

CONTENTS

INTRODUCTION 2-1

LOCATION 2-1

SITE DESCRIPTION 2-1

ENVIRONMENTAL CONTEXT 2-5

Landscape 2-5

Geology..... 2-6

Hydrology 2-8

Hydrogeology..... 2-9

Sensitive Receptors..... 2-9

SITE AND PLANNING HISTORY 2-10

INTRODUCTION

This chapter describes the existing physical and environmental characteristics of Penrhyn Quarry, together with the proposed extension. Allied to this, a number of the chapters within this volume provide descriptions of the site in relation to particular environmental topics, providing *inter alia* 'baseline' surveys.

- 2.1 In this respect, Chapter 6 describes the landscape character and topography of both the existing quarry and the proposed extension, whilst Chapter 7 considers the ecological habitats, flora and fauna that exist within the proposed extension and wider areas. Chapter 8 describes the archaeological and cultural heritage aspects and Chapter 9 describes the water environment. Finally, Chapter 10 considers the local noise climate. All chapters describe the baseline conditions as they exist today, plus provide an indication as how the baseline may change with time in the absence of the proposed development.
- 2.2 These existing conditions provide a base against which the effects of the proposals may be evaluated.

LOCATION

- 2.3 Penrhyn Quarry is located immediately to the south of the town of Bethesda, to the west of the A5(T). The settlements of Mynydd Llandegai, Bryn Eglwys, Coed y Parc and Braichmelyn form an arc to the north of the quarry, with the Afon Ogwen lying to the east and the mountains of the Glyder Ridge to the south.
- 2.4 For identification purposes, the quarry is centred on National Grid Reference (NGR) SH 61947 64839, with the administrative offices located at SH 62016 65382. **Drawing PQ 2/1** illustrates the location of the quarry in terms of the extent of the existing planning permission.
- 2.5 In terms of administration, the whole of the quarry is located within the administrative boundary of Gwynedd Council, but lies adjacent to the area administered by the Snowdonia National Park Authority.
- 2.6 The proposed extension to the quarry lies at the south-western corner of the quarry workings, centred on NGR SH 60904 63891. Again, Drawing PQ 2/1 illustrates the location of the proposed extension within the context of the overall quarry workings at Penrhyn.

SITE DESCRIPTION

Penrhyn Quarry

- 2.7 Penrhyn Quarry extends over an area of some 318 hectares (ha), the majority of which has been disturbed to some degree by quarrying or associated activities. Penrhyn Quarry comprises two quarries: North Quarry and South Quarry. The North Quarry is separated from the South Quarry by

a substantial area of slate waste which has been loose tipped. In addition to the two quarries is a works area within which are situated a range of buildings.

2.8 The main elements of Penrhyn Quarry are:

- the old North Quarry (now worked out and flooded. Includes infrastructure associated with 'Zip World');
- the existing permitted working area in the South Quarry;
- the slate waste tips;
- the processing area, aggregate processing plant and the administration offices.

2.9 The northern and eastern limits of the quarry are covered in the main by a series of slate waste tips, many of which are very old and reflect the primary means of slate waste disposal in the nineteenth century. The more recent slate waste tips are located on the north-western limits of the quarry and within the current quarry working area (at its northern end).

2.10 The old North Quarry is some 150 metres deep having been taken down in approximately 15m high benches. Mineral extraction (with the exception of reworking some of the waste tips) has ceased and it is now flooded to a depth of some 90m and overflows via an adit into the Afon Ogwen. The eastern side of the North Quarry is formed by steep faces, many of which are now covered by scree hiding the form of the quarry benches. To the east of the old quarry are historic slate tips; between the tips and quarry rim is an access track providing access to the launch pad for the zip lines (associated with Zip World). The northern and north western aspects to the old quarry are more open, with the site infrastructure (offices, buildings, plant and machinery) located on a plateau, shielded by peripheral slate tips. To the west and south are areas of more recent tipping.

