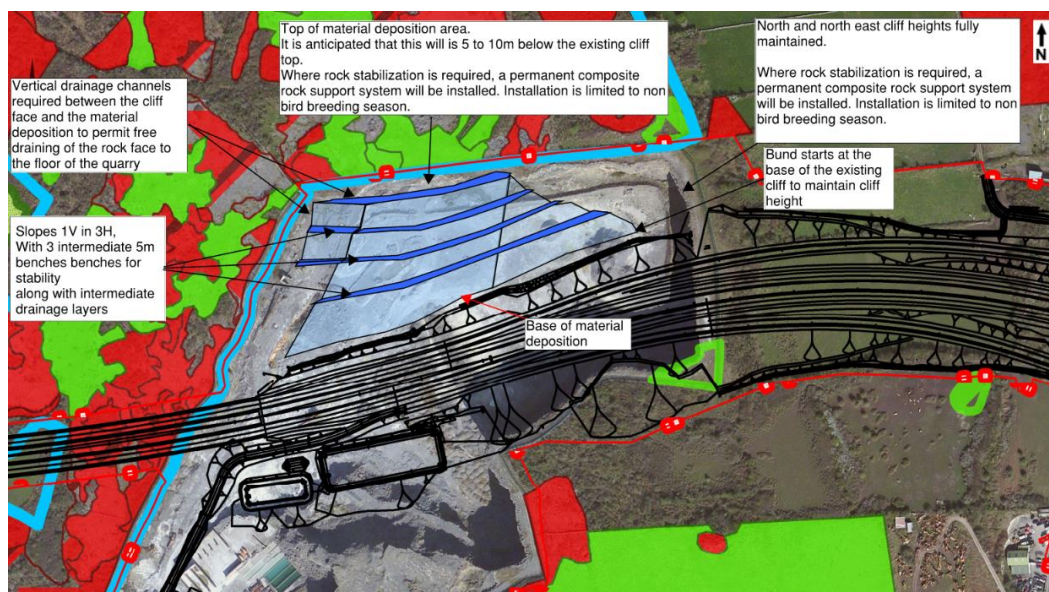
This placement area is complex in terms of drainage, environmental and stability requirements. This area is required to provide stability to the existing blast damaged rock face and prevent encroachment on the Lough Corrib cSAC including Annex I habitat. The particular requirements for deposition area DA28 as outlined in the EIAR include:

- That granular layers will be introduced into the fill area to control slope stability. The contractor is required to complete a slope stability assessment of each area

- That free draining granular material is provided up to +17.7mOD
- That free draining granular material is provided between the existing cliff face and the material deposition material to allow the cliff face to maintain its drainage system
- That a filter separator (e.g. geotextile) is provided between the horizontal interface of free draining material and U1 material to prevent the migration of fines material. The horizontal interface will maintain the existing drainage regime
- To maintain the north and north east cliff heights
- To provide intermediate horizontal stability benches

A schematic of DA28 is shown into **Figure 3.8** below.

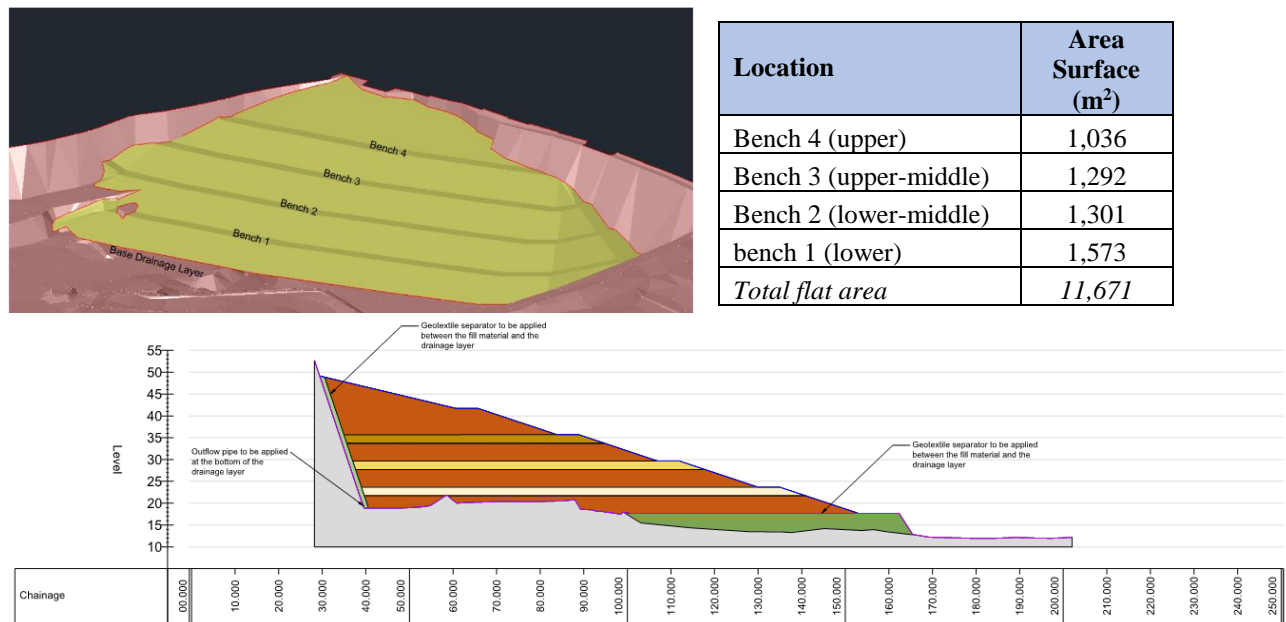
Figure 3.8: Schematic of Lackagh Quarry Material Deposition Area DA28



A slope stability assessment was completed to establish the MDA geometry and associated stability requirements. Following this a Civil 3D model was generated to determine material volumes including volumes of stability and drainage materials in addition to U1 and peat layers.

This layout maximised material placement and stabilisation of the existing blast damaged rock face using material placement. Refer to **Figure 3.9** and **Table 3.2** for plan, profile, surface area details and material volumes.

Given the complexity of the placement area there are a number of particular requirements for DA28 which are summarised and compared to the proposed modified layout in **Table 3.4**.

Figure 3.9: Plan and Profile section for DA28**Table 3.2: Break down of material in DA28**

Layer ID	Description	Volume m ³
	Vertical and Quarry Base Interface Drainage Layer (This material has potential to be acquired on site as U1 material, but this is not guaranteed, as this material has particular characteristic requirements)	13,000
	Base Drainage Layer (quarry base to +17.7mOD): (Potentially obtained as U1 material)	67,000
	Granular Stability Layers (U1 material)	66,000
	Cohesive Material (U1 material)	217,000
	Peat	-
	Total (0 peat / 283,000 U1 / 80,000 potential U1 material)	363,000

3.2.4.2 Proposed MDA Modifications for DA28 (2019)

This location is proposed to stabilise existing blast damaged rock face within Lackagh Quarry and was not originally identified as an ecological habitat compensation area. Refining DA28 in terms of the placement geometry and material composition (including the addition of peat placement), a slope stability and volumetric assessment was completed.

The proposed MDA modification includes balancing of material placement, stabilisation of the existing blast damaged rock face through a combination of material placement and a combination of rock bolt, rock dowel, steel mesh and

sprayed concrete on the exposed rock face and creates an opportunity to facilitate ecological habitat compensation, to compensate for reducing or removing other areas of ecological habitat compensation within the quarry. Refer to **Figure 3.10** and **Table 3.3** for plan, profile, surface area details and material volumes of the modified MDA.

Given the complexity of the placement area, there are a number of particular requirements for DA28 which are summarised and compared to the EIAR layout in **Table 3.4**.

Figure 3.10: Civil 3D Plan and Profile section for DA28 – Modified Layout

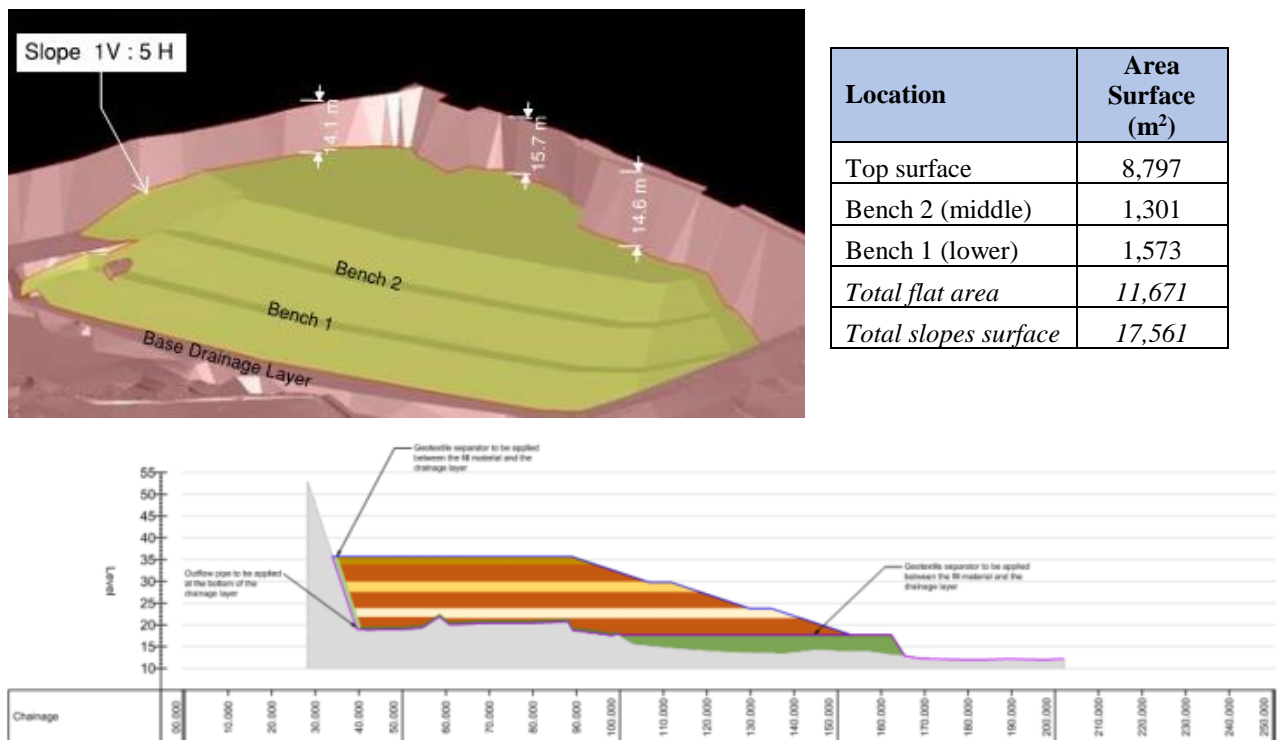


Table 3.3: Break down of material in DA28 – Modified Layout

Layer ID	Description	Volume m ³
	Vertical and Quarry Base Interface Drainage Layer (This material has potential to be acquired on site as U1 material but this is not guaranteed as this material has particular characteristic requirements)	10,000
	Base Drainage Layer (quarry base to +17.7mOD): Possibly Imported material (Potentially obtained as U1 material)	67,000
	Granular Stability Layers (U1 material)	49,000
	Cohesive Material (U1 material)	168,000

Layer ID	Description	Volume m ³
	Peat	14,000
	Total (14,000 peat / 217,000 U1 / 77,000 possible U1 material)	308,000

3.2.4.3 DA28 Summary and Particular Requirements

In summary both options are viable. The initial EIAR has minimised the exposed rock face solution therefore, reducing the volume of intrusive rock stabilisation measures. The modified solution reduces the depth of deposition creating a large flat surface that will be used to facilitate the removal of DA23 and the creation of ecological habitat compensation. Reducing the depth of placement increases the depth of exposed rock face which will require intrusive rock stabilisation.

The modified solution provides an opportunity to reduce or remove other placement areas identified to facilitate the creation of ecological habitat compensation within Lackagh Quarry, for example DA23. The ecological habitat compensation area at DA28 would be completed in accordance with the measures outlined in Construction Environmental Management Plan (CEMP), Appendix A.7.5 of the EIAR. Permanent access would be provided to allow for appropriate maintenance of this area in accordance with the requirements set out in the Compensatory Habitat Management Plans, Appendix A.8.26 of the EIAR.

The particular requirements for DA28 are summarised for both solutions below in **Table 3.4**.

