Responses to Ballinrooaun Quarry Extension – items 2, 5, 6, 7 and 11

2. *The surface of the 'restored to previous levels' will be prone to settlement and preferential gullying during heavy rainfall, which commonly happens with newly planted land, especially when there are small amounts of fines in the subsoils. After a number of years this could potentially result in a scoured surface, especially as there are relatively high slope angles over much of the proposed extraction area. The re-profiling measures outlined in 11.5.1 to 11.5.3 will need to be repeated after three years with follow up post- monitoring, submit proposals for same.*

Response

The existing slope angles measured over the proposed extraction area vary from 5 to locally 15 degrees (1v:11.4h to 1v:3.7h), with an average of about 8 degrees (1v:7.1h), see Figure 7.3 of the EIAR. These slope angles would be considered relatively shallow, and are significantly less than the reinstated slope angles of the adjoining quarry.

Notwithstanding the above, it is recognised that there is potential for settlement and preferential gullying of the restored surface, for this reason the following further re-profiling measures are proposed:

(a) Settlement. To allow for some potential settlement of the placed fill, the final restored level will be overfilled by about 0.5m. This is included in section 7.4.4.

(b) Re-profiling measures (see 11.5.1 to 11.5.3). After 3 years following restoration of any area (that is placing 3m of non-commercial sand with a 0.3m topsoil overlay with grass seeding) the restored area will be inspected, and any settlement and erosion/gullying will be made good with site-won topsoil and grass seeding.

(c) Replanting of hedgerows. A number of existing hedgerows will be removed as part of the works. These hedgerows will be re-planted on the same alignment and species as present as soon as is practical following restoration of the surface at the location of the hedgerows. In the unlikely event of localised erosion/weathering additional hedgerows may be planted using same species as present. For further details on hedgerow planting see 11.5.1 to 11.5.3.

(d) Following final restoration, or at any intermediate stage of restoration, the quarry operator will facilitate periodic visits from IGH/GSI, as required to inspect the restored surface. The facility for IGH/GSI to inspect the site is already included in section 7.6.7.

(e) The finished restoration will be to the original landform topography as surveyed in July 2017 by Coastway Surveys Ltd using laser-scanning techniques. A digital copy of this data is included in this submission.

5. *The EIAR as submitted includes insufficient detail on the material to be imported for the restoration of the landform. The EIAR should be amended to include for more detailed assessment, mitigation and specification on the type of material to be imported and used in the restoration of the quarry. The EIAR shall also sufficiently demonstrate or model how soil erosion or slippage will be avoided where the less permeable infill material meets the relain sandy overburden upon completion of restoration.*

Response

The response is in 2 parts, namely:

(a) More detailed assessment on type of material to be imported and used in the restoration of the quarry, and

(b) Avoidance of soil erosion or slippage where the less permeable infill material meets the relain sandy overburden upon completion of restoration.

Response to part (a).

Section 7.4.4 in the EIAR refers to the type of fill material to be imported for use in filling. The fill material will be an inert soil imported from pre-approved external sites. The inert fill will comprise subsoil that will contain soil and stone. No peat, topsoil, contaminated soils or non-hazardous waste will be accepted. This would be similar to European Waste Catalogue (EWC) code 17.05.04[1] (soil and stones that are non-hazardous), except it would originate from a non-contaminated site.

Inert subsoil will comprise natural materials composed of a combination of one, some or all of the following components, namely clay, silt, sand, gravel or stone. A classification (specification) of the inert subsoil to be imported to site has been carried out based on typical subsoils encountered in Ireland, see Table 1.

Subsoil will naturally behave as either a granular or cohesive material. For simplicity, the imported subsoil has been divided into 2 classes, namely granular and cohesive material. Cohesive material has been further divided into wet and dry. For each material class a description and identification is given together with typical examples of soils within each class.

Granular material will naturally act as a drainage material and will not hold water, as such its behaviour will remain essentially the same whether it is wet or dry.

Where the different material classes are located and how they are used (mitigation) in the filling is also given. For example, wet cohesive material would be unsuitable to be placed on the temporary fill slope and would need to be placed and spread on the quarry floor in layers.

[1] Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous (EPA, 2015)

