Gwynedd Slate Industry Transport Routes

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Cadw

Llywodraeth Cymru
Welsh Government

Gwynedd Slate Industry Transport Routes

Project No. G2302

Report No. 1207

Prepared for: Cadw

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Abbreviations

The following abbreviations are standard:

BU: Bangor University
CR: Cambrian Railways
CRO: Caernarfon Record Office
DRO: Dolgellau Record Office
FR: Festiniog Railway
F&BR: Festiniog and Blaenau Railway
GAT: Gwynedd Archaeological Trust
GWR: Great Western Railway
ICE: Institution of Civil Engineers
LMS: London Midland and Scottish (Railway)
LNWR: London and North Western Railway
NLW: National Library of Wales
NRM: National Railway Museum
NWNGR: North Wales Narrow Gauge Railway
PTyB: Plas Tan y Bwlch
SAM: Scheduled Ancient Monument
TR: Talyllyn Railway
TNA: The National Archives
WHR: Welsh Highland Railway

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1 INTRODUCTION

1.1 Project Aim

The slate quarrying areas of Gwynedd have recently been included on the UK shortlist for new World Heritage Sites to be submitted to UNESCO. Cadw grant-aided projects undertaken by the Trust have previously involved the assessment of the archaeology of the slate industry (*Gwynedd Slate Quarries* 1995); this examined the documentary resource relating to the Gwynedd slate quarries and from this research, quarries were selected to be surveyed that contained the more significant archaeological remains (*Gwynedd Slate Quarries: mills, power systems, haulage technology, barracks* 1997). Other reports have considered other extractive industries. Studies have also been undertaken of the archaeology of the coastline, the major slate exporting harbours (Port Penrhyn [Abercegin], Caernarfon and Porthmadog [GAT 2005]), and of some of the many smaller ports, quays and jetties.

This report therefore addresses a schematic gap in our understanding of the resource between the quarries themselves and the harbours, namely the overland transport systems which connected the quarries with navigable water.

This project considers the transport infrastructure which underpinned the industrial landscapes, and how they linked inland slate quarries to the coast. The recent Cadw grant-aided characterisation projects have identified not only the significance of inland transport routes as landscape elements in their own right, but also their impact in terms of settlement, building material and architecture. Our understanding of the evolution of the historic landscape is, therefore, dependent upon a clearer perception of the transport routes and systems which have shaped it.

1.2 Scope

This document includes all dedicated slate transport routes within the county of Gwynedd as defined by the 1974 boundaries, though it is noted here that the World Heritage bid only includes potential sites within the present day county of Gwynedd.

Not included are standard gauge railways forming part of the national (UK) railway network.

1.3 Definitions

Edge railway – a railway system in which the flange is on the wheel, not on the rail; as such, the dominant type of railway technology.
Industrial railway – a railway built to serve the needs of an industrial undertaking; not a public railway.
Industrial road – a road built to serve the needs of an industrial undertaking; not a public road.
Narrow gauge railway – a railway to a narrower gauge than a standard gauge railway.
Parish road – a road built and maintained by the parish authorities.

Plateway – a railway system in which the flange is on the rail, not on the wheel; a common technology from the 1780s to the 1830s.
Public railway – a railway so constituted that it carries all types of goods and possibly passengers also, by statute.
Public road – a road managed in such a way (eg by turnpike trust or by local authority) that it carries all types of traffic.
Railroad – edge iron railway of the hybrid (experimental) type from the early nineteenth century.
Railway – a guided system for railed vehicles; as such includes plateways, railroads and waggonways.
Shropshire railway – an early wooden rail system typically of narrow gauge.
Standard gauge railway – a railway built to the Stephenson gauge of 1.435m/4' 8½" inches.
Turnpike – a road managed by a turnpike trust, abolished by the Local Government Act of 1888.
Tyneside railway – see waggonway.
*Waggonwa*y – a wooden edge-rail system typically to a gauge of between 1.2m-1.5m/4' and 5', associated with the collieries of the north-east of England in the 17th and 18th centuries.

The word 'tramway' is often used but is avoided here as ambiguous since it can mean any early railway, a plateway, any industrial railway, and an urban or inter-urban street railway. The Croesor, the Rhiwbach and Hendre Ddu systems are often called 'tramways' but are referred to as railways here.