Table 3.4: Supplementary conditions for DA28 for the EIAR area details and the proposed modifications

Rational	EIAR Area Details (2018)	Proposed Modifications (2019)
Geometry	Upper level is 51.0 mOD	Upper level is 35.7mOD
Stability	The external side slope gradient must be 1V in 3H	The external side slope gradient must be 1V in 3H
	Three granular stability layers are required. Detailed design to be completed based on the placement material characteristics	Two granular stability layers are assumed. Detailed design to be completed based on the placement material characteristics
	The granular stability layers are assumed to be 2m deep. Detailed design will confirm the depth of the stability layer. This will be completed based on the placement material characteristics	The granular stability layers are assumed to be 2m deep. Detailed design will confirm the depth of the stability layer. This will be completed based on the placement material characteristics
	Granular stability layers can be obtained from U1 granular material. Refer to Table 3.2 and Table 3.3 for estimated volumes	Granular stability layers can be obtained from U1 granular material. Refer to Table 3.2 and Table 3.3 for estimated volumes

Rational	EIAR Area Details (2018)	Proposed Modifications (2019)
	Intermediate benches are required. These shall be a minimum of 5m wide	Intermediate benches are required. These shall be a minimum of 5m wide
	The benches are located 6 m apart vertically. With a 1V in 3H slope the benches are 18m horizontally apart.	The intermediate benches are to be located 6m apart vertically. With a 1V in 3H slope the benches are 18m horizontally apart.
Drainage	The free draining granular material between the existing cliff face (including bench faces) and material deposition material to allow the cliff face to maintain its drainage system shall be 1m wide	A free draining granular material between the existing cliff face (including bench faces) and material deposition material to allow the cliff face to maintain its drainage system shall be 1m wide A filter separator (e.g. geotextile is required between the horizontal interface between the drainage layer and general fill to prevent migration of fines sediment)
	A free draining granular material between the existing quarry base and material deposition material to maintain its drainage system. This is required: Where the exiting quarry level at a material deposition area is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD; and Above this level a minimum of 0.5m free drainage material is required at this interface	A free draining granular material between the existing quarry base and material deposition material to maintain its drainage system. This is required: Where the exiting quarry level at a material deposition area is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD; and Above this level a minimum of 0.5m free drainage material is required at this interface
	A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment	A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment
Rock Face stability	The exposed rock face exposed above the material deposition may require additional measures for stability are required, refer to Section 4 of this report The additional slope stability/health and safety solutions include the direct solution of, rock bolt, rock dowel, steel mesh and sprayed concrete combination	The exposed rock face exposed above the material deposition is approximately 15m high, therefore additional measures for stability are required, refer to Section 4 of this note The additional slope stability/health and safety solutions include the direct solution of rock bolt, rock dowel, steel mesh and sprayed concrete combination
Environmental		An access track for maintenance shall be no steeper than 1V in 5H slope to the upper bench Maintenance is required of the finished surfaces in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR
Environmental		Peat will be included with in the placement

3.3 Volumetric Summary

The vast majority of the material placement capacity is located in Lackagh Quarry. A direct comparison of the MDAs included in the EIAR in 2018 and the proposed modifications in 2019 are summarised below in **Table 3.5** (material volumes) and **Figure 3.11** (plan areas).

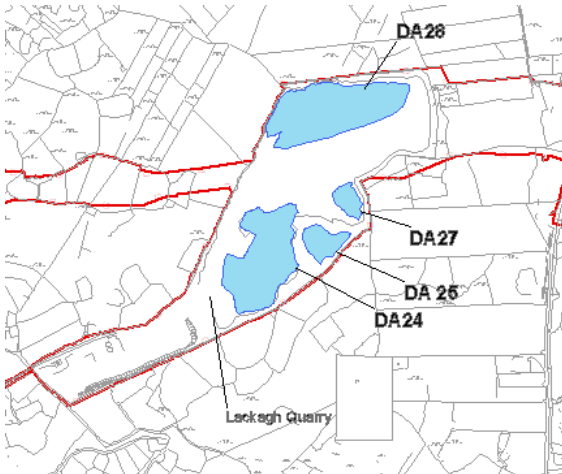
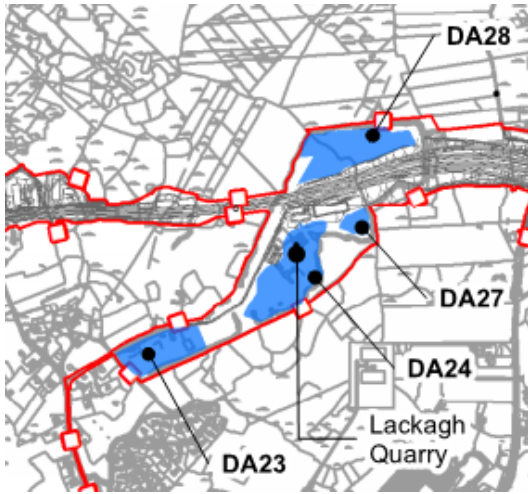
As observed in the table below, the capacity of the allowable material placement in the Modified MDAs within Lackagh Quarry exceeds the capacity requirement as set out in Section 2.2 as follows:

- Peat: 54,000m³ (required 51,800m³ as per **Section 2.2**)
- U1 Non-Hazardous Material: 301,000m³ (required 185,500 m³ as per **Section 2.2**)

Table 3.5: Lackagh Quarry Capacity Summary

Material Deposition Area	EIAR Area Details (2018)		Proposed Modification (2019)	
	Allowable Capacity of U1 m ³	Estimated Capacity of Peat m ³	Estimated Capacity of U1 m ³	Estimated Capacity of Peat m ³
DA23	33,000	12,000	0	0
DA24	190,000	40,000	63,000	37,000
DA25	0	0	3,500	3,000
DA27 volume above the base drainage layer, (volume of potential U1 for drainage layers)	27,000	0	16,700 (19,500m ³ / Potential U1 2,800m ³)	0
DA28 volume above the base drainage layer, (volume of potential U1 for drainage layers)	283,000 (363,000 / 80,000 Potential U1)	0	217,000 (294,000 / 77,000 Potential U1)	14,000
Total (drainage layer volume excluded)	533,000	52,000	301,000	54,000

Figure 3.11: Lackagh Quarry Material Deposition (Area details 2018 and Proposed Modification 2019)



4 Blast damaged slope stability solutions

Material deposition in DA24, 27 and 28 provides stability to the existing blast damaged rock face. Removing or reducing the placement profile in these areas may require alternative slope stability solutions for the exposed blast damaged rock face and these measures are presented below.

For Lackagh Quarry two slope stability / health and safety solutions for the exposed rock face are considered:

1. Direct solution – rock bolt, rock dowel, steel mesh and sprayed concrete combination
2. Indirect solution – rock trap, fence and exclusion zone combination

These solutions are discussed in more detail below.

4.1 Direct Solution

Where rock stability and/or health and safety is required for exposed rock faces an alternative solution to material placement can be provided through a permanent composite rock support system designed to the relevant design standards (Eurocode 7, BS8081) and best practice guidance documents. The design solution will include a combination of the following:

- i. Rock bolts
- ii. Rock dowels
- iii. Steel mesh
- iv. Sprayed concrete

This solution is expensive and is best suited in areas where an indirect solution is not viable. For instance, in DA28 it would be employed above the top of the material placement level to ensure no encroachment on the Lough Corrib cSAC.

4.2 Indirect Solution

An alternative solution can be provided through a rock trap, fence and exclusion zone solution designed to the relevant design standards with reference to Transport Research Laboratory (TRL) report PPR555 “Rock engineering guides to good practice rock slope remedial and maintenance works”. An example of this indirect solution is presented in **Figure 4.1** below.

Figure 4.1: Extracts from (TRL) report PPR555, Rock Trap and Fence



Figure 6.10 Effective Rock Trap Barrier (A77, Ballantrae)

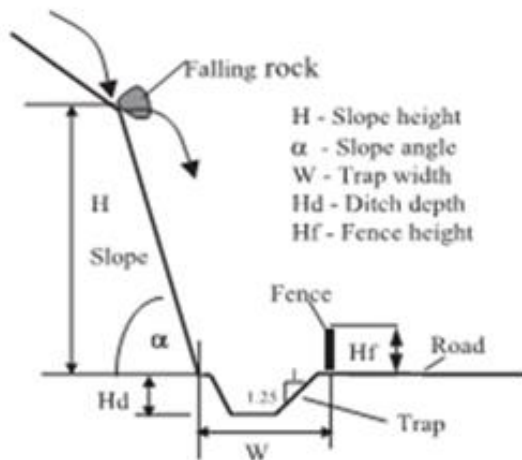


Figure 6.12 The Shaped Ditch for Catching Falling Rock (after Franklin and Dusseault, 1989)

Rock trap and fence requirements vary depending on the exposed slope height and angle as outlined in Figure 6.12, Table 6.2 in TRL report PPR555. TRL recommend that Ritchie's chart (presented below in **Figure 4.2**) can be used for irregular and bulk blasted slopes which is the case in Lackagh Quarry.

Figure 4.2: Extract from (TRL) report PPR555, Comparison of rock Trap Design Chart Recommendations***Table 6.2 Comparison of Rock Trap Design Chart Recommendations***

Rock slope details		Rock trap design chart recommendations					
		Ritchie (1963)		Mak & Blomfield (1986)		Fookes & Weltman (1989)	
Height (m)	Angle (deg.)	W (m)	H _d (m)	W (m)	H _f (m)	W (m)	H _d +H _f (m)
5	60	3	1.2	1.5	0.9	1.5	1.25
5	80	3	0.9	1.5	0.6	1.5	2.25
10	60	4.6	1.6	1.5	1.6	2.5	1.25
10	80	4.6	1.2	1.5	0.9	2.5	2.25
12	60	4.9	1.9	1.5	1.6	3	1.25
12	80	4.9	1.3	1.5	0.9	3	2.3
20	60	6.2	2.1	NA	NA	5.3	1.5
20	80	6.2	1.5	NA	NA	5.3	3

* For notation of W, H_d and H_f, see Figure 6.12

The exposed slopes on site vary considerably, up to **70** degrees. The exclusion zone at the base of the slope will accommodate excavation of the rock trap and maintenance access. Generally, where required the exclusion zone will be up to 15m from the base of the exposed slope with a rock barrier fence height of approximately 1.5 to 2m.

4.3 Summary

The direct solution is the more expensive method of stabilisation and should only be considered in areas where protection of Limestone pavement is required or where maintenance is an issue.

The indirect solution including a rock trap, fence and exclusion zone solution is viable in all areas, however it requires maintenance and may require up-keep.

5 Ecological Habitat Compensation

There will be a permanent loss of c0.7ha of the Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] (hereafter referred to as 6210) as a result of the proposed road development and a permanent loss of c0.54ha of the Annex I habitat Limestone pavements [*8240] (hereafter referred to as *8240). The loss of both these habitats is outside a European site. To compensate¹ for the loss of 6210 and as an overall biodiversity gain for *8240², it is proposed to recreate c7.14ha of 6210. (1.73ha to compensate for the loss of c0.7ha of 6210 and 5.41ha as a biodiversity gain for *8240).

As set out in the Compensatory Habitat Management Plans in Appendix A.8.26 of the EIAR there are seven receptor sites for 6210, with an area of 2.29ha located outside Lackagh Quarry and an area of 4.85ha located within Lackagh Quarry. These are listed below in **Table 5.1**.

Table 5.1: Ecological Habitat Compensation Areas

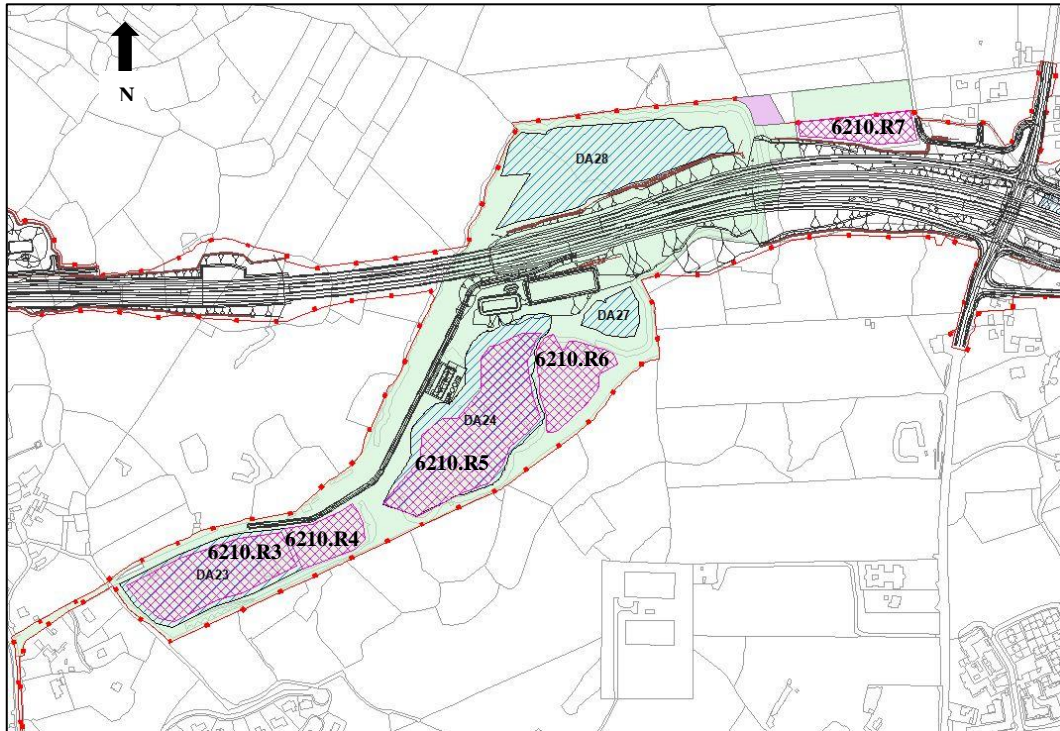
Reference	Area (ha)	Comment
6210.R1	0.83	Located outside Lackagh Quarry
6210.R2	0.98	Located outside Lackagh Quarry
6210.R3	1.38	Located inside Lackagh Quarry
6210.R4	0.51	Located inside Lackagh Quarry
6210.R5	2.14	Located inside Lackagh Quarry
6210.R6	0.82	Located inside Lackagh Quarry
6210.R7*	0.48	Located outside Lackagh Quarry

Note: * This site whilst on Lackagh Quarry lands is considered outside Lackagh quarry for this assessment and not modified.

The receptor sites for Lackagh Quarry are shown on **Figure 5.1** below.

¹ The compensatory habitat areas are not compensatory measures in the context of the requirements of Article 6(4) of the Habitats Directive as they are not compensating for an impact that would adversely affect the integrity of any European site. As concluded in the NIS, it is our opinion that the proposed road development will not result in such an impact on any European site.