Table 1 Imported material class, identification and placement/use in fill

Class	General Soil Specification	Typical Constituents	Site Check/Identification [1]	Example Soil Type [4]	Location and Use in Fill
1	General granular	Any material or combination of inert dominantly sand, gravel and stone [2] Granular material may include natural gravel, crushed gravel, crushed rock	• Granular soil cannot be molded and when squeezed will not stick together. • Comprises individual parts (e.g. sand, gravel)	Sands and gravels (undifferentiated) Alluvial (river) gravels Crushed natural stone aggregate Weathered rock Unweathered rock	• No restriction where material located in filling operation. • Where practical placed in the upper fill to provide drainage and competent working surface.
2A	Wet cohesive	Any material or combination of inert clay, silt, sand, gravel and stone	• Cohesive soil is sticky and will hold together when squeezed in the hand. • Wet material can be easily molded and will exude water when squeezed. • Will tend to flow when placed.	Lake/river sediments Wet glacial till [3]	• Located in floor of quarry. • Placed in thin layer (less than 1m) and spread to avoid concentrated zone of wet soil • Avoid placing in upper fill as would provide poor running surface. • Not be placed in front face of temporary fill slope.
2B	Dry cohesive	Any material or combination of inert clay, silt, sand, gravel and stone	• Cohesive soil is sticky and will hold together when squeezed in the hand. • Dry material can be difficult to mold and will exude little/no water when molded. • Will not flow when placed.	Glacial till [3] Macamore Clay (Irish Sea Basin glacial till)	• No restriction where material located in filling operation. • Where practical placed in the upper fill to provide competent working surface.

Notes:

(1) In most cases visual inspection of the material will be sufficient to determine the class of material
(2) General granular material is likely to contain some finer material (clay and silt) but would be classed as granular where it behaved essentially as a granular soil
(3) Glacial till is the dominant subsoil found in Ireland and comprises a mix of particle sizes (clay silt, sand, gravel and larger). The range of particle size can vary greatly but overall the matrix of the material behaves essentially as a cohesive soil.
(4) Example soil types are for illustration only and are based on EPA subsoil classification.
(5) All soils comprise mineral constituents with no organic matter.

In addition to the above, imported inert fill will be selected and tested in accordance with the Waste Acceptance Criteria and Development of Soil Trigger Values for EPA-Licensed Soil Recovery Facilities Draft (EPA, 2017), or latest updated version.

Response to part (b).

Filling will commence at the quarry floor and will proceed upwards in suitable benches until the imported inert fill surface level is within about 3.3m of the original ground surface. Once the filling has reached this level, the sandy subsoil stored on site will be placed over the inert fill to form a 3m thick capping layer. The topsoil, also stored on site, will then be placed over the sandy subsoil to a thickness of about 0.3m. (see 7.4.4).

Rainfall on the restored ground surface will partly result in runoff due to the presence of topsoil with a proportion of the rainfall penetrating the ground. The upper 3m of sandy subsoil is relatively permeable and will transmit water downward until it meets the less permeable boundary with the inert fill.

A build-up of water (perched water table) will occur above the interface of the sandy subsoil and inert fill. The potential for this water to cause instability of the restored quarry has been examined (see 7.6.2 and Appendix B of section 7) and findings are summarised below.

(i) A slope stability analysis was carried out of the reinstated quarry using suitable soil and groundwater parameters along a critical cross-section through the reinstated quarry assuming a build-up of water in the sandy subsoil and inert fill (see Figure 7.5).

(ii) The analysis calculates the factor of safety (FoS) of the reinstated quarry. For stability, an acceptable FoS is a value of 1 or greater. An FoS below 1 would indicate that the reinstated quarry slope has an unacceptable degree of stability.

(iii) The results of the analysis show an acceptable FoS for the reinstated quarry of 3.18, and for a sensitivity check, assuming a 1m high perched water-table within the sandy subsoil capping layer, the FoS is 3.16 (Figure 7.6).

(iv) The results of the analysis show an acceptable and high FoS.

(v) A further check on the stability of the sandy subsoil layer assuming the layer was completely filled with water (which is unrealistic) can be determined from:

$$FoS = (1 - r_u)\ (\tan \phi')\ /\ (\tan \alpha) = 1.84$$

Where

r_u pore water pressure ratio (0.5 complete saturation, 0 no water)

ϕ' angle of internal friction of sandy subsoil (33 degrees)

α slope angle (10 degrees)

The above results clearly show that the build-up of water within the fill material does not represent a stability risk to the restored quarry with FoS notably greater than 1, that is restored slope is stable and does not represent a risk from instability.

In the temporary condition it would be necessary to control water emerging from the interface of the sandy subsoil and inert fill, as such the following measures are to be included, also see Figure 1:

(i) A temporary flat bench is to be left at the upper surface of the inert fill between the inert fill slope and the area of the restored quarry (that is where the sandy subsoil and topsoil have been placed). Bench width to be at least 6m wide to allow access for machinery.

(ii) A temporary shallow interceptor ditch is to be constructed on the flat bench at the base of the sandy subsoil slope to intercept emerging water and channel it to the edge of the filling area and into the quarry floor.

(iii) The front face of the restored sandy subsoil slope, which is temporary, shall be at a shallow inclination of about 20 degrees (1v:3h) or less to avoid slumping of slope.