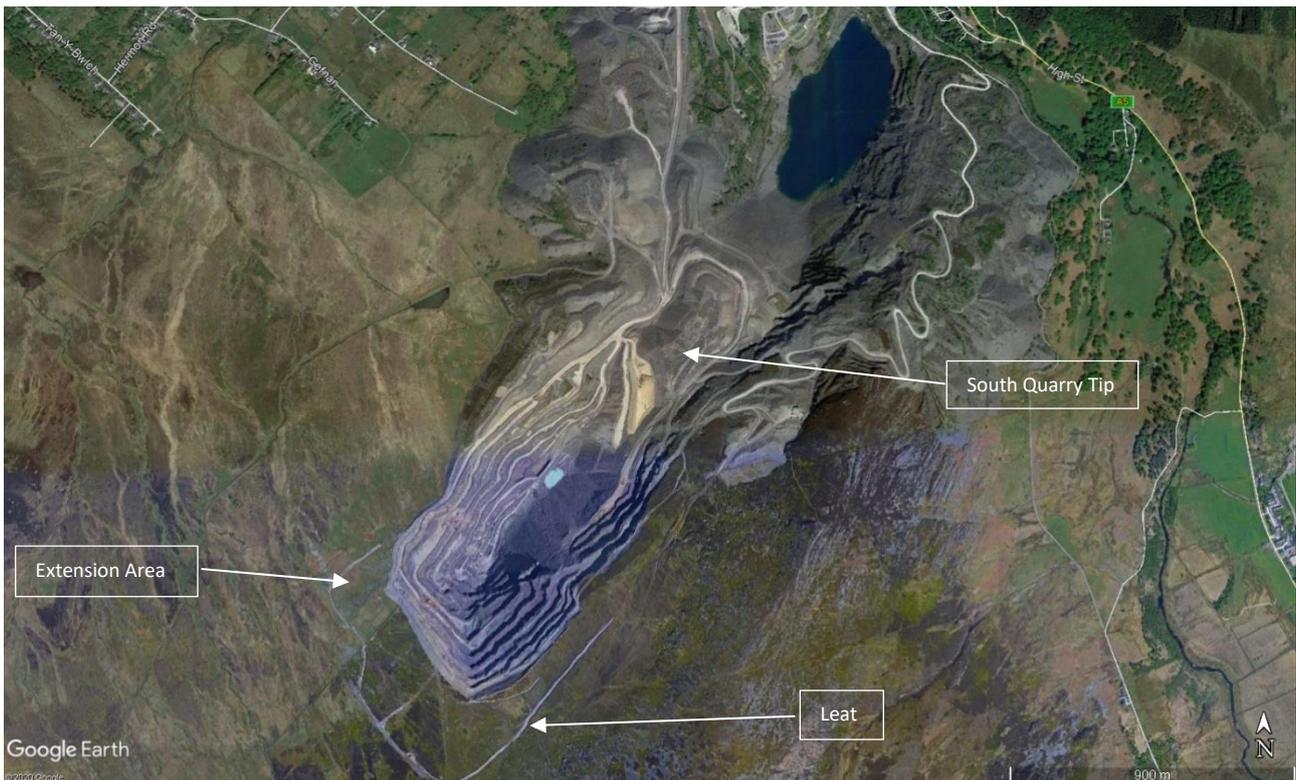
2.11 The current quarry workings are located in the South Quarry and are advancing in a general south-westerly direction, averaging some 120m in depth from original ground levels. The South Quarry is rectangular in shape, approximately 1400m long and 500m wide. On the south-eastern side the quarry has been developed into the slopes of Y Fronllwyd, whilst to the west the land is more open, comprising heath/bog (Gwaen Gynfi). On the western side of the quarry, located at the toe of the tips, is an area that is being managed as an "*ecological compensation area*" (refer to **Drawing PQ 2/1**) which was agreed following the removal of land from the Special Area of Conservation as part of an earlier planning application for an extension in c. 2012 (see below). As in the North Quarry the benches are approximately 15 metres in height and are permitted to extend to within 350m of the Afon Marchlyn Mawr.

2.12 The works area is at an elevation of around 180m AOD, with the peripheral tips rising to the north and west to between 200m and 220m AOD. Further to the south (and on the western side of the South Quarry) the tips increase in height to around 360m AOD, with a similar elevation reached by the tip that divides the North and South Quarries. Between these two tips is routed the main haul road. The haul road steadily climbs from the works site to a peak of 315m AOD, before dropping into the void of the South Quarry. The base of the South Quarry is currently at an elevation of 250m

AOD, whilst the rim reaches around 400m to 440m AOD on the south eastern side and between 365m and 315m AOD on the north western side.