² Limestone pavement cannot be directly compensated for as it cannot be recreated

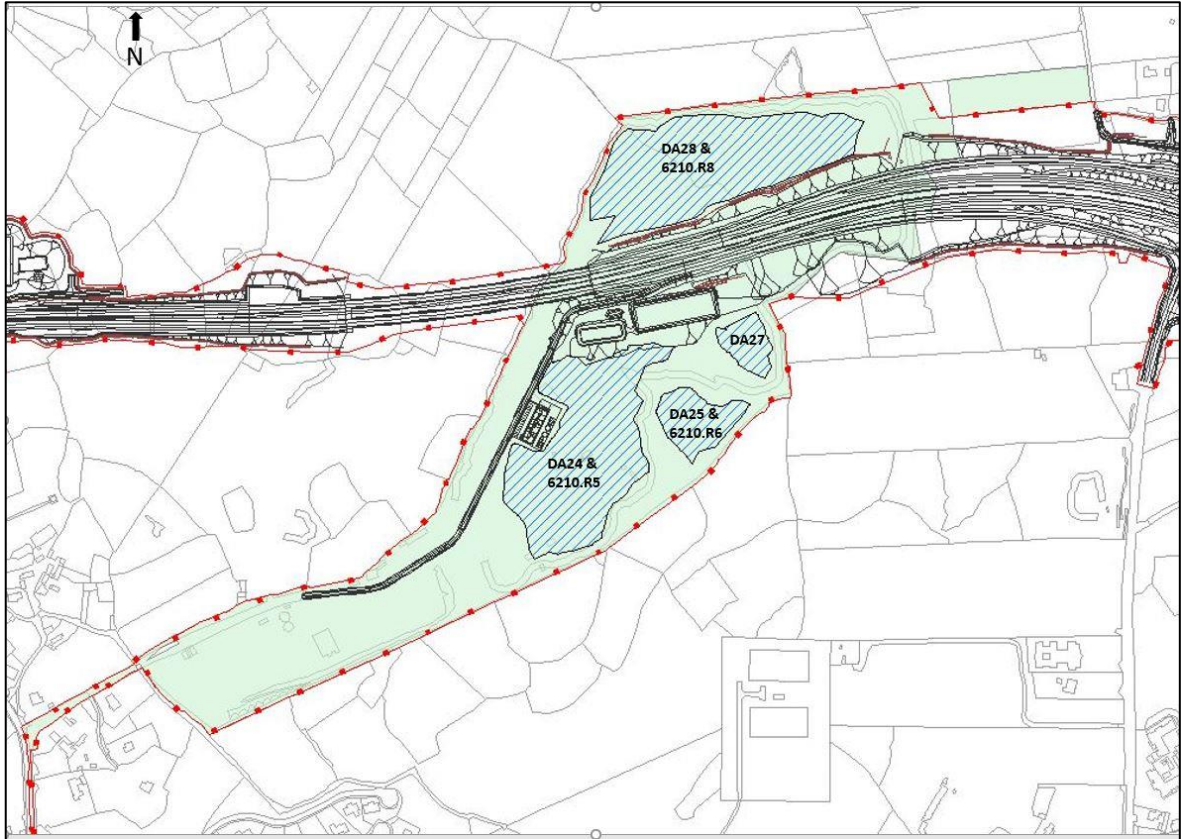
Figure 5.1: Ecological Habitat Compensation Areas 2018

The full loss of 6210 can be compensated in receptor sites outside of Lackagh Quarry (i.e. providing an area of 1.73ha) with an excess of 0.56ha in the receptor sites outside the quarry. This 0.56ha plus the remaining 4.85ha of 6210 to be created is proposed to provide an overall biodiversity gain for *8240. **Table 5.2** below presents the 6210 receptor sites within Lackagh Quarry proposed as part of the EIAR published in 2018 and the proposed modifications to these sites in 2019 as shown on **Figure 5.2** below. As can be seen for this table, the full area committed to in the EIAR can be provided for with the proposed modifications.

Table 5.2: Ecological Habitat Compensation Areas 2018 versus 2019 within Lackagh Quarry

Reference	Area (ha) 2018	Area (ha) 2019	Comment
6210.R3	1.38	0.00	Relocated to DA28
6210.R4	0.51	0.00	Relocated to DA28
6210.R5	2.14	2.03	DA24 remodelled and plan area increased
6210.R6	0.82	0.37	DA25 added and area refined
6210.R8 (DA28)	0.00	2.45	DA28 remodelled and plan area increased to facilitate recreation of 6210
Total Areas	4.85	4.85	

Figure 5.2: Ecological Habitat Compensation Areas 2019



6 Conclusions and Recommendations

6.1 Material generated for placement

In summary, approximately **366,000m³** of material that will be generated for placement in MDAs and can be is split into two material type categories:

- Peat, approximately, **76,000m³**
- U1, Non-Hazardous Material, approximately **290,000m³**

Bulking will occur when soil or rock is excavated for example 1m³ of soil or rock in-situ in the ground does not translate to 1m³ in a lorry or placed and compacted on site. Assuming a general bulking factor of 30% the placement totals equate to:

- Peat, 76,000m³ - bulked **98,800 m³**
- U1, Non-Hazardous Material, 290,000m³ in-situ – bulked **377,000 m³**
- **Total: 475,800m³**

6.2 Material Deposition Area Capacity

6.2.1 EIAR (2018)

The allowable Material Deposition Area capacity exceeded the volume of material that will be generated by the proposed road development and is surplus to the requirements for constructing the proposed road. This surplus provided flexibility to the project at construction stage, whilst assessing all scenarios as part of the EIAR. The calculated allowable capacity as a part of the EIAR:

- Peat (assuming 0.5 to 2m depth of peat) – **99,000m³**
- U1 Non-Hazardous Material – **725,000m³**

It is observed that the volume of peat generated from the proposed road development compares with the allowable capacity in the areas of the MDAs. Therefore, all areas identified as peat receptors are expected to be used as MDAs. There is excess U1 allowable capacity, therefore there is scope to refine the MDA locations, footprints and volumes as presented in the EIAR. These proposed modifications are presented in this report.

There are 32 MDA locations. Within Lackagh Quarry there are 4 placement areas DA23, 24, 27 and 28. These locations were identified for the creation of ecological habitat compensation, to provide stability to the existing blast damaged rock face and to prevent encroachment on the Lough Corrib cSAC including areas of Annex I habitat. North of the proposed road development within Lackagh Quarry placement of material is limited to the north western area of the quarry, as the north eastern area is used to mitigate potential impacts on Peregrine Falcon.

The total volume of material required for the four MDAs within Lackagh Quarry is 236,800m³ of which 51,800m³ is peat and 185,000m³ is U1 material.

Where material placement is not available to provide stability to exposed blast damages rock faces, there are two support solutions (described in **Section 4**) proposed namely:

1. Direct solution – rock bolt, rock dowel, steel mesh and sprayed concrete combination
2. Indirect solution – rock trap, fence and exclusion zone combination

6.2.2 Modified (2019)

With excess allowable material deposition capacity, there was scope to refine the MDA locations, footprints and volumes. Factors that influence the MDA plan area, geometry and composition include available material deposition material, requirements for blast damaged slope stability, ecological habitat compensation and landscaping maintenance.

This report examined Lackagh Quarry Material Deposition Areas, the proposed modifications for each MDA within the quarry and the estimated material capacity within the quarry. These modifications included the removal of DA23, remodelling of DA24, DA27 and DA28 and the additional of DA25. These are described in **Section 3.2** of the report and are summarised in **Section 6.3**.

6.3 Recommendations

Within Lackagh Quarry the following modifications are recommended:

- Removal of DA23: DA28 has been remodelled and modified to accommodate the ecological habitat compensation from DA23 thus facilitating the removal of DA23 as a MDA and also maintaining the other environmental commitments of the EIAR
- Modified DA24: DA24 has been remodelled and decreased in size whilst maintaining the environmental commitments of the EIAR including:
 - ecological commitments in Section 8.9.1 of Chapter 8, Biodiversity and Appendix A.8.26 of the EIAR
 - hydrological commitments in Section 11.4.1.5 of Chapter 11, Hydrology of the EIAR
- Addition of DA 25: To accommodate habitat compensation from the reduced DA24 whilst maintaining the environmental commitments of the EIAR including:
 - ecological commitments in Section 8.9.1 of Chapter 8, Biodiversity and Appendix A.8.26 of the EIAR
 - hydrological commitments in Section 11.4.1.5 of Chapter 11, Hydrology of the EIAR
- Modified DA27: DA27 has been remodelled and decreased in size whilst maintaining the environmental commitments of the EIAR including:
 - ecological commitments in Section 8.9.1 of Chapter 8, Biodiversity and Appendix A.8.26 of the EIAR

- hydrogeological commitments in Section 10 of Chapter 10.5.3.5 Hydrogeology of the EIAR
- hydrological commitments in Section 11.4.1.5 of Chapter 11, Hydrology of the EIAR
- Modified DA28: DA28 has been remodelled and the extents of flat areas increased to accommodate the ecological habitat compensation from DA23 thus facilitating the removal of DA23 as a MDA and also maintaining the other environmental commitments of the EIAR including:
 - ecological commitments in Section 8.9.1 of Chapter 8, Biodiversity and Appendix A.8.26 of the EIAR
 - hydrogeological commitments in Section 10 of Chapter 10.5.3.5 Hydrogeology of the EIAR
 - hydrological commitments in Section 11.4.1.5 of Chapter 11, Hydrology of the EIAR

Table 6.1 and **6.2** summarise the proposed deposition volumes and requirements in Lackagh Quarry. **Table 6.1** is an update of **Table 3.1** in **Section 3** of this report, with changes highlighted in blue text and strikethrough text. **Table 6.2** compares the material volume in the EIAR with the proposed modified volumes. **Figure 6.1** illustrates the proposed modified layout as per **Figure 3.10** in **Section 3.3**.

Figure 6.1: Lackagh Quarry Material Deposition Proposed Modification 2019

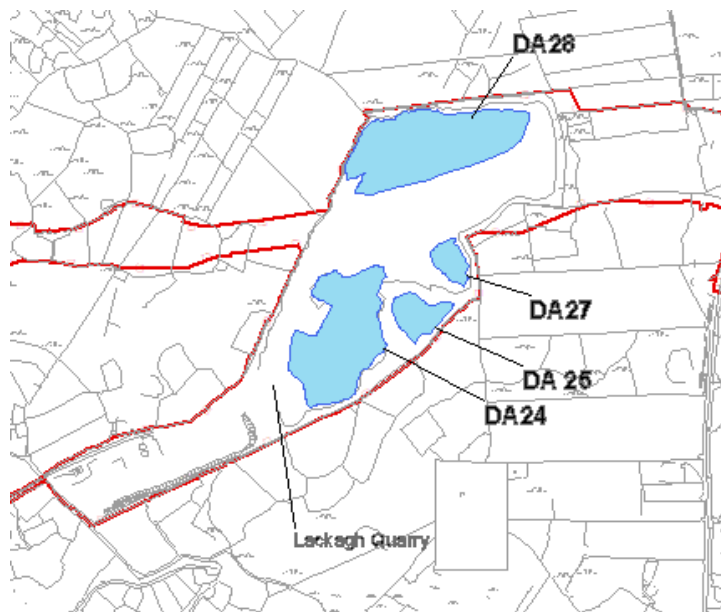


Table 6.1: Summary of proposed Lackagh Quarry material deposition area details and requirements

Number	Approx. Chainage	Area (ha)	Approx. Capacity (m ³)	Material designation	Construction / Design Specific Requirement
DA23	11+000	1.727	45,000	Peat with U1 bunds	Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIA Report
DA24	11+350	2.52	200,000 100,000	U1 with Peat placed in U1 bunds at higher levels	Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA25	11+550	0.48	6,500	U1 with granular drainage layers	Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA27	11+550	0.4	27,000 16,700	U1 with granular drainage layers	Drainage layer to +17.7mOD required, a filter separator (e.g. geotextile is required between the horizontal interface between the drainage layer and general fill to prevent migration of fines sediment). Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR
DA28	11+650	2.8	250,000 241,000	U1 with Peat placement on the flat areas and granular drainage layers (vertical and horizontal) and stability layers throughout.	Drainage layer to +17.7mOD required, a filter separator (e.g. geotextile is required between the horizontal interface between the drainage layer and general fill to prevent migration of fines sediment). Vertical and horizontal drainage layers are required between the existing rock face and material placement. Contractor to update drainage design to include for their proposed Material Deposition Area in accordance with the requirements set out in the EIAR

Table 6.2: Summary Volumes

Location	EIAR		Proposed Estimated Capacity following review	
	Peat m ³	U1 Material m ³	Peat m ³	U1 Material m ³
Required (bulked volumes)	98,800	377,000	98,800	377,000
<i>Placement Volumes -</i>	<i>Allowable Capacity</i>		<i>Estimated Capacity</i>	
Outside Lackagh Quarry in areas with peat	47,000	25,000	47,000	25,000
Outside Lackagh Quarry in areas without peat		167,000		167,000
DA 23	12,000	33,000	Removed	Removed
DA 24	40,000	190,000	37,000	63,000
DA 25	0	0	3,000	3,500
DA 27		27,000	0	16,700
DA 28		283,000	14,000	217,000
<i>Totals</i>				
Placement Volume	99,000	725,000	101,000	492,200
Surplus / Deficit of what is required	Nil	+348,000	+2,200	+115,200

6.4 Particular Commitments

The particular commitments for each MDA within Lackagh Quarry area summarised below.