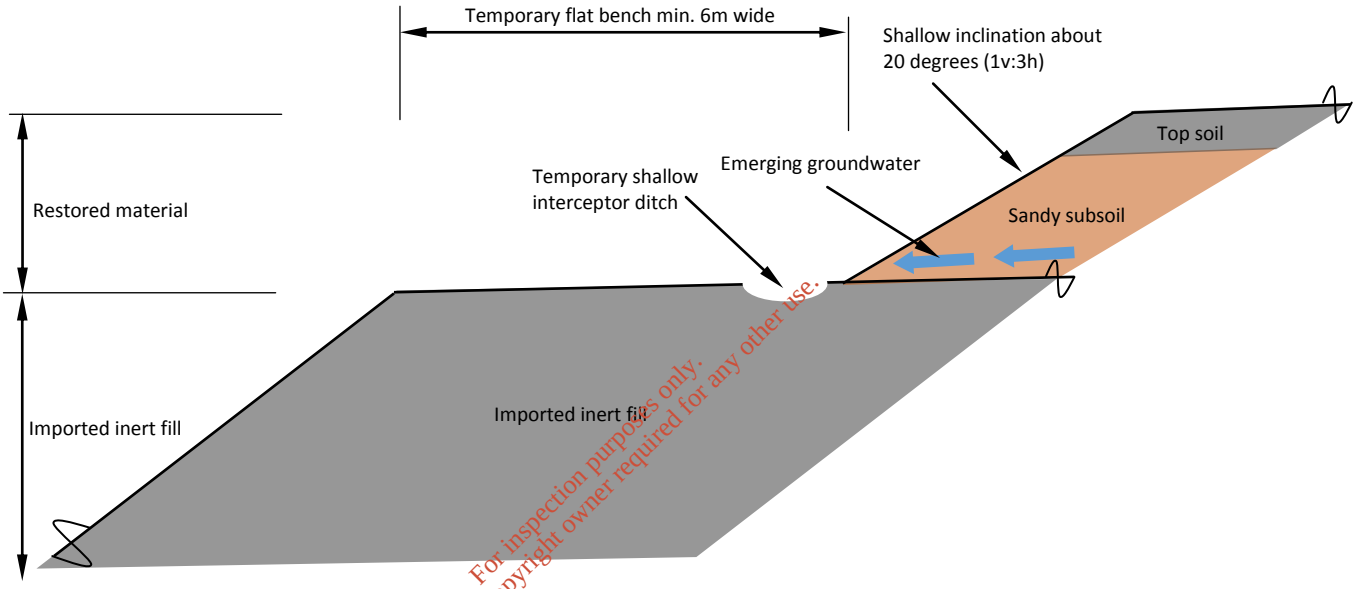

Figure 1 Typical section through temporary upper part of restored/filled slope

6. *The applicant is requested to clarify the locations and methods of storing the overburden for the years before restoration is complete.*

Section 7.6.3 in the EIAR refers to storage of overburden. Further details are given below.

Soil stripping of overburden for restoration purposes will involve separating the material into topsoil and subsoil stockpiles.

It is proposed to store material for restoration at designated locations on the site, either in the floor of the existing quarry to the northeast (and/or proposed quarry floor) or in a bund along the southern boundary of the proposed quarry extension.

The plan area of the existing quarry is over 10,000m^2 with a potential to fill up to about 10m or more, if required. The proposed quarry floor would also be used to store sandy subsoil, which as the extraction moved westward could be more practical as it would be closer to the restoration areas.

The bund along the southern boundary will be about 15m wide at its base with a maximum height of about 2m, with a flat/even 2m-wide central section running down its centre. This gives a storage of 17m^3 per metre of bund. With total bund length of about 360m then available storage volume in bund is 6120m^3. Topsoil would be stored in the bund.

Soil stripping and restoration will be carried out progressively. By year 4, filling and part restoration will be underway and at that time it is estimated that about 30% of the extraction area would have been stripped prior to restoration. The maximum required overburden storage is based on 30% of the extraction area being stripped, taking into account any re-use of material in restoration.

Overburden volumes for restoration and storage location:

Overburden	Total Volume	Maximum Stored Volume	Storage Location
Topsoil	17,490m^3	5,250m^3	Bund on southern boundary
Sandy subsoil	174,900m^3	52,500m^3	Floor of existing quarry to northeast and floor of proposed quarry, as required

7. *Submit revised drawings showing the distance of the quarry face from all adjoining landholdings demonstrating a minimum of 100m distance at all times.*

Boundary drawings revised to show minimum 100m distance of quarry face from adjoining landholdings. Following amended drawings are included:

Drawing 7.1

Drawing 7.2

Drawing 7.3 (1 of 2)

Drawing 7.4 (2 of 2)

11. Please clarify under Section 8.6.5 of the EIAR the high winter water table is stated as being between 29AOD and 38AOD and the proposed sandpit floor is stated as being 38m AOD however there should remain a minimum of 5m above the high water table at all times. Also in the Planning report specifies that the quarry is to be quarried to 40mAOD at its lowest point. Submit clarification on this statement and revised section drawings showing the quarry floor a minimum of 43mAOD and/or 5m above the high winter water table.

Floor of quarry is to be maintained at 5m above high groundwater level. Section drawings revised to show the quarry floor a minimum of 5m above the high winter water table. Following amended drawings are included:

Drawing 7.3 (1 of 2)

Drawing 7.4 (2 of 2)