2.13 Figure 2-1 below provides an illustration of the current form of the southern part of the quarry workings.

Figure 2-1
Context of the Southern Quarry



Access

2.14 Access to the quarry is gained via a private road which joins the B4409 at NGR SH 62573 65964, some 88m to the west of the junction with the A5(T). This access is also shared with Zip World. The A5(T) joins the A55 North Wales Expressway at a grade separated junction (Junction 11), located approximately 5km to the north.

Rights of Way

2.15 During 2002 the following footpath diversion, creation and closure orders were confirmed:

- Stopping Up and Creation Order – Footpaths 46 (Part) and 50 (Part);
- Diversion Order – Footpath 45 (Part);
- Stopping Up Order – Footpaths 42 (Part) and 50 (Part).

- 2.16 The Stopping Up Order attaching to Footpaths 46 and 50 (Part) was for a temporary period expiring in March 2017. As part of the Review of Old Mineral Permission (ROMP) process under the Environment Act 1995 new stopping up orders were confirmed which will remain in place until the end of 2034 by which time the footpaths are to be reinstated (following the completion of restoration works).

Land Use

- 2.17 The predominant land use within the quarry is related to the quarry workings and associated ancillary operations. As such the uses include:
- slate extraction area (both weathered and prime slate);
 - overburden and slate waste tips;
 - roofing slate production buildings;
 - aggregate processing plant;
 - roofing slate product storage areas;
 - aggregate stockpiles;
 - office accommodation;
 - staff welfare facilities;
 - car parking areas;
 - haul roads;
 - access road; and
 - restored workings.
- 2.18 Also within the curtilage of the quarry is a leisure use associated with 'Zip World'. This use is subject to separate planning controls.

The Proposed Extension

- 2.19 The proposed extension to the slate workings is located at the south-western corner of the quarry workings, contiguous with the working area. Notably, the extension would be wholly within the confines of the area covered by planning permission C12/0874/16/MW (dated 18 December 2012) but out with the extraction limits shown on the approved plans attached to that permission.
- 2.20 It is approximately rectangular in shape, measuring around 2.3 ha and effectively 'squares off' the quarry workings within the area bounded by the peripheral leat.

- 2.21 The proposed extension is bounded to the north and east by the approved quarry working area (including areas within the permission still to be worked) with a recently constructed 'leat' (drainage channel) forming the southern and western boundaries, beyond which are areas of open upland land (Gwaen Gynfi). The proposed extension currently forms part of Gwaen Gynfi (be it severed by the leat) and so has no dominant land use other than upland grazing.
- 2.22 In terms of topography, the proposed extension site ranges in elevation from approximately 385m AOD at the south-western boundary to approximately 355m AOD at the northern boundary.
- 2.23 For identification purposes, the proposed extension area is shown edged in red on **Drawing PQ 2/1**, whilst **Drawing PQ 2/2** shows the setting of the proposed lateral extension to a scale of 1:10,000. Finally **Drawing PQ 2/3** shows the extent of the proposed lateral extension in more detail (to a scale of 1:2500).

Waste Slate Tips

- 2.24 The extraction of slate produces large volumes of waste slate materials which need to be tipped in a fashion that does not impede the working of future areas. Historically, such materials were tipped at the edge of the quarry workings to create the 'fan' tips that have characterised the slate quarries in North Wales. Under the current operations, the majority of the waste slate is tipped within the northern end of the South Quarry; however, material has also been tipped on the western edge of the workings.

ENVIRONMENTAL CONTEXT

Landscape

- 2.25 Penrhyn Quarry is set within an open landscape on ground to the south east of the quarry rising steeply to the summit of Glyder Fawr at over 1,000m AOD.
- 2.26 The Glyder Ridge is separated from the Carneddau Range in the east by the deeply incised valley of the River Ogwen. The Carneddau Range is marginally higher than the Glyder Ridge, reaching 1064 m AOD at the summit of Carnedd Llewelyn that is almost directly to the east of the submission site, these mountains again rising steeply from the adjacent landscape. The River Ogwen flows in a northerly direction from Llyn Ogwen, passing close to the eastern end of Penrhyn Quarry and through Bethesda before heading towards the mouth of the Menai Straits near Bangor.
- 2.27 Regarding vegetation cover, the lower lying areas to the northwest of the mountains and southeast part of Anglesey are comprised predominantly of agricultural grazing land interspersed with woodland blocks (some large) and many groups of mature trees. While most field boundaries are defined by stone walls there are a significant amount of mature trees and other vegetation associated with these features. Rivers such as the Rhythallt / Seiont and lower reaches of the Ogwen are also lined with mature and often dense tracts of vegetation.
- 2.28 As the slopes steepen towards the mountains i.e. Glyder Ridge and Carneddau Range the vegetation cover dissipates with rough upland grassland and heath giving way to bare rock and scree. The summits of the ridge features having virtually no visible vegetative cover at all.