Table 6.3: Supplementary conditions for DA28 for Options 1 and 2

Number	Particular Requirement
DA23	No material placement
DA24	Design: <ol style="list-style-type: none"> 1. MDA: The designer shall complete a detailed stability design based on the placement material characteristics 2. Exposed rock face: The designer shall undertake a permanent composite rock support system designed to the relevant design standards (Eurocode 7, BS8081) and best practice guidance documents Estimated Capacity:

Number	Particular Requirement
	<ol style="list-style-type: none"> 1. U1 material: 63,000m³ 2. Peat: 37,000m³ <p>Geometry:</p> <ol style="list-style-type: none"> 1. Volumetric capacity as per Table 6.2 2. Peat and U1 material 3. Area comprises of two platforms and a sloped transition zone 4. The external side slope gradient is 1V in 3H <p>Stability:</p> <ol style="list-style-type: none"> 1. U1 material used to stabilise and contain Peat <p>Rock Face Stability:</p> <ol style="list-style-type: none"> 1. Implementation of slope stability / health and safety solutions for the exposed rock face. This solution includes rock bolt, rock dowel steel mesh and sprayed concrete combination – Direct solution <p>Drainage:</p> <ol style="list-style-type: none"> 1. Contractor to update drainage design to include for their proposed MDA in accordance with the requirements set out in the EIAR 2. Contractor to include a drainage layer if required to maintain surface drainage in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR 3. A free draining granular material between the existing cliff face (including existing quarry bench faces) and material deposition material to allow the cliff face to maintain its drainage system must 1m wide. This will be a vertical layer. 4. A free draining granular material between the existing quarry base and MDA (horizontal layers) to maintain its drainage system. This is required: <ol style="list-style-type: none"> a. Where the exiting quarry level at a MDA is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD b. Above this level (+17.7mOD) a minimum of 0.5m free drainage material is required at the interface between the exiting quarry floor level and the MDA 5. A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment <p>Environmental:</p> <ol style="list-style-type: none"> 1. Maintenance is required of the finished surfaces in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR
DA25	<p>Design:</p> <ol style="list-style-type: none"> 1. MDA: The designer shall complete a detailed stability design based on the placement material characteristics <p>Estimated Capacity:</p> <ol style="list-style-type: none"> 1. U1 material: 3,500m³ 2. Peat: 3,000m³ <p>Geometry:</p> <ol style="list-style-type: none"> 1. Volumetric capacity as per Table 6.2 2. U1 and peat material 3. Area comprises of a series of benches and slopes 4. The external side slope gradient is 1V in 3H <p>Stability:</p> <ol style="list-style-type: none"> 1. U1 material used to stabilise and contain Peat 2. U1 material will be used to stabilise the slopes or an alternative as per design <p>Cliff Edge Stability:</p> <ol style="list-style-type: none"> 1. The MDA shall be a minimum of 5m from the cliff edge <p>Drainage:</p>

Number	Particular Requirement
	<ol style="list-style-type: none"> 1. Contractor to update drainage design to include for their proposed MDA in accordance with the requirements set out in the EIAR 2. Contractor to include a drainage layer if required to maintain surface drainage in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR 3. A free draining granular material between the existing cliff face (including existing quarry bench faces) and MDA to allow the cliff face to maintain its drainage system must 1m wide. This will be a vertical layer 4. A free draining granular material between the existing quarry base and material deposition material (horizontal layers) to maintain its drainage system. A minimum of 0.5m free drainage material is required at the interface between the exiting rock surface at the base of the MDA and the material disposition 5. A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment <p>Environmental:</p> <ol style="list-style-type: none"> 1. Maintenance is required of the finished surfaces in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR
DA27	<p>Design:</p> <ol style="list-style-type: none"> 1. MDA: The designer shall complete a detailed stability design based on the placement material characteristics 2. Exposed rock face: The designer shall undertake a permanent composite rock support system designed to the relevant design standards (Eurocode 7, BS8081) and best practice guidance documents <p>Estimated Capacity:</p> <ol style="list-style-type: none"> 1. U1 material: 16,700m³ 2. Peat: 0m³ <p>Geometry:</p> <ol style="list-style-type: none"> 1. Volumetric capacity as per Table 6.2 2. U1 material only 3. Area comprises of a series of benches and slopes 4. The external side slope gradient is 1V in 3H <p>Stability:</p> <ol style="list-style-type: none"> 1. U1 material will be used to stabilise the slopes or an alternative as per design <p>Rock Face Stability:</p> <ol style="list-style-type: none"> 1. Implementation of slope stability / health and safety solutions for the exposed rock face. This solution includes rock bolt, rock dowel, steel mesh and sprayed concrete combination - Direct solution <p>Drainage:</p> <ol style="list-style-type: none"> 1. Contractor to update drainage design to include for their proposed MDA in accordance with the requirements set out in the EIAR 2. A free draining granular material between the existing cliff face (including existing quarry bench faces) and MDA to allow the cliff face to maintain its drainage system must 1m wide. This will be a vertical layer 3. A free draining granular material between the existing quarry base and material deposition material (horizontal layers) to maintain its drainage system. This is required: <ol style="list-style-type: none"> a. Where the exiting quarry level at a MDA is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD b. Above this level (+17.7mOD) a minimum of 0.5m free drainage material is required at the interface between the exiting quarry floor level and the MDA

Number	Particular Requirement
	<ol style="list-style-type: none"> 4. A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment
DA28	<p>Design:</p> <ol style="list-style-type: none"> 1. MDA: The designer shall complete a detailed stability design based on the placement material characteristics 2. Exposed rock face: The designer shall undertake a permanent composite rock support system designed to the relevant design standards (Eurocode 7, BS8081) and best practice guidance documents <p>Estimated Capacity:</p> <ol style="list-style-type: none"> 1. U1 material: 227,000m³ 2. Peat: 14m³ <p>Geometry:</p> <ol style="list-style-type: none"> 1. Volumetric capacity as per Table 6.2 2. Peat and U1 material 3. Area comprises an upper main platform at 35.7mOD and a series of slopes and transition zones 4. The external side slope gradient is 1V in 3H with an access track slope of 1V in 5H <p>Stability:</p> <ol style="list-style-type: none"> 1. U1 material and Peat placement on the upper bench. The upper level is 35.7mOD 2. A minimum of two granular stability layers are required. Where available this material may be sourced from the U1 material or imported 3. The intermediate benches are to be located 6m apart vertically. With a 1V in 3H slope the benches are 18m horizontally apart <p>Rock Face Stability:</p> <ol style="list-style-type: none"> 1. Implementation of slope stability / health and safety solutions for the exposed rock face. This solution includes rock bolt, rock dowel, steel mesh and sprayed concrete combination - Direct solution <p>Drainage:</p> <ol style="list-style-type: none"> 1. Contractor to update drainage design to include for their proposed MDA in accordance with the requirements set out in the EIAR 2. Contractor to include a drainage layer if required to maintain surface drainage in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR 3. A free draining granular material between the existing cliff face (including existing quarry bench faces) and MDA to allow the cliff face to maintain its drainage system must 1m wide. This will be a vertical layer 4. A free draining granular material between the existing quarry base and MDA (horizontal layers) to maintain its drainage system. This is required: <ul style="list-style-type: none"> • Where the exiting quarry level at a MDA is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD 5. Above +17.7mOD a minimum of 0.5m free drainage material is required at the interface between the exiting quarry floor level and the MDA 6. A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment <p>Environmental:</p> <ol style="list-style-type: none"> 1. Maintenance is required of the finished surfaces in accordance with the Habitat Compensation Management Plan outlined in Appendix A.8.26 of the EIAR

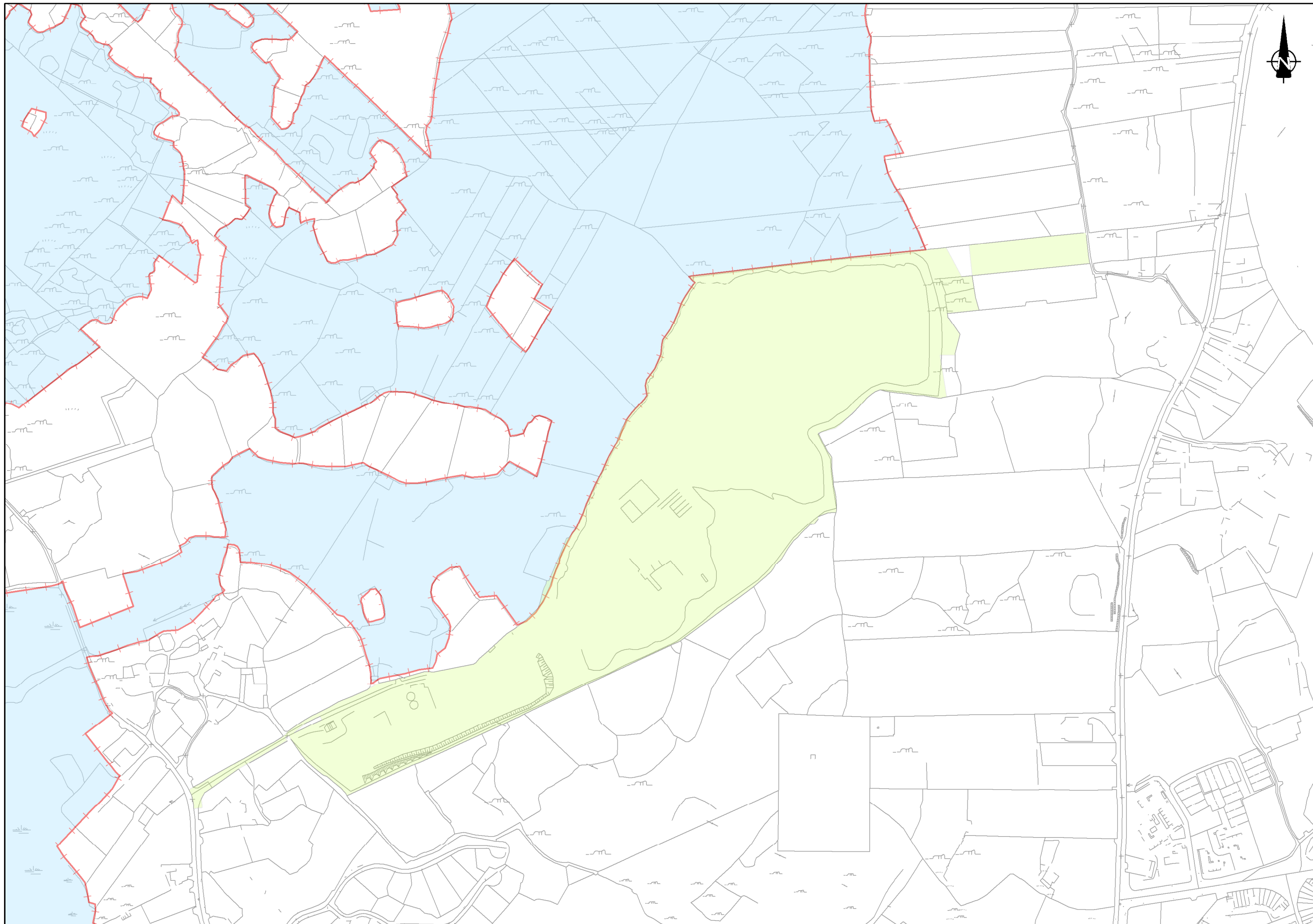
7 References

- i. *GCOB - 4 03 - 4 16_Lackagh Tunnel Geo and Hydro Appraisal_I3 2018*
- ii. *Transport Research Laboratory (TRL) report PPR555 Rock engineering guides to good practice rock slope remedial and maintenance works by P McMillian, AJ Harber and I M Nettleton. June 2000*
- iii. *Earthworks: a guide, N. A. Treter and Thomas Telford Limited 2001*

Annex 1

Lackagh Quarry Layout - Drawings

A1



FOR INFORMATION

- Legend**
- Extents of Lackagh Quarry
 - Lough Corrib cSAC

San áireamh tá sonraíocht Shuirbhéireacht Ordánais Éireann arna áitgheadh faoi Cheadúnas OSI Uimh. 2010/19CCMA/Comhairle Contae na Gaillimhe. Sáraíonn áitgheadh neamhdáilithe cóipeacht Shuirbhéireacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhéireacht Ordánais Éireann, 2010.

© Suirbhéireacht Ordánais Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/19CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/19CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/19CCMA/Galway County Council.