1.4 Contribution to Welsh Government Priorities

Programme for Government

By identifying new sites and assessing the status of known sites, and by encouraging volunteers to become involved, this project will contribute to:

- Designation of heritage assets
- Widening access to our culture and heritage

Historic Environment Strategy for Wales

This project will contribute to the following priorities:

- Heritage Protection
- Providing evidence for heritage at risk
- Preparation of guidance on the protection of heritage assets of local importance
- Developing skills in the community

Pan Wales Heritage Interpretation Plan

This project will contribute to the following priorities:

- encourage appreciation of the historic environment
- foster understanding and care about the historic environment and heritage

Cadw Community Archaeology Framework

This project will aim to:

- Encourage participation in heritage projects

- Encourage active learning about the history of the area
- Offer opportunities to acquire new skills
- Engage new audiences
- Contribute to new research

2 EXISTING APPROACHES

2.1 Existing approaches to the archaeology of industrial transport systems

The detailed archaeological study of industrial transport systems dates back to the 1960s, though the Newcomen Society had published articles on canals from as early as 1951.

Dr Michael Lewis' *Early Wooden Railways* is the work of a classical archaeologist who identified the need and opportunity to analyse the material and the documentary evidence in relation to each other. In this study, Dr Lewis established the typology of the 'Tyneside railway' and the 'Shropshire railway', both dating from the very early years of the 17th century, the former characterised by a comparatively broad gauge (1.2m-1.5m/4'-5') and typically the use of one horse to pull one substantial wagon, the latter to a narrower gauge (0.6.-1m/2'-3'3") and the custom from very early on of coupling the smaller wagons to together to form a train (Lewis 1970).

Dr Lewis subsequently applied the same blend of documentary research and examination and of material evidence to the Gwynedd slate industry in the archaeological campaigns he conducted with volunteer input on behalf of Coleg Harlech and later the Snowdonia National Park. The archive of this summer school, still active under the tutelage of Dr D Gwyn and Ms Celia Hancock, is preserved at PTyB and has informed the present document. At RCAHMW, Stephen Hughes' *Brecon Forest Tramroads* follows Lewis in placing equal emphasis on material and documentary evidence and confirms the typology of Lewis' study, but also offers a three-age chronological sequence of *simple railways* (1603 onwards), *hybrid (experimental) railways* (early nineteenth century onwards) and *modern railways* (1830 onwards with the opening of the Liverpool and Manchester and of the Baltimore and Ohio). It has become clear that Wales had an extensive if un-quantified network of track (probably the densest in the world, and certainly well over 1,500km in length) before the modern railway in the shape of the Taff Vale made its appearance in 1840-41. In addition, Wales' needs and industrial capacity had made possible such important 'firsts' in railway technology as the locomotive (1804), passenger transport (1806, if not earlier) and articulated rolling stock (1821), as well as the early development of long-distance town-to-town services.[1]

More recently, historians have also discussed the validity of an *early main line* period from 1830 to mid-century. A more recent study by Lewis considers the question of the evolution of the industrial railway post-1830 as an adjunct to the main-line modern railway, and remarks:

The history of the industrial railway naturally divides itself into two broad periods, markedly distinct yet bound by a strong continuity. The first period is that before the Railway Age – before, let us say, 1830 – when virtually every railway was built for a purely industrial purpose. The second embraces the Railway Age and beyond, when the industrial railway continued to serve exactly the same function, but no longer stood alone. There has been a tendency, except among the relatively small band of devotees, to dismiss the industrial railway as something of a poor relation of the public passenger railway: at first as the uncouth and primitive caveman contrasted with his cultured and technically advanced descendants, later as the humble artisan cousin of the urbane tycoon of big business. Such a view lacks historical balance (Lewis 1999).

Other than Lewis, however, no historian or archaeologist has studied this question further. A review of the available literature however, strongly suggests that in the period 1830-1860, industrial railways tended to perpetuate pre-1830s technologies or did their best to adapt main line practice to

[1] For instance, the 84km journey from Hereford to Newport could be made by rail from 1829 (Lewis 2014)

the sharp curves and confined spaces that collieries, contractors' sites and ironworks required. The constant improvement in locomotive performance meant that design-expired machines that had been built for express passenger work could be snapped up cheaply and put to shunting. Some attempt was made to devise new traction systems suitable for small-scale industrial undertakings such as the portable railway devised by William Crosskill of Beverley (Yorkshire) in the 1850s, which was never really successful. By the 1860s purpose-built tank locomotives to all gauges between 0.6m and 2.13m were becoming more readily available from manufacturers who came to specialise in this sort of work, by which time the Festiniog Railway was also offering a model for both cheaply-constructed secondary lines as well as for internal railways in industrial undertakings.