Geology

- 2.29 The geological setting of Penrhyn Quarry has been comprehensively described in connection with planning application ref. C12/0874/16/MW (the re-alignment application) and the Environment Act Review (ref. C16/1164/MW). This report, produced by GWP Consultants, has been updated to include the findings from more recent geological mapping and drilling. The updated report¹ is appended to this Chapter (as **Appendix 2/1**).
- 2.30 The 1:50,000 geological map of the District (Sheet 106 – Bangor) and 1:10,000 geological sheets SH 66 NW and 66 SW, published by the British Geological Survey, indicate that Penrhyn Quarry lies within the Llanberis Slate Formation of Cambrian age (550 million years old). These published maps show that this formation comprises mainly of purple, red, green and blue-grey silty mudstones (slates), inter-bedded with thin units of coarser siltstones and sandstones.

Figure 2-3
Published Cambrian Stratigraphy of the Bethesda Area

Stratigraphy	Formation	Lithology
Cambrian	Marchlyn Formation	Silty Mudstones
	Bronllwyd Grit Formation	Coarse Sandstones
	Llanberis Slate Formation	Mudstones
	Fachwen Formation	Siltstones and Sandstone
	Padarn Tuff Formation	Volcanic Ash-flow Tuffs

- 2.31 At Penrhyn Quarry, the Llanberis Slates Formation is unconformably (and possibly fault bounded) to the north by the linear outcrop of the underlying Fachwen Formation, and the more extensive Padarn Tuff Formation. To the southeast, the slate belt appears to be conformably overlain by the coarse sandstones and grits of the Bronllwyd Grit Formation and the silty mudstones of the Marchlyn Formation. To the southwest of the current workings, the published information also shows that the solid (Cambrian) strata are overlain by Glacial Boulder Clay, which buries the solid strata under 5 to 30m of boulders and gravel in a clay matrix.
- 2.32 The Cambrian sequence in this area has undergone low grade regional metamorphism which has altered the general rock characteristics, and has included a well-developed (slaty) cleavage into these fine grained deposits. The cleavage recorded in this area is generally sub-vertical (dipping at about 80° to the southeast) and lies sub-parallel to the principle (northeast / southwest) fold axes developed in this part of region.

¹ Penrhyn Quarry Realignment 2019 - Geological Statement

- 2.33 The Llanberis Slates are characterised by the presence of numerous sub-parallel NE-SW trending major faults, and associated anticlinal and synclinal axial fold lines. Within the quarry, the slates themselves are folded and are cut by a series of faults which form distinctive geological and geotechnical domains. The contact with the younger strata of the Fachwen and Padarn Tuff formations to the northwest has been mapped as being faulted whereas the contact with the Bronllwyd Grit to the southeast is thought to be conformable.
- 2.34 Those parts of the sequence exposed within the quarry workings, are seen to be affected by numerous sub-vertical dolerite dykes of Ordovician age which both follow and cross (obliquely) the trend of the main structural elements. The dykes have been altered during regional metamorphism and are strongly boudinaged² and pervasively mineralised.
- 2.35 The overall structure within the quarry comprises a large synclinal fold (bordered by a large anticlinal fold in the northeast of the North Quarry). The faulted axis of the syncline runs roughly northeast to southwest along the centre of the quarry areas. The trend of the fold axes is coincident with the cleavage. The folded strata are transected by a number of sub-vertical faults, the majority of which also trend northeast to southwest although less frequent north to south cross faulting is also developed. The majority of faults are thought to have normal displacements to the south without any significant lateral displacement. The throw across individual faults is difficult to establish but is thought to be generally in the order of 5-40m. However, there is inferred to be significant vertical throws (of c. 150m) across two major 'boundary faults' which effectively subdivide the South Quarry into three parallel geological and geotechnical domains from which similar slate product materials are currently derived.
- 2.36 Geological and geotechnical domains comprise areas of similar geological materials and or geological structure. In the South Quarry there are three such domains separated from one another by the large 'boundary faults' which trend sub-parallel to the direction of quarry face advance. They comprise:
- The **Hard Greys Domain** (in the south eastern faces). This domain is separated from the adjacent Purple Domain by the Hard Grey Fault. The strata comprises the silty, purple/grey slates and thin sandstones of the Hard Grey sequence.
 - The **Purple Domain** (the advancing south western faces). This is the area from which the slate block for roofing slate is derived.
 - The **Red and Blues Domain** (in the north western faces). This domain is separated from the adjacent Purple Domain by the Purple Boundary Fault. The area is transected by numerous small faults of similar orientation to that of the Hard Grey and Purple Boundary Faults. Slate extracted from the Red and Blue domains are used to produce decorative aggregates.
- 2.37 The slate rock is weathered to a depth of approximately 55m in the more competent Hard Grey Domain and 55-65m below ground surface elsewhere within the Purple Domain. This currently