Clients

Consultant

ARUP

Corporate House
City East Business Park
Ballybrit, Galway, Ireland

Tel +353 (0)91 460675
www.N6GalwayCity.ie
www.arup.ie

Job Title
N6 Galway City Ring Road

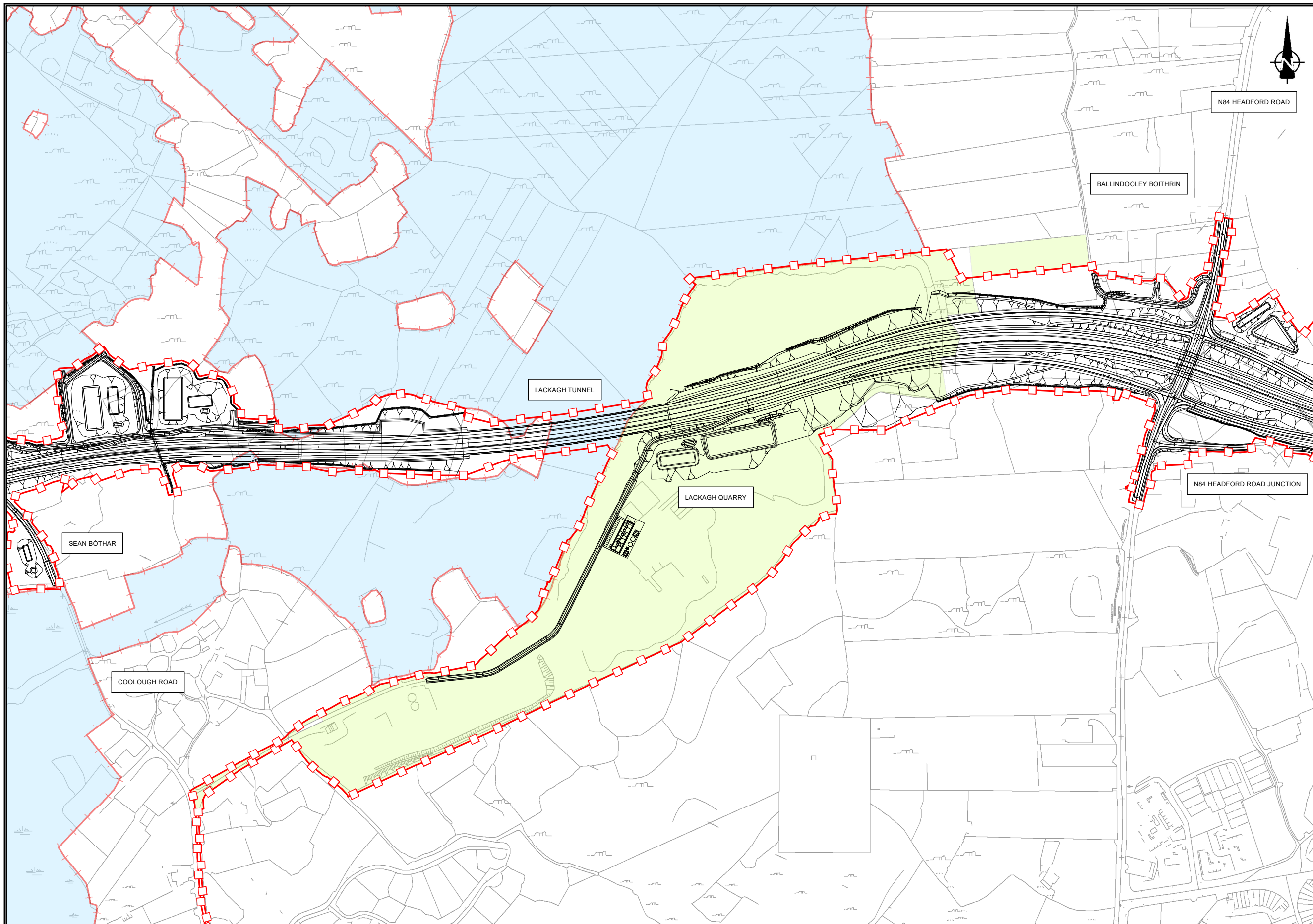
Scale: 1:5,000
Date: August 2019

I1	30/08/2019	KD	JC	MH
Issue	Date	By	Chkd	Appd

Drawing Title
Plan Layout of Lackagh Quarry
Pre-Construction Excluding
Mitigation Measures

Drawing Status
For Information

Job No	Drawing No	Issue
233985-00	Figure 1.8.1	11



FOR INFORMATION

Legend

- Proposed Development Boundary
- N6 GCRR Road Design
- Lough Corrib cSAC
- Extents of Lackagh Quarry

San áireamh tá sonraíocht Shuirbhíreacht Ordánais Éireann arna atáirgeadh faoi Cheadúnas OSI Uimh. 2010/19CCMA/Comhairle Contae na Gaillimhe. Sáraíonn atáirgeadh neamhdáilithe cóipeacht Shuirbhíreacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordánais Éireann, 2010.

© Suirbhíreacht Ordánais Éireann. Gach ceart ar chosaint.
Uimhir cheadúnais 2010/19CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/19CCMA/Galway County Council.
Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/19CCMA/Galway County Council.

Clients

An Roinn Iompair
Turasóireachta agus Spóirt
Project Ireland 2040
Galway City Transport Project

Comhairle Chontae na Gaillimhe
Galway County Council

TII
Transport Infrastructure Ireland

Consultant

ARUP

Corporate House
City East Business Park
Ballybrit, Galway, Ireland

Tel +353 (0)91 460675
www.N6GalwayCity.ie
www.arup.ie

Job Title

N6 Galway City Ring Road

Scale: 1:5,000

Date: August 2019

Issue	Date	By	Chkd	Appd
I1	30/08/2019	KD	JC	MH

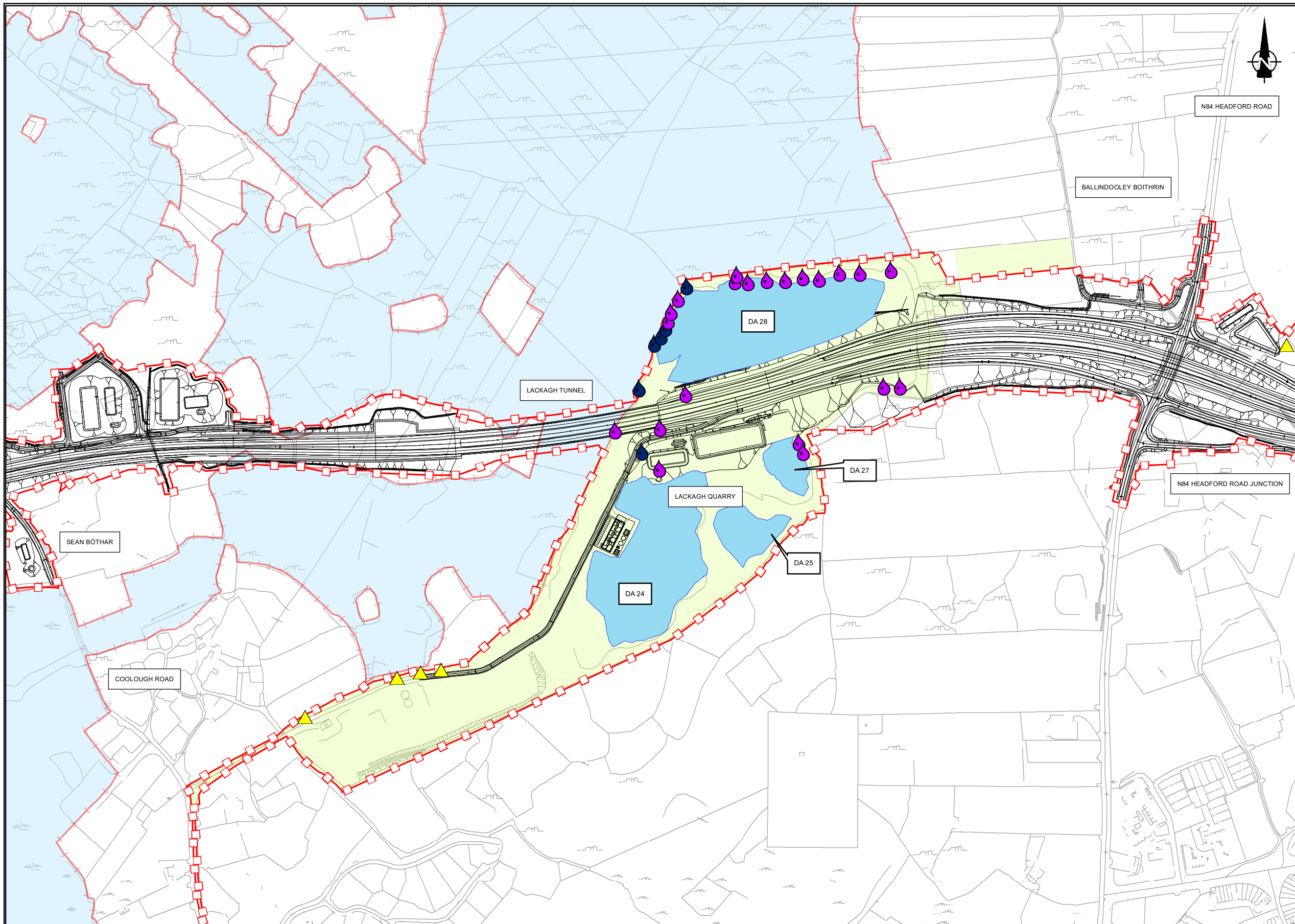
Drawing Title

Plan Layout of Lackagh Quarry
Post-Construction Excluding
Mitigation Measures

Drawing Status

For Information

Job No: 233985-00
Drawing No: Figure 1.8.2
Issue: 11



FOR INFORMATION

Legend

- Proposed Development Boundary
- N6 GCRR Road Design
- Lough Corrib cSAC
- Extents of Lackagh Quarry
- MDAs
- Petrifying Springs
- Groundwater Seepage Points
- Proposed Artificial Bat Roosts

San áireamh tá sonraíocht Shuirbhíreacht Ordánais Éireann arna ástigeadh faoi Cheadúnas OSI Uimh. 2010/19CCMA/Comhairle Contae na Gaillimhe. Sáraíonn ástigeadh neamhdánalthe cóipcheart Shuirbhíreacht Ordánais Éireann agus Rialtas na hÉireann. © Suirbhíreacht Ordánais Éireann, 2010.

© Suirbhíreacht Ordánais Éireann. Gach ceart ar chosaint. Uimhir cheadúnais 2010/19CCMA/Comhairle Contae na Gaillimhe.

Includes Ordnance Survey Ireland data reproduced under OSI Licence number 2010/19CCMA/Galway County Council. Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright. © Ordnance Survey Ireland, 2010.

© Ordnance Survey Ireland. All rights reserved. Licence number 2010/19CCMA/Galway County Council.

Clients

An Roinn Iompair, Tionscail agus Spóirt
 Project Ireland 2040
 Galway City Transport Project

Comhairle Chontae na Gaillimhe
 Galway County Council

TII
 Transport Infrastructure Ireland

Consultant

ARUP

Corporate House
 City East Business Park
 Ballybrit, Galway, Ireland

Tel +353 (0)91 460675
 www.N6GalwayCity.ie
 www.arup.ie

Job Title

N6 Galway City Ring Road

Scale: 1:5,000

Date: August 2019

Issue	Date	By	Chkd	Appd
I1	30/08/2019	KD	JC	MH

Drawing Title

Plan Layout of Lackagh Quarry
 Post-Construction Including
 Mitigation Measures

Drawing Status

For Information

Job No	Drawing No	Issue
233985-00	Figure 1.8.3	I1



N6 GCRR

Lackagh Quarry

Lackagh Quarry

N6 GCRR



FOR INFORMATION

Clients

Consultant

Corporate House
City East Business Park
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675
www.N6GalwayCity.ie
www.arup.ie

Job Title
N6 Galway City Ring Road

Scale N.T.S.

Date: August 2019

Issue	Date	By	Chkd	Appd
I1	30/08/2019	SN	JC	MH

Drawing Title
Aerial View of Lackagh Quarry
- Post Construction Excluding Mitigation Measures
Sheet 1 of 3

Drawing Status
For Information

Job No
233985

Drawing No
Figure 1.8.4

Issue
11

1
2
3
4
5
6
7
8
9
10



Rock Face Protection
N6 GCRR
Exposed Rock Safety/Stability Required
DA 27
DA 24
Exposed Rock Safety/Stability Required

FOR INFORMATION



DA 28

Note:
For Inflows and Bat Roosts details refer to Figure 1.8.3.

Clients

Consultant

Corporate House
City East Business Park
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675
www.N6GalwayCity.ie
www.arup.ie

Job Title
N6 Galway City Ring Road

Scale N.T.S.

Date: August 2019

Issue	Date	By	Chkd	Appd
I1	30/08/2019	SN	JC	MH

Drawing Title
Aerial View of Lackagh Quarry
- Post Construction Including Mitigation Measures
Sheet 2 of 3

Drawing Status
For Information

Job No 233985	Drawing No Figure 1.8.5	Issue 11
-------------------------	-----------------------------------	--------------------