In recent years there has been a considerable expansion of interest in pre-1830s railways, reflected in several publications, including the proceedings of a series of international conferences since 1996 and the publication by Helen Gomersall and Andy Guy of *A Research Agenda for the Early British Railway* in 2008 (http://www.rchs.org.uk/trial/Research%20agenda.pdf).

The archaeology of both pre-and post-1830 railways is considered by Ransom 1981, Morriss 1999 and Palmer, Nevell and Sissons 2012 as well as in several papers in the *Early Railways* series.

These studies and the approaches they embody are set out in detail here because they are relevant to the specific circumstances of the slate-carrying narrow-gauge railways in Gwynedd, some of which are essentially early industrial railways from the 'hybrid' period, which in the 1860s and 1870s were mainly either replaced by, or modernised to become, smaller versions of the locomotive-worked modern railway. It is likely that they will contain both 'hybrid' and 'modern' features.

Industrial roads by contrast have been much less studied. Gomersall and Guy (2008) remark of the Newcastle 'wainways' built as alternatives to the extensive network of wooden waggonways serving the collieries of the north-east, 'Almost nothing is known of them' and recommend 'Any roadways of the 18th century or earlier that may have been purpose-built for private goods traffic alone should be subject to detailed archaeological examination.' There is evidence that by the end of the 18th century, engineers had developed a sophisticated grasp of the relative advantages and disadvantages of roads, canals and railways for the transport of goods and minerals (ICE Accession 1803DunnC). The archaeology of turnpike roads has been analysed in some detail (eg Quartermaine et al, 2003) but so far as is known, the only study of industrial roads in a Welsh context, perhaps in any UK context, is Hughes's forthcoming *Swansea Canal*. The challenge is compounded by the fact that roads are subject to unremarked-on changes in the way they are administered – a private industrial road might become a turnpike – and incremental, non-transformative improvements in their engineering. Records are scanty and away from the main routes built by Telford, Rennie and their circle, roads were often the responsibility of parish overseers with no ambitions to make a name for themselves, and gangs of local labourers (see Gwyn 1999 for discussion). Railways, by contrast, are capital-intensive and draw on a much wider variety of skills which leave a much wider archive.

2.2 Existing approaches to heritage and conservation of slate transport routes

Plate 1 A busy day at the Harbour station on the Festiniog Railway, a popular tourist destination (Copyright Festiniog Railway).

Of the railways which form part of this assessment, the FR, the WHR and the TR are all in operation as heritage railways over their historic routes, the Corris Railway Society operates over 1.2km of the former route, a short length of track has been brought back into use on the course of the Penrhyn Quarry Railway, the Welsh Highland Heritage Railway operates at Porthamdog and the Padarn Lake Railway runs trains over 4km of the former Dinorwic Quarry Railway. It is noted here that these systems constitute significant tourist attractions, and a major factor in regional economic regeneration and a focus for railway enthusiasm all over the world (Plate 1). Those involved in these railways have a strong sense of their heritage, and whilst this is often centred on iconic locomotives and carriages, and has to be tempered by the need to meet modern standards for safety-critical work, they have increasingly demonstrated a readiness to work to the highest heritage standards. The FR, for instance, has a subsidiary company entirely dedicated to heritage and routinely carries out Conservation Management Plans for all major heritage projects, which have included the restoration of much of its historic fleet of slate wagons (Plate 2 and Plate 3). The TR maintains links with heritage professionals through the Narrow Gauge Railway Museum Trust.

Plate 2 A Talyllyn loco pulling restored slate trucks.

Plate 3 A Festiniog Railway gravity train showing restored/conserved wagons.

2.3 Existing approaches to railways as World Heritage sites

The key text for considering railways as potential World Heritage sites is Coulls, Divall and Lee 1999. This notes:

> Not all railways worthy of World Heritage status need to be designated in their own right. Railways have always been built as a means to some other end, and it would be fitting if this fact were reflected by the inclusion of railways as integral parts of locations designated as World Heritage sites partly or chiefly for other reasons.

In addition, Gwyn, Cossons and Rees 2012 (the Baseline study prepared for Gwynedd County Council) point out:

> It is also noted that there are three railway World Heritage Sites and eight on the tentative list (one being an extension of an existing site), as well as another transport link in the shape of the Augustów Canal in Poland. Inclusion of railways associated with the slate industry will therefore require a robust case. Of particular relevance are the chemin de fer de Cerdagne, an operational narrow-gauge electric railway in the Pyrenees, and the Sistema Ferrocarril Presidente Carlos Antonio López in Paraguay, the last major state-owned railway to be entirely steam-operated, using British technology, now believed to be disused.