² A structure which is sometimes present in metamorphic rocks apparently as a result of tension and in which a competent bed is thinned and thickened so that it resembles in cross section a string of sausages

coincides roughly with the William Parry bench level at c. 342m AOD. The weathered slate from the Hard Greys and Purple Domains comprises overburden which goes to tip. Some of the weathered materials from the Reds and Blues Domain may be suitable for use as decorative aggregate.

- 2.38 As noted above, the strata are cut by numerous sub-vertical dolerite dykes of Ordovician age. These are igneous intrusive features generally less than 6m in width and which have been subject to regional metamorphism resulting in them being strongly boudinaged (pinched at irregular vertical intervals). The effects on the adjacent baked slate aureole are variable. In the majority of instances the slates are baked in an aureole extending no further than 3-4 from the dyke margins. The baking removes the slaty cleavage making the baked rock unsuitable for slate making; beyond the aureole there is generally no change in joint spacing. However, the recently exposed large dyke at the southern end of the South Quarry displays distinctly different characteristics. In this instance the slate well beyond the baked margins of the dyke is intensely fractured and altered such that no workable material for producing slates can be recovered from this area. The margin of unworkable slate extends 25m either side of the dyke margins, giving a barren area over 50m wide.
- 2.39 The soil type at the proposed extension area (taken from the LandIS Soilscales website, developed by Cranfield University³) are described as “*Slowly permeable and wet very acid, upland soils with peaty surface*” (Soilscale 19). These soils are classified as a low fertility and drain to the local stream network. To the east is Soilscale 16, which is described as “*Very acid loamy upland soils with a wet peaty surface*” and has a low fertility. As such the proposed extension is not considered to be ‘best and most versatile’ agricultural land.

Hydrology

- 2.40 Based on the assessment undertaken by Envireau Water (refer to Chapter 9) the principal watercourse adjacent to Penrhyn Quarry is the Afon Ogwen which flows in a north-westerly direction, to the east of the quarry. The Ogwen has a catchment area of approximately 32km² up to where it borders the quarry, comprising predominately upland mountainous terrain. Immediately adjacent to the quarry boundary at the location of the old quarry void, the elevation of the Afon Ogwen ranges from 160 to 145m AOD falling steeply towards Bethesda where it reaches an elevation of 110m AOD. At Bethesda, the Afon Caseg and the Afon Llafar converge with the Afon Ogwen before discharging some 7km downstream, to the Menai Strait on the eastern side of Bangor, Gwynedd.
- 2.41 Several other minor watercourses are located to the south-west of the quarry, close to the proposed extension area. A watercourse rises on the western boundary of the proposed extension area at an elevation of circa. 390m AOD. A second watercourse rises immediately to the north of the northern boundary of the extension area. Observations at the quarry by Company employees have shown that both of these watercourses experience rapid, high flows following heavy rain, due to the upland nature of the catchment. These streams are also known to dry out during extended periods of little or no rainfall.