A1
1
2
3
4
5
6
7
8
9
10

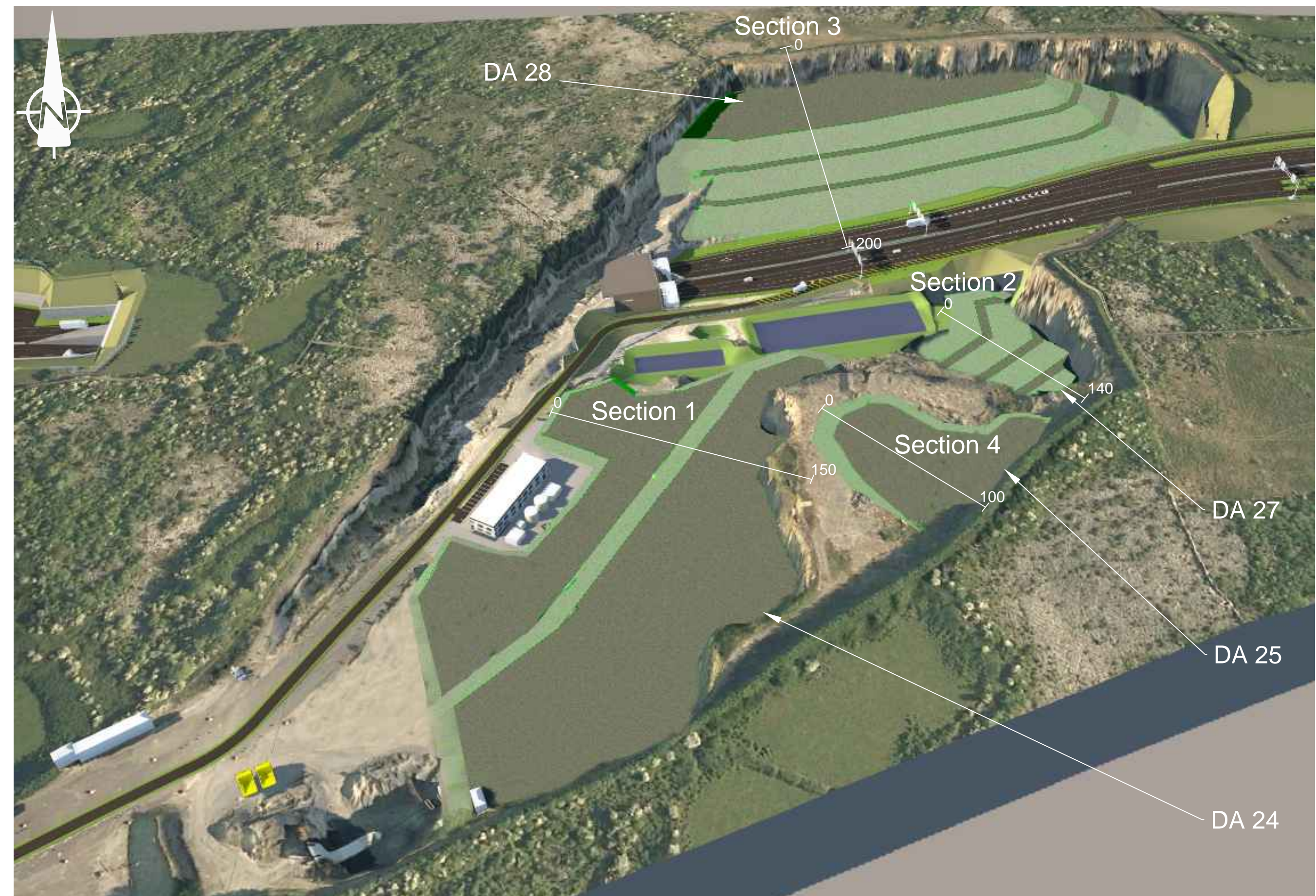
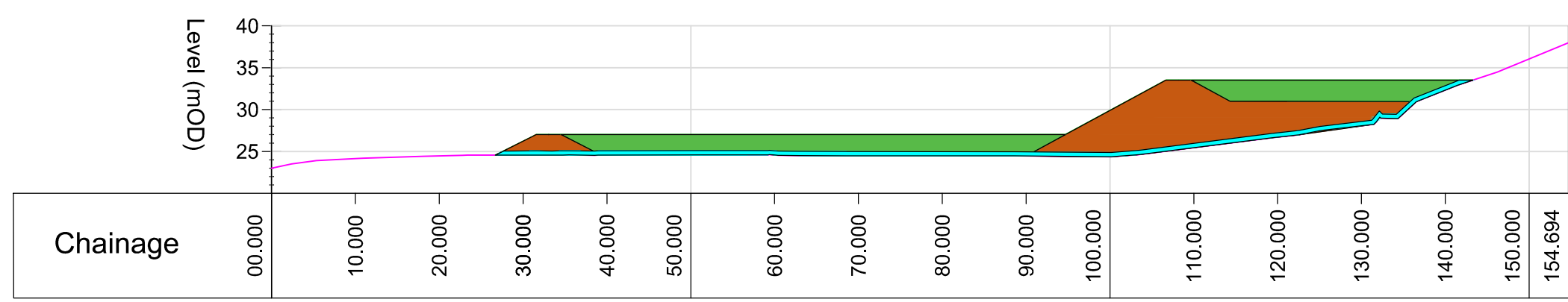
A B C D E F G H I J K L M N O P

FOR INFORMATION

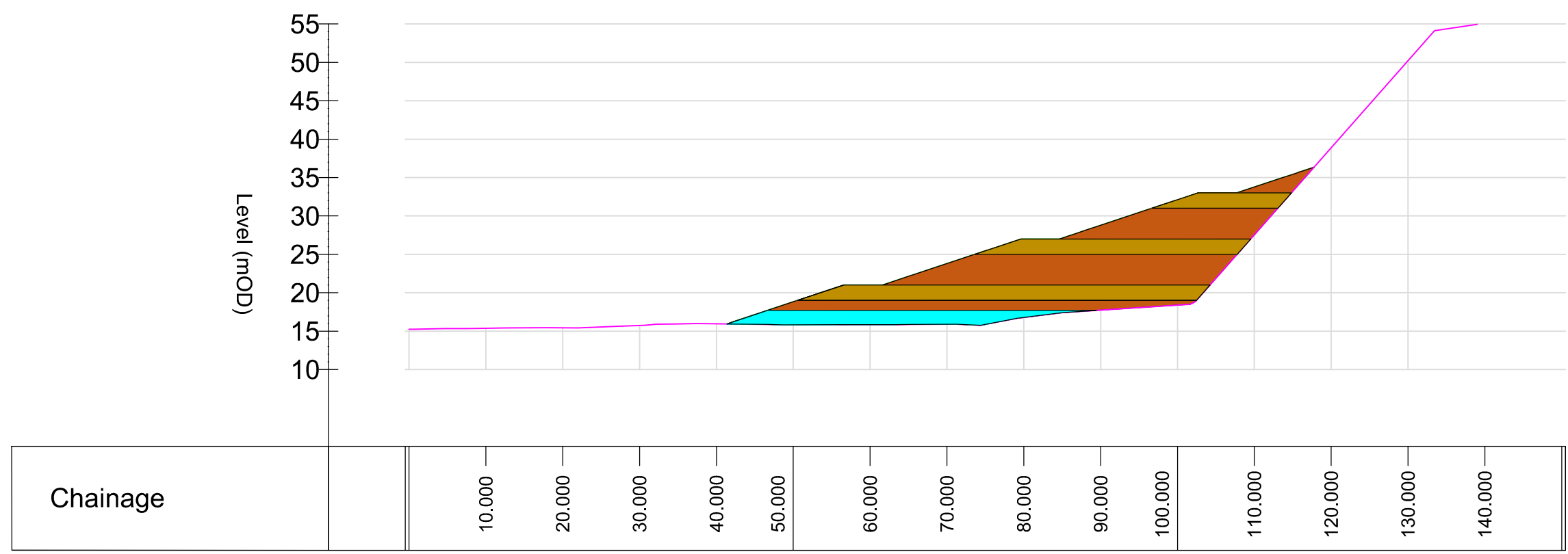
Legend:

- Cohesive Material
- Peat
- Granular Free Drainage Layer
- Notional Stability Layer

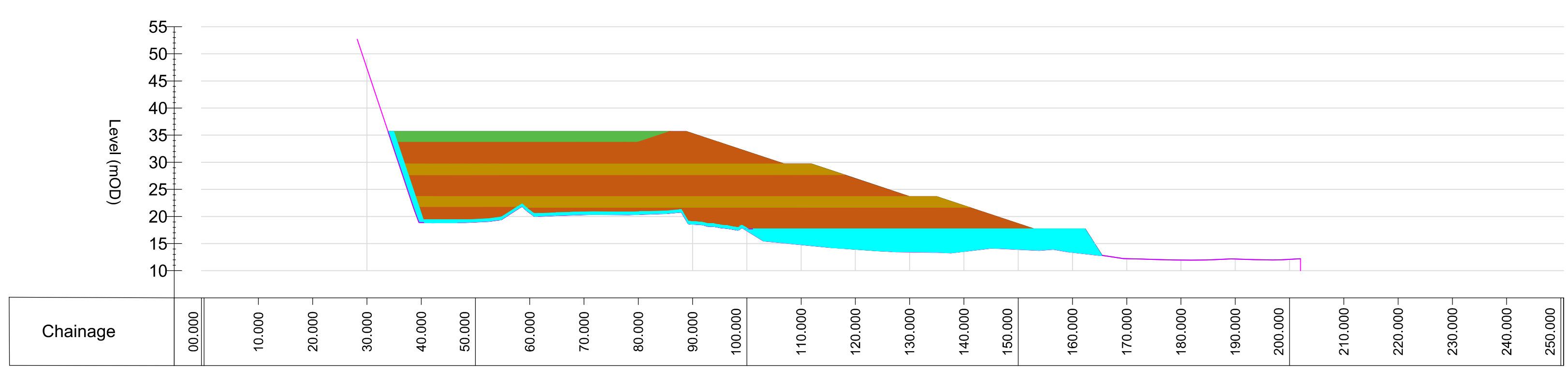
DA 24 SECTION 1



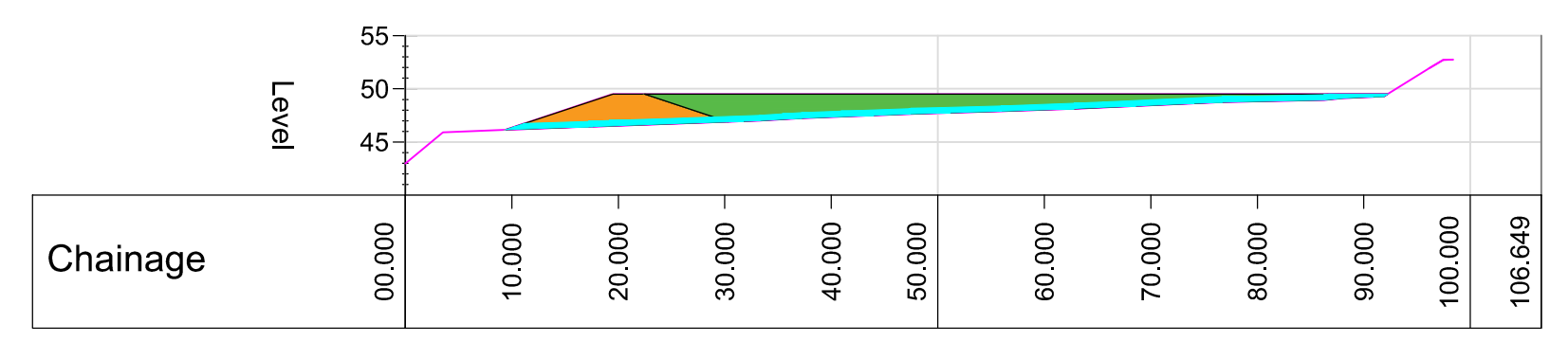
DA 27 SECTION 2



DA 28 SECTION 3



DA 25 SECTION 4



Clients

Consultant

Corporate House
City East Business Park
Ballybrit, Galway, Ireland.

Tel +353 (0)91 460675
www.N6GalwayCity.ie
www.arup.ie

Job Title
N6 Galway City Ring Road

Scale N.T.S.

Date: August 2019

Issue	Date	By	Chkd	Appd
I1	30/08/2019	SN	JC	MH

Drawing Title
Aerial View of Lackagh Quarry
- Typical Cross Section Of DA24, DA27, DA28
Sheet 3 of 3

Drawing Status
For Information

Job No: **233985**
Drawing No: **Figure 1.8.6**
Issue: **11**

Annex 2

Material Deposition Areas Baseline Report

A2

Galway County Council
N6 Galway City Ring Road
Material Deposition Areas - Baseline
Report

GCOB-4.03.4.2.1_001

Issue 1 | 30 August 2019

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.



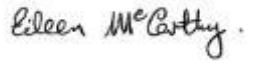
Job number 233985.00

Ove Arup & Partners Ireland Ltd

Arup
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

ARUP

Document verification

Job title		N6 Galway City Ring Road		Job number	
				233985.00	
Document title		Material Deposition Areas - Baseline Report		File reference	
Document ref		GCOB-4.03.4.2.1_001			
Revision	Date	Filename	Material Deposition Areas_Baseline Report_I1.docx		
Issue 1	30 Aug 2019	Description	Issue 1		
			Prepared by	Checked by	Approved by
		Name	Juli Crowley	Mary Hurley	Eileen McCarthy
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue Document verification with document					
<input checked="" type="checkbox"/>					

Contents

	Page	
1	Introduction	1
2	Material Volumes and Composition	2
2.1	Material Volumes	2
2.2	Material Composition	3
2.3	Volume and Composition Summary	3
3	Material Deposition Area	4
4	Design Criteria	6
4.1	Engineering Design Requirements	6
4.2	Environmental Requirements	11
4.3	Site Specific Requirements	12
5	Material Deposition Area Capacity	17
6	Summary	19

1 Introduction

This report has been prepared to document the requirements for the Material Deposition Areas (MDAs) required as part of the proposed N6 Galway City Ring Road, hereafter referred to as the proposed road development.

Earthworks material generated during construction and surplus to the fill requirement of the proposed road development has been assessed for suitability for beneficial re-use on site in MDAs within the proposed development boundary. MDAs are required to satisfy the necessary engineering, environmental and safety requirements for the proposed road development in the following locations:

- Construction within the grade separated junctions, where the ground level of the junction is much higher than the surrounding landscape
- Landscaping and attenuation pond construction
- Slope stabilisation at Lackagh Quarry in areas where the exposed quarry has significant blast damage
- To facilitate the creation of ecological habitat creation

The locations of the MDAs are shown on Figures 7.301 and 7.302 of the EIAR. Material not suitable for placement within the MDAs, for example hazardous material, will be removed off site¹.

Approximately **366,000m³** material will be generated for placement in MDAs across the whole length of the proposed road development.

The objective of this report is to present:

- an overview of the MDAs including the:
 - volume and composition of the material suitable for placement
 - location
 - area footprint
 - permitted placement material at each location
 - capacity
- the design criteria to be adhered to by the contractor including the:
 - engineering design requirements
 - environmental design requirements
 - site-specific design requirements
- a summary of the MDA requirements

¹ Refer to Chapter 7, Construction Activities of the EIAR and the Construction Environment Management Plan (CEMP) in Appendix A.7.5 of the EIAR for waste management of material to be removed off site.

2 Material Volumes and Composition

2.1 Material Volumes

Material that will be generated during excavation was firstly quantified and classified. Then this material was assessed for its acceptability for re-use as part of the proposed road construction. Following this the volume of material surplus to the fill requirements of the proposed road development was determined.