Existing railway sites are:

- the Semmering
- Mountain Railways of India
- Rhaetian Railway in the Albula / Bernina Landscapes.

Tentative sites also include (in addition to those mentioned above):

- Les vestiges du train de Zinga (Central African Republic) – no criteria submitted; the description notes 'The site can be compared to Robert Island (sic), which is the symbol of overwhelming change to populations at a period of human history and which has contributed to an inter-cultural change.'
- Locomotive depot of the Temuco Railroad Station (Chile) – criterion iv (an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history)
- Malleco Viaduct (Chile) – criteria 1 (a masterpiece of human creative genius);and iv (see above)
- Extension to the Mountain Railways of India (Kangra Valley Railway, the Maharaja Railways and the Matheran Light Railway) – criteria ii (an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design)and iv (see above)

The following sites no longer appear to be on the tentative list:

- Railway Bridge Over Yenissey River (Russian Federation)
- Railway Station in the City of Aguascalientes and its Housing Complex (Mexico)

In addition, early railway sites (though not functioning railways) form part of the Pontcysyllte aqueduct and the Ironbridge Gorge World Heritage sites.

3 METHODOLOGY

3.1 Research objectives

The project identifies the resource and assesses its significance. It adds primary data to the study of transport infrastructure relating to the slate quarrying industry, and provides key management information to aid World Heritage Site nomination.

3.2 Identification of the resource

Sites were identified by examination of primary, secondary and cartographical sources, as well as material from the Gwynedd Archaeological Trust Historic Environment Record (HER) and National Monument Record (NMR). These were combined into a database with grid references allowing comparison to other source material though a Global Information System (GIS), in this case MapInfo.

The information in the basic database was supplemented by and checked against primary and secondary documentary sources.

3.3 Desk Top Study

3.3.1 Documentary resource

There is an abundant documentary resource for slate transport, although it is weighted very much in favour of railway systems. This reflects the fact that railways are complicated, capital-intensive and safety-critical, and therefore generate an abundant archive, and also that they attract the attention of enthusiastic amateurs, who research their history in great detail and publish their findings in specialist volumes.

3.3.2 Archive sources

Archive sources for roads and riverine/lacustrine transport include collections from lawyers' offices, primarily the Porth yr Aur collection in CRO, but also Poole, estate archives such as Vaynol and Glynllifon in CRO, Penrhyn in BU and Oakeley in DRO, and to some extent the archives of quarry companies. These include historic map sources. There are scattered references to pre-capitalised period in local history sources such as Hughes 1866, Williams 1869 and Williams 1983. Other visual sources are paintings, and from the 1860s onwards a few photographs.

Archive sources for the railways vary from the abundant to the scanty. The Festiniog Railway Company archives in CRO are exceptionally detailed. Some official papers of the Nantlle Railway are preserved in the CRO, including a few in the LNWR collection. Records of the Penrhyn and Dinorwic railway systems can be found in the collections of the quarries they served and of the estates on which they ran, in CRO and BU, as well as in the Slate Museum Collection in CRO. The Talyllyn's archive is in the DRO. Papers relating to the Corris Railway are mainly to be found in TNA, reflecting its curious history as effectively a 'bus company obliged to operate a railway as well, before becoming part of the GWR. Only incidental references can be identified for the Gorsedda railway (1856), the Croesor tramway, the Rhiwbach tramway and the Cwm Ebol-Pennal railway. This is to a great extent compensated by the assiduous researches of railway historians and quarrying and mining enthusiasts.

Plate 4 A rare illustration of a slate cart, on its way from Ffestiniog to one of the Dwyryd quays (NLW MSS 22341B).

3.3.3 Visual material

Photographs survive in numbers for some of the railway systems from the 1870s onwards. Some are in national collections such as those from John Thomas' Cambrian Gallery in Everton from NLW, and the FR commissioned its own photograph album from R.H. Bleasdale in 1887, which not only forms an important archive of how an intensely-worked public narrow gauge railway functioned at its height but also says something of its own self-identity as an organisation basking in international recognition (Gray 2003). Quite a number of photographs of the Talyllyn, Corris, Penrhyn and Dinorwic have been identified, but coverage of the Rhiwbach, the Gorsedda and the lower section of the Nantlle from Pen y Groes to Caernarfon varies from scanty to non-existent. Ciné film of the last years of operation on the Penrhyn, Dinorwic and Nantlle is commercially available.

The assiduous researches of local and industrial historians have identified paintings and sketches of slate quarry transport from before the era of photography which are useful for conveying details of items such as carts which do not survive (Plate 4).

3.3.4 Secondary studies

The works of James Boyd and Peter Johnson among others (see Bibliography) have greatly expanded knowledge of, and increased interest in, Gwynedd railway history. Boyd's histories are firmly of the 'internalist' school (that is, focussing on the technical and mechanical aspects of what it takes to run a railway) and were written before the advent of online sources, whereas Johnson's studies have increasingly come to consider corporate history and the relationship between the regional economy and the transport systems they called into being. Dr Michael Lewis' studies have examined the very

early capitalised period of the industry (1760s to 1850s) and include roads and river shipping as well as rail transport, but concentrate on the Ffestiniog and Glaslyn areas. Some of the 19th century parish historians such as Hughes 1866 and Williams 1882 have left valuable testimony of the pre-railway period - Hughes for instance wrote at a time when the old slate route from Penrhyn down to Abercegin (PRN 59463) was still an inherited memory, even though it had been displaced by Ffordd y Lord in the late 18th century, which in turn yielded to the railroad in 1801.

On a global scale, Ransome 1996 is an excellent study of technology transfer in this period, and Hilton 1990 is not only a magisterial study of American narrow gauge railways but also analyses the gauge question very thoroughly, and devotes the first chapter to an examination of the FR's influence on narrow gauge practice world-wide.

3.4 Choice of routes for assessment

Routes for assessment were selected on the basis that their *raison d'etre* was the industrial transport of slate on the first stage of its journey from the quarry to wider markets. For this reason, pre-industrial roads were not included unless there was compelling evidence that they had evolved into being a significant slate transport route at a later stage. Turnpike routes were not included, on the basis that they are the subject of another assessment, with the one exception of *Ffordd y Lord*, the Penrhyn quarry's road of the late 18th century, which seems to have been turnpiked early on (as witness the place-name Hen Dyrpeg along its route) but which is still under-researched. Similarly parish roads were not included. Overall, it proved difficult to confirm that some smaller roads were built with slate transport in mind, and difficult to identify how exactly some quarries that are known to have been productive in the pre-railway period, such as Cilgwyn, transported their output. The following were identified:

PRN	Name	Map Figure Number
59296	Cwmorthin quarry road	20, 21
59297	Dinorwic quarry drag	8
59298	Dinorwic quarry road	6, 7, 8
59460	Fachwen quarry road	7, 8, 10
59299	Ffordd Casson	20, 21
59300	Ffordd yr Iuddew Mawr	19, 20
59301	Ffordd y Lord	2, 3
59302	Hafod y Llan quarry road	14
59303	Lord quarry road	21,
59304	Pant Mawr quarry road	19, 20
59305	Rhosydd quarry road	20
59306	Cefn Du quarry road	8, 10
59307	Cedryn quarry road	4
59308	Cwm Eigiau quarry road	4
59309	Melynllyn quarry road	4
59463	Penrhyn quarry road to Aberogwen	2, 3

One canal was identified:

PRN	Map Figure Number	Map Figure Number
59310	Cemlyn canal	19

Railways were included which took slate either to coastal or harbours or the main-line network or both, but railways built under the auspices of the major British companies to form part of the UK system were not. Two lengths of railway which carried little or no slate have also been included. These are the Welsh Highland Railway, of which the central section carried primarily passengers, timber and agricultural goods, and the Festiniog Railway's deviation. The first is included because its complicated genesis makes it illogical to exclude it and because its route at Cwm Cloch illustrates the comparative potential of steam and electric traction on the 0.6m gauge. The second, a diversionary route making use of a spiral formation built from 1965 to 1978, is included for two reasons. One is because it forms part of the route path of the railway's demonstration slate gravity trains and also because it provides a strong visual contrast with two earlier methods of negotiating a challenging landscape, the incline system of 1836 and the tunnel of 1842. The second is that it exemplifies how a technology used on the Festiniog-inspired Darjeeling Himalayan Railway has been applied locally.