³ <http://www.landis.org.uk/soilscales/>

- 2.42 The Afon Marchlyn Mawr rises to the south of the quarry from the upland area, flowing 200m to the west of the proposed extension area. The proposed extension area does not extend into the Afon Marchlyn Mawr catchment area. These watercourses drain to the Galedffwrdd at Mynydd Llandegai. Galedffwrdd rises on Gwaen Gynfi wet heathland and flows northeast to the Afon Ogwen at Tanysgafell.
- 2.43 Marchlyn Bach Reservoir and Marchlyn Mawr Reservoir (both natural dammed lakes) are situated approximately 1km and 1.5km to the south of the proposed extension area, respectively. These reservoirs form the source of the Afon Marchlyn Bach and Afon Marchlyn Mawr watercourses.

Hydrogeology

- 2.44 Again, based on the information presented in Chapter 9 the mud indurated nature of Slate makes it effectively impermeable; however, faulting, jointing, fracturing and cleavage planes in Slate provide a secondary permeability. The slates of the Llanberis Slate Formation at the quarry have been designated by the Environment Agency / Natural Resource Wales as a secondary B aquifer - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- 2.45 The Llanberis Slate Formation can contain sandstone units. These sandstone units are not present at the quarry; however, they are located to the north west of the quarry.
- 2.46 The sandstone units of the Llanberis Slate Formation; the Padarn Tuff Formation and the Bronllwyd Grit Formation in the vicinity of the quarry are designated as Secondary A aquifers - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These units do not occur on the quarry or extension area but are present to the north west of the quarry.
- 2.47 The superficial deposits in the vicinity of the quarry are designated as unproductive strata.
- 2.48 Evidence at the quarry shows that groundwater movement / storage is very low. It is reported by Welsh Slate that the quarry does not undertake any groundwater dewatering of the current quarry void. Pumping from the quarry sump area does occur and although this may contain a minor component of groundwater, the vast majority of water removed is the result of the accumulation of surface runoff and rainfall.

Sensitive Receptors

Land use designations

- 2.49 The following designations lie in close proximity to the quarry:
- Snowdonia National Park;
 - Snowdonia Special Area of Conservation (SAC);
 - Eryri Site of Special Scientific Interest (SSSI);
 - Scheduled Monuments;

- Ty'n Twr close to junction of A5 and B4409
- Slate Gwaliau at Felin Fawr, Penrhyn, near Coed-y-parc
- Penrhyn Quarry railway, north of Coed-y-parc
- Penrhyn Slate Quarry Railroad, north of Coed-y-parc
- Penrhyn Quarry: relict areas, quarry hospital and underground levels

2.50 The SSSI and SAC affect land within the proposed extension. The Scheduled Monument within Penrhyn Quarry (which was designated in August 2021) lies within the North Quarry area, away from the proposed extension.

Residential/Human receptors

2.51 The quarry is located within a rural location with a number of isolated properties surrounding it: the majority of receptors are located to the north of the quarry, with some in close proximity to the boundary of the quarry (for example Owgen Holiday Park, Tai Pont Twr, Grisiau-Cochion and 3 Tai Duon are all within 100m of the quarry boundary). The southern edge of the village of Bethesda is located around 350m from the northern edge of the quarry boundary (which is formed by a historic slate tip).

2.52 In the context of the proposed extension, the closest receptors are located off Tan y Bwlch (approximately 1.3km to the north-northwest) and Gefnan (approximately 1.8km to the north). A small number of individual properties also lie around 1.7km to the south-west of the proposed extension. For context, the southern edge of the village of Bethesda is over 2.8km to the north-east, whilst the settlement of Deiniolen is a similar distance to the west-southwest.

SITE AND PLANNING HISTORY

2.53 Whilst there is a long history of quarrying at Penrhyn the planning history starts with the original grant of planning permission for “proposed tipping and quarrying development” on 12 November 1947. This permission was subject to the registration procedure under the Planning and Compensation Act 1991, with the registration granted by Gwynedd Council on 7 November 1994. This consent previously governed all workings that have taken place at Penrhyn up until 2000 when the consolidating Planning Permission C96A/0020/16MW was granted. That permission was amended in 2008, with a new permission (C08A/0039/16/MW) issued on 9 June 2008.

2.54 In December 2012 planning permission (C12/0874/16/MW) was granted for a “*proposed extension and re-alignment of slate extraction operations with a progressive scheme of restoration*”.

2.55 Most recently, all of the mineral planning permissions were reviewed under the provisions of the Environment Act 1995. The development scheme for the quarry was subject to an EIA and new conditions issued for the whole site (decision ref. C16/1164/16/MW).