This analysis determined that approximately **366,000m³** of material will be generated for placement in MDAs. The materials comprise:

- **33,700m³* of Topsoil** a Class 5 material as outlined in TII Series 600 Table 6/1
- **76,000m³* of Peat** in accordance with TII Series 600 Cl 601.2, non-hazardous peat shall be categorised as Unacceptable U1 material
- **65,000m³* of Marginal Material** which is overburden material that requires treatment such as addition of lime or air drying in order to meet acceptability requirements of TII Series 600 and used within the construction of the proposed road development
- **147,500m³* of U1 Soil:** Non-hazardous soil which does not comply with the requirements outlined in TII Series 600 Cl 601.1, shall be categorised as Unacceptable U1 material
- **43,800m³* of U1 Rock:** Non-hazardous rock which does not comply with the requirements outlined in TII Series 600 Cl. 601.1, shall be categorised as Unacceptable U1 material

*estimated volumes

2.1.1 Material Bulking

No account for material bulking from in-situ to placed volume is included in the generated material volume of **366,000m³** (presented above). Bulking occurs when soil or rock is excavated, for example 1m³ of soil or rock in-situ in the ground does not translate to 1m³ in a lorry or placed and compacted on site.

Given the nature of U1 material, which is unsuitable for road construction, compaction may be challenging. Typically, bulking factors depend on material type and size and can range from 10-15% for granular material, 20-40% for cohesive material, 25-45% for peat and 30-80% for rock depending on the size (gravel to boulders). Assuming a general bulking factor of 30% the deposition volumes equate to:

- 33,700m³ of **Topsoil** bulked = **43,800m³**
- 76,000m³ of **Peat** bulked = **98,800m³**
- 65,000m³ of **Marginal Material** bulked = **84,500m³**
- 147,500m³ of **U1 Soil** bulked = **191,750m³**

- 43,800m³* of **U1 Rock** bulked = **56,950 m³**

2.1.2 Volume Limitations

Material volumes are based on the difference between the existing and proposed vertical and horizontal road alignment which identifies areas of cut and fill (embankments). The excavated material has been classified based on ground investigation information available for the area and assessed for acceptability and reusability, based on the requirements of TII SRW Series 600 Earthworks, for re-use as part of the construction of the proposed road development.

It should be noted that the ground investigation data provided valuable information on the soils and geology at point locations. Between each point the data has been interpolated using a conservative interpretation to defined material boundaries. While ground conditions can vary between locations the exploratory locations were selected following the completion of the comprehensive baseline data collection.

2.2 Material Composition

For the purpose of defining the material suitable for placement in MDAs, the materials are grouped into two material type categories. This natural split is influenced by the engineering properties. These are:

1. **Peat** is typically present over the granite bedrock on the western extents of the proposed road development. The thickness of peat is typically between 0.5 – 1.0m. According to Cl. 601.2 of the NRA SRW Series 600, peat is a Class U1 material which is unacceptable and must be removed
2. **U1, Non-Hazardous Material**, which consists of topsoil, materials from swamps, marshes and bogs, made ground comprised of man-made materials, argillaceous rock and calcite, logs, stumps and perishable material, materials in a frozen condition, clay having a liquid limit determined in accordance with BS 1377 : Part 2, exceeding 80 or plasticity index determined in accordance with BS 1377 : Part 2, exceeding 55, material susceptible to spontaneous combustion and non-hazardous materials other than those classified as acceptable

2.3 Volume and Composition Summary

Based on the two material groups presented in Section 2.2, the estimated volume of material available for MDAs is:

- 76,000m³ of Peat bulked = **98,800m³**
- 290,000m³ of in-situ U1, Non-Hazardous Material bulked = **377,000m³**
- **Total volume: 475,800m³**

As part of the MDA assessment the various environmental specialists including ecological, landscape & visual, geotechnical, hydrogeological and hydrological specialists completed an environmental assessment of the material group type suitable for deposition in a particular location to ensure there are no environmental constraints preventing placement of a particular material in these locations.

Subsequently each area was designated as a U1 Material receptor only or as a peat and U1 Material receptor.

3 Material Deposition Area

Material Deposition Areas are located east and west of the River Corrib within the proposed development boundary. These locations were selected to satisfy the necessary engineering, environmental and safety requirements for the proposed road development.

A total of 32 site areas have been identified as MDAs along the route of the proposed road development and their locations are shown on Figures 7.301 and 7.302 of the EIAR. **Table 3.1** below details the placement footprint area and material type at each location. The material type stated in **Table 3.1** does not state the material required as part of stabilisation and drainage layers within the MDA. These are outlined in **Section 4** of this report. The ecological requirements detailed in the Habitat Compensation Management Plan in Appendix A.8.26 of the EIAR must also be adhered to where the MDAs are provided to facilitate the ecological habitat compensation.

Peat can only be used in areas stated in the table below and not in other MDAs, however in areas where peat is permitted it is not mandatory that peat is placed at each of these locations. Alternative materials can be placed at these locations as long as the material volume capacity is not exceeded.

Table 3.1: Material Deposition Area locations, area footprint and material type

Number	Location	Approximate Chainage	Area (ha)	Material Type
DA01	R336 Coast Road	0+050	0.089	Peat with U1 bunds
DA03	Cnoc na Gréine	0+350	0.112	Peat with U1 bunds
DA04	Na Foraí Maola Thiar	1+050	0.098	Peat with U1 bunds
DA05	Na Foraí Maola Thoir	1+450	1.051	U1
DA06	Troscaigh Thiar	1+800	0.483	Peat with U1 bunds
DA07	Bearna to Moycullen Road	2+900	0.065	Peat with U1 bunds
DA08	Bearna to Moycullen Road	2+950	0.602	Peat with U1 bunds
DA09	An Chloch Scoilte	3+250	0.239	Peat with U1 bunds
DA11	An Chloch Scoilte	3+950	0.314	Peat with U1 bunds
DA12	An Chloch Scoilte	4+050	0.18	Peat with U1 bunds
DA13	Cappagh	4+850	0.121	Peat with U1 bunds
DA14	Ballymoneen	5+250	0.811	Peat with U1 bunds
DA15	Keeraun	5+950	0.484	Peat with U1 bunds
DA17	Bushypark	0+050	0.079	U1
DA18	Bushypark	0+075	0.393	U1
DA19	Bushypark	0+200	0.353	Peat with U1 bunds

Number	Location	Approximate Chainage	Area (ha)	Material Type
DA20	Dangan	8+100	0.149	U1
DA21	Dangan	8+200	0.069	U1
DA24	Lackagh Quarry	11+350	2.52	U1 with contained peat placement in flat areas
DA25	Lackagh Quarry	11+350	0.48	U1 with contained peat placement in flat areas
DA27	Lackagh Quarry	11+550	0.4	U1
DA28	Lackagh Quarry	11+650	2.8	U1 with contained peat placement in flat areas
DA29	Ballinfoile	12+200	0.208	Peat with U1 bunds
DA31	Twomileditch	13+650	0.234	Peat with U1 bunds
DA32	Twomileditch	14+000	1.368	U1
DA33	Parkmore	13+950	0.315	U1
DA34	Parkmore	13+950	0.195	U1
DA35	Coolagh	16+000	0.395	Peat with U1 bunds
DA37	Coolagh	16+550	1.15	U1
DA38	Coolagh	16+350	1.797	U1
DA39	Coolagh	16+450	0.44	U1
DA40	Coolagh	16+500	0.782	U1

4 Design Criteria

A number of factors influence the MDA plan area, geometry and composition. These include the requirements for MDA slope stability, blast damaged slope stability, ecological habitat compensation (including their maintenance) and landscaping requirements. The constraints of the existing location also influence the MDA, for example slope stability of existing blast damaged rock faces in Lackagh Quarry. As outlined in the EIAR there is scope to refine the MDAs. The allowable capacity of the MDAs is presented in **Section 5** of this report.

This section of the report presents the Material Deposition Area criteria that the Contractor shall adhere to at the construction stage. These include:

- Engineering Design Requirements
- Environmental Design Requirements
- Site Specific Design Requirements

4.1 Engineering Design Requirements

The engineering design requirement include:

- Stability Design
- Height of material placement area
- Drainage requirements

4.1.1 Stability Design

The MDA design will be governed by the available area, the placement material, the proposed placement volume, construction sequence (including timeline) and the site-specific location constraints.

4.1.1.1 Deposition area slopes

Bund slopes will be constructed from U1 material, not peat. Bund slope gradients are permitted to range from 1 vertical (V) in 2 horizontal (H), 1 (V) in 3 (H) or 1 (V) in 4 (H).

The slope is governed by the available material, i.e. the steeper the slope the superior the material quality. A free draining granular layer may be incorporated into the slope and/or slope surface to achieve slope and surface stability. A slope stability assessment will be undertaken at construction stage using the parameters of the proposed placement material for each MDA complying with Eurocode 7, BS8081 slope stability requirements to ensure stable MDAs.

In general, a 1 (V) in 3 (H) slope has been assumed for each proposed MDA.

4.1.1.2 Low strength material

Low strength material will generally be placed in the central section of the MDAs as it is not suitable for placement on bund side slopes for stability reasons. This is particularly relevant to peat. Where low strength material is proposed stability layers may be introduced into the fill to control slope stability.

Some of the low strength U1 material encountered along the proposed road development will likely increase in strength with reworking such as drying. This is evident from the material encountered during the ground investigation.

The peat encountered along the proposed road development during the ground investigation ranged in natural moisture content from 90 to 970%. Careful handling is essential to retain any existing structure and integrity of the excavated materials. The following principles will be employed when handling peat at the construction phase of the proposed road development:

- Minimise plant movements and haul distances in relation to any peat earthworks activities
- Appropriate temporary storage areas for excavated peat close to the excavation will be developed
- Peat placement will occur as soon as possible after excavation where practicable

A number of peat reinstatement options at the MDAs are available to the contractor including:

- Peat placement in the upper central portion of the MDA only (U1 material placed in the bund slopes and base)
- Peat blending with a more consolidated peat, granular material or cement
- Drying of peat to reduce the natural moisture content
- Containment, separating the placement area into a series of cells, with the cell structure constructed from impermeable material
- Covering of the peat with subsoils or topsoils to prevent dust generation and to allow for appropriate ecological/landscape finish to surface
- The surface of the MDAs is finished with an ecological/landscape treatment. The treatment should have regard to the local environment and may provide for seeding to meadow grass, for heath development, with or without shrub planting

Where MDAs are used to facilitate ecological habitat compensation (areas DA01-DA06, DA08 and DA13-DA15, DA24, DA25, DA27 and DAA28) a number of the above principles will not apply. The more site-specific requirements for these areas in terms of peat removal, handling, storage, placement and treatment are outlined in Appendix A.8.26 of the EIA Report.

4.1.2 Material placement height

Material placement is generally limited to 2m above existing ground level with the deposition height locally varying depending on the local topography where local depressions occur. Exceptions for placement greater than 2m are discussed below and presented in **Table 4.1**.

Material placement greater than 2m is proposed at locations for where the deposition material is contained within embankments for health and safety requirements and in Lackagh Quarry where material placement is required for health and safety for slope stability purposes. Lackagh Quarry design requirements are discussed in **Section 4.3.2**.

In areas where material placement is greater than 2m granular layers (class 1 type material) may be introduced into the fill to control slope stability.

The embankment height for MDAs that are contained within embankments will be governed by the lowest embankment height, refer to **Figure 4.1** below.

Figure 4.1: Contained Material Deposition Area

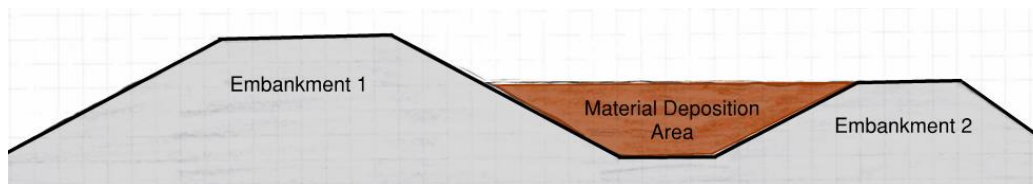


Table 4.1: Locations where the material placement height may exceed 2m

Number	Approximate Chainage	Placed material type	Rational for permitting material placement greater than 2m
DA25	11+000	Peat with U1 bunds	Located within Lackagh Quarry site
DA27	11+550	U1 with granular drainage layers	Located within Lackagh Quarry site and required for slope stabilisation of existing blast damage to quarry walls
DA28	11+650	Peat, U1 with granular drainage layers	Located within Lackagh Quarry site and required for slope stabilisation of existing blast damage to quarry walls and protection of Lough Corrib cSAC Annex I habitat
DA29	12+200	Peat with U1 bunds	Contained within embankments
DA39	16+450	U1	Contained within embankments
DA40	16+500	U1	Contained within embankments

4.1.3 Drainage

The drainage arrangement for each MDA shall comply with TII publications standards and the requirements outlined in the Construction Environmental Management Plan (CEMP) for sediment, erosion and pollution control.

In areas prone to ponding of water a drainage layer is required at the base of the MDA. A number of areas specifically identified by the hydrogeologist in Lackagh Quarry also require a drainage layer at the base of the MDA and at the interface between the existing rock face and the deposition material. Refer to **Section 4.3.2** for the drainage requirements in Lackagh Quarry.

The drainage layer will comprise of a free draining granular material (low percentage fines) overlain with a filter separator (e.g. geotextile) to prevent the migration of fines material from the material placed in the deposition area.

MDAs shall be isolated from overland contribution with the only contribution to drainage flows from such sites being the direct rainfall on to the site.