The following were identified:

PRN	Name	Map Figure Number
59459	Alexandra quarry railway	11, 13
59311	Blaen y Cwm quarry railway	21
59312	Braich quarry railway	13
59313	Bryneglwys quarry railway	25
59314	Bryngwyn to Fron quarry railway	13
59315	Cedryn quarry railway	4, 5
59316	Corris Railway	27, 28
59317	Craig Ddu quarry railway	21
59318	Croesor railway	18, 19, 20
59319	Cwm Ebol quarry railway	26
59320	Cwm Eigiau quarry railway	4
59321	Cwmorthin quarry railway	20
59322	Cwt y Bugail quarry railway	21
59323	Dinorwic quarry railroad	6, 7, 8
59324	Dinorwic Quarry Railway	6, 7, 8, 10
59325	Festiniog Railway	19, 20, 21, 23
59326	Festiniog Railway deviation	20,
59461	Festiniog Railway inclines	20,
59327	Gorsedda Junction and Portmadoc Railways	16, 17, 22, 23
59328	Gorsedda railway	17, 22, 23
59329	Hafod y Llan quarry railway	14,
59330	Manod/Bwlch y Slaters quarry railway	21
59331	Moel Tryfan quarry railway	11, 13
59332	Moelwyn quarry railway	19, 20
59449	Nantlle Railway	9, 11, 13
59450	Pant Mawr and Fron Boeth quarry railway	19,
59451	Penrhyn quarry railroad	2, 3
59452	Penrhyn Quarry Railway	2, 3
59453	Rhiwbach quarry railway	21
59454	Rhosydd quarry railway	19, 20
59455	Talyllyn Railway	24, 25
59456	Talysarn to Fron quarry railway	13
59457	Welsh Highland Railway	9, 10, 11, 12, 13, 14, 16, 18, 22, 23
59458	Wrysgan quarry railway	20

59462	Rhos quarry railway	15

3.5 Digitisation

Each separate transport route was identified by a GIS polygon with its unique PRN. It was given a name based on its official title if a publicly-constituted or officially-recognised entity (therefore, for instance, Gorsedda Junction and Portmadoc Railways) or by the most logical and easily-understood denominator otherwise (Gorsedda quarry railway for the earlier part of the system). In the three cases, established local names have been used, *Ffordd y Lord*, *Ffordd yr Iuddew Mawr and Ffordd Casson*, in order to keep these names in memory.

As much as possible, this polygon in each case respects what is known of the extent and function of the transport system it identifies. Polygons defining roads were created in such a way as to include their present-day earthworks and cuttings, but it is noted here that these may bear little or no resemblance to their earlier 'industrial' role – for instance, part of the Cwmorthin quarry road of *c.* 1827 now forms part of the A470, having been incorporated into the Portmadoc and Beaver Pool Turnpike in the intervening period. Routes were digitised as far as their statutory authority extended, and branches were digitised separately and given a separate PRN.

It was considered counter-productive to attempt to include road infrastructure in the GIS layers, as there is no certainty that any infrastructure necessarily has any association with the slate-carrying function of the road. Railway infrastructure however was included within the GIS mapping; it would be illogical to exclude it given the nature of railway operations where – for instance – a signal box located on a station platform might control signals at some distance from the main station complex. Given the time-constraints of the project, individual items within the railway ensemble could not be digitised, and this assessment restricts itself to identifying the most significant examples and providing an overall discussion of their importance on the basis of the authors' personal knowledge and professional judgement of the resource.

3.6 Field work

Field work was undertaken during March 2014 and has been augmented by the authors' personal knowledge of the sites.

4 FINDINGS OF THE STUDY

4.1 Historical context

There is evidence that slate industry of Gwynedd has its roots in the Roman period, and seems to have been revived in the early second Christian millennium. The industry remained small-scale until the late 18th century when various factors combined to increase the demand for roofing materials within the United Kingdom, Ireland and further afield.

Expansion of the industry took place by fits and starts, but by the late 19th century Gwynedd was supplying approximately one third of the slate-products produced world-wide, competing in a global market with other quarries in England, France, Belgium, Germany, the USA, Scotland, Ireland, Spain, Portugal and Scandinavia, and was employing 16,000 men in about 60 quarries.

The Gwynedd slate industry possessed a number of advantages compared to many of its competitors; not only where the slates themselves mainly of good quality but many of the quarries lay within comparatively near reach (9km) of navigable water. The overland journey between quarry and shipping point nevertheless called for engineered transport routes, variously roads, a canal and railways, once output started to grow.

Changes in this basic pattern become evident from the mid-19th century. Main-line railways forming part of the UK network increasingly took over from coastal shipping, though this did not always have a major effect on the quarries' own overland transport systems, as often the