Table 4.2: Deposition areas requiring drainage layers

Number	Location	Requirement
DA01	R336 Coast Road	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA03	Cnoc na Gréine	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA04	Na Foráí Maola Thiar	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA05	Na Foráí Maola Thoir	The site has saturated ground with a drainage channel with poor conveyance. Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR to address this issue.
DA06	Troscaigh Thiar	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA07	Bearna to Moycullen Road	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA08	Bearna to Moycullen Road	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA09	An Chloch Scoilte	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA11	An Chloch Scoilte	This area is divided by the Bearna Stream which is a Salmonid system. Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR which will address this issue.
DA12	An Chloch Scoilte	
DA13	Cappagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA14	Ballymoneen	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA15	Keeraun	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR

Number	Location	Requirement
DA17	Bushypark	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA18	Bushypark	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA19	Bushypark	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA20	Dangan	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA21	Dangan	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA24	Lackagh Quarry	Refer to Section 4.3.1
DA25	Lackagh Quarry	Refer to Section 4.3.1
DA27	Lackagh Quarry	Refer to Section 4.3.1
DA28	Lackagh Quarry	Refer to Section 4.3.1
DA29	Ballinfoile	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR Contractor
DA32	Twomileditch	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR Contractor
DA33	Parkmore	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA34	Parkmore	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA35	Coolagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA37	Coolagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA38	Coolagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA39	Coolagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR
DA40	Coolagh	Drainage requirements for proposed MDA in accordance with the requirements set out in the EIAR

4.2 Environmental Requirements

The MDAs listed in **Table 4.3** below also facilitate the ecological habitat compensation measures. Therefore, specific requirements which are set out in the Habitat Compensation Management Plan in Appendix A.8.26 of the EIAR apply at these sites.

Table 4.3: Deposition areas and habitat compensation

Deposition area	Requirement
DA01	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA03	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA04	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA05	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR); also mitigation in relation to the Marsh fritillary butterfly during clearance (see Section 8.5.8.2 of Chapter 8 Biodiversity of the EIAR)
DA06	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA08	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA09	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA13	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR); also mitigation in relation to the Marsh fritillary butterfly during clearance (see Section 8.5.8.2 of Chapter 8 Biodiversity of the EIAR)
DA14	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA15	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA24	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA25	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA27	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)
DA28	Requirements relating to habitat/peat removal, handling, storage, placement and treatment (see Appendix A.8.26 of the EIAR)

4.3 Site Specific Requirements

This section of the report outlines specific requirements that the Contactor shall adhere to for the relevant MDA. These are discussed below under the following headings:

- Slope Surface
- Lackagh Quarry
- Placement of Material derived from a different Lithology
- Streams
- ESB Network
- Demolition
- Landscape and Visual

4.3.1 Slope Surface

Depending on the location, the outer slopes of MDAs may be covered in topsoil and seeded to grass, or alternatively it may be appropriate to use lower quality topsoil and seed to locally appropriate mix of meadow grasses. A proportion of the outer slopes may also be planted with shrubs appropriate to the location and soil type, e.g. blackthorn, hawthorn, hazel, holly, willow, etc. The final surface shall reflect the surrounding environment of the MDA location.

For sediment control a rapid formation of a surface crust and vegetation cover is required to permit surface water run-off and prevent these sites becoming sediment laden.

Where MDAs are required to facilitate ecological habitat compensation there are specific requirements that must be adhered to as stated above in Section 4.2 of this report.

4.3.2 Lackagh Quarry

Within Lackagh Quarry four Material Deposition Areas have been identified, DA24, DA25, DA27 and DA28. Lackagh Quarry material deposition is extracted from this report and discussed in detail in Appendix A.11.1 and Annex 1 to that appendix of the Request for Further Information (RFI) Response.

The slope stability assessment for each placement area in Lackagh Quarry shall incorporate:

- the specific design requirements
- the available and proposed area
- the placement material and volume
- the construction sequence
- the site-specific location constraints

The particular requirements for Lackagh Quarry are set out in the Appendix A.11.1 RFI Response and include:

- Habitat compensation were specified. Maintenance is required of the finished surfaces in accordance with the Habitat Compensation Management Plan in Appendix A.8.26 of the EIAR
- Implementation of slope stability / health and safety solutions for the exposed rock face. This solution includes rock bolt, rock dowel, steel mesh and sprayed concrete combination. The designer shall undertake a permanent composite rock support system designed to the relevant design standards (Eurocode 7, BS8081) and best practice guidance documents
- Drainage systems in accordance with the requirements set out in the EIAR
- Drainage layers as necessary to maintain surface drainage in accordance with the Habitat Compensation Management Plan in Appendix A.8.26 of the EIA.
- A free draining granular material between the existing cliff face (including existing quarry bench faces) and material deposition material to allow the cliff face to maintain its drainage system must 1m wide. This will be a vertical layer
- A free draining granular material between the existing quarry base and material deposition material (horizontal layers) to maintain its drainage system. This is required:
 - Where the exiting quarry level at a MDA is below +17.7mOD. In these areas free draining granular material is required up to +17.7mOD
 - Above this level (+17.7mOD) a minimum of 0.5m free drainage material is required at the interface between the exiting quarry floor level and the MDA
- A filter separator (e.g. geotextile) is required between all drainage layers (vertical and horizontal) and general fill to prevent migration of fines sediment
- Maintain north east cliff heights

4.3.3 Introduction of Material derived from a different Lithology

The overburden across the proposed road development consists of glacial till derived from the underlying bedrock. The bedrock changes approximately at the N59 Moycullen Road, from a granite in the west to a limestone bedrock in the east which have different chemical compositions.

To prevent impact to the local peatland habitats in granite bedrock areas, the following fill limitations will be incorporated at the locations identified below in **Table 4.4**.

- Only pavement and capping layers protected from surface water runoff and groundwater movements are permitted to be derived from non-native material
- All other acceptable fill material will be derived from native material or other pH compatible material

There are no limitations for the placement of granite derived material in limestone bedrock areas as there are no potential environmental impacts.

Table 4.4: Fill Limitation Areas in MDAs in granite bedrock areas

Fill Limitation Area Location*	Fill Limitation Chainage area	
	From	To
1	0+620	0+775
2	1+300	1+450
3	1+830	2+065
4	2+875	3+090
5	3+440	3+550
6	3+595	3+890
7	4+800	5+150
8	7+850	7+900

*Refer to Chapter 11, Hydrology of the EIAR for details

4.3.4 Watercourses

Watercourses that are located near, or in close proximity to MDAs are presented in **Table 4.5** below. The requirements outlined in the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the EIAR will be implemented at these locations. These requirements include, but are not limited to:

- A setback of at least 5m from the drain/watercourse to the excavated material will be maintained for material deposition and a bund constructed to contain the excavated material. A silt fence shall be installed at least 3m from the drain/watercourse before the excavated material is deposited and shall be maintained in place until vegetation has re-established
- Where appropriate, the MDAs will be provided with a runoff collection and treatment system. This will consist of a shallow swale around the perimeter. This will be located just behind the bund or where the placed material meets the existing ground contour (approx. 2m wide by 0.25m deep). Check dams may be required to manage velocities and potential erosion within the swales
- The final surface of the MDAs will be shaped to drain towards the perimeter swale and shallow surface drains will be installed to accommodate this. The perimeter swale will discharge via a settlement pond prior to discharge at a suitably controlled rate to the watercourse or groundwater body
- In general the MDAs will be confined by the boundaries of impervious material and therefore the final surface will be shaped to shed surface water runoff to the road surface water collection/ conveyance and treatment system. Such areas will be landscaped immediately upon completion
- Interceptor drains will be installed where necessary to prevent additional drainage contribution to the MDA by diverting local drainage around these areas.

Table 4.5: MDAs and streams

Deposition area	Stream	Requirement
DA07	Stream	5m clearance required
DA11	Bearna Stream	5m clearance required
DA14	Tonabrocky stream	5m Buffer required between site and stream

4.3.5 Underground and Overhead Services

Each MDA shall be surveyed for underground and overhead services prior to placement. Electrical powerlines operated by ESB Networks are present within one MDA, these locations are presented in **Table 4.6**. It should be noted that unknown services may also be present and the contractor will carry out their own inspection for services in advance of any works.

Where services are present the following requirements are applicable:

- Relevant service providers to be contacted prior to the commencement of works to agree placement and site-specific requirements with respect to the relevant services
- 5m horizontal clear distance from existing and proposed exterior powerlines
- Existing ground level to be maintained directly beneath overhead powerlines
- No planting shall be established on MDAs under overhead powerlines and over underground services

Table 4.6: MDAs with overhead services*

Deposition area	ESB lines	Site requirement
DA37	Yes	Maintain existing ground levels directly beneath the existing and proposed 110kV diversion and 5m horizontal clear distance from the exterior powerline.

*Additional services may be present following contractor's survey and all will adhere to the above requirements

4.3.6 Demolition Required

Structures that are present on a MDA site will be removed. **Table 4.7** identifies the buildings within the MDAs that will be demolished.

Table 4.7: MDAs with structures

Deposition area	Building
DA24	Derelict building within disused quarry

4.3.7 Landscape and Visual Requirements

The landscape requirements are presented in **Table 4.8** and generally relate to maintaining trees and vegetation and the setback of the MDAs requirements from property boundaries.

Table 4.8: MDAs additional requirements

Deposition area	Requirement
DA11	Maintain streamside vegetation and trees
DA15	Setback from property boundary for security and privacy
DA17	Existing ground level is sloped, placement height governed by topography and slope stability. Maintain mature trees on boundaries and setback from church grounds
DA18	Existing ground level is sloped, placement height governed by topography and slope stability. Maintain mature trees on boundaries
DA19	Existing ground level is sloped, placement height governed by topography and slope stability. Maintain mature trees on boundaries and setback from graveyard boundary
DA20	Existing ground level is sloped, placement height governed by topography and slope stability. Maintain mature trees on adjoining residential boundaries and setback from property boundaries
DA21	Existing ground level is sloped, placement height governed by topography and slope stability. Maintain mature trees on adjoining residential boundaries and setback from property boundaries
DA32	Setback from hedgerow and mature copse of trees on adjoining property boundary
DA34	Setback from boundary hedgerow and trees
DA35	Setback from eastern boundary to maintain trees and vegetation
DA38	Maintain existing mature planting along N6

5 Material Deposition Area Capacity

The allowable capacity for each MDA was also assessed by the environmental specialists. For each MDA the allowable capacity and permitted material type are presented in **Table 5.1**.

The allowable capacity is the volume of material that is permitted in each area and shall be incorporated in the design as a design constraint. This allowable capacity is influenced by the location, area footprint and location specific design requirements. A 3D model was produced for each area to quantify the capacity of each area and determine the volume of deposition material between an existing surface and a proposed surface.

Table 5.1 also presents the estimated placement volume for each area. The estimated capacity is the estimated volume of material that will be placed in an area taking into consideration the relevant design requirements set out in Section 4 above.

As noted previously the total allowable capacity of the 32 MDAs exceeds the volume of material surplus to the construction of the proposed road development. This allows for:

- an increase / decrease in volume of a material type during construction
- volume changes based on the available material (stability assessment)
- construction programme flexibility, placing material in an efficient manner

Table 5.1: MDA allowable placement material, estimated placement volume and material type

Number	Location	Allowable Capacity (m ³)	Estimated placement volume (m ³)	Material Type
DA01	R336 Coast Road	1,200	1,200	Peat with U1 bunds
DA03	Cnoc na Gréine	2,700	2,700	Peat with U1 bunds
DA04	Na Foráí Maola Thiar	1,300	1,300	Peat with U1 bunds
DA05	Na Foráí Maola Thoir	24,000	24,000	U1
DA06	Troscaigh Thiar	7,800	7,800	Peat with U1 bunds
DA07	Bearna to Moycullen Road	500	500	Peat with U1 bunds
DA08	Bearna to Moycullen Road	11,500	11,500	Peat with U1 bunds
DA09	An Chloch Scoilte	3,800	3,800	Peat with U1 bunds
DA11	An Chloch Scoilte	3,700	3,700	Peat with U1 bunds
DA12	An Chloch Scoilte	2,000	2,000	Peat with U1 bunds

Number	Location	Allowable Capacity (m ³)	Estimated placement volume (m ³)	Material Type
DA13	Cappagh	2,100	2,100	Peat with U1 bunds
DA14	Ballymoneen	10,700	10,700	Peat with U1 bunds
DA15	Keeraun	4,000	4,000	Peat with U1 bunds
DA17	Bushypark	800	800	U1
DA18	Bushypark	2,200	2,200	U1
DA19	Bushypark	6,300	6,300	Peat with U1 bunds
DA20	Dangan	1,500	1,500	U1
DA21	Dangan	900	900	U1
DA24	Lackagh Quarry	230,000	104,000	U1 with contained peat placement in flat areas
DA25	Lackagh Quarry	6,500	6,500	U1 with contained peat placement in flat areas
DA27	Lackagh Quarry	27,000	16,700	U1
DA28	Lackagh Quarry	283,000	242,000	U1 with contained peat placement in flat areas
DA29	Ballinfoile	5,700	5,700	Peat with U1 bunds
DA31	Twomileditch	4,400	4,400	Peat with U1 bunds
DA32	Twomileditch	23,000	23,000	U1
DA33	Parkmore	5,200	5,200	U1
DA34	Parkmore	1,900	1,900	U1
DA35	Coolagh	6,600	6,600	Peat with U1 bunds
DA37	Coolagh	10,800	10,800	U1
DA38	Coolagh	63,000	41,500	U1
DA39	Coolagh	17,600	17,600	U1
DA40	Coolagh	35,000	35,000	U1

6 Summary

A portion of the necessary engineering, environmental, landscape and safety requirements for the proposed road development are met by the implementation of Material Deposition Areas.

The volume of material that is available and suitable for placement in MDAs is presented in **Section 2** of this report.

Their locations were selected to satisfy the necessary engineering, environmental, landscape and safety requirements for the proposed road development. The allowable material type of each MDA was also assessed by the environmental specialists. The locations and allowable placement material are tabulated in **Section 3** and the locations are presented on Figures 7.301 and 7.302 of the EIAR.

Section 4 of the report details the requirements of the MDAs and the criteria that the Contractor shall adhere to .

In **Section 5** the allowable capacity for each Material Deposition Area is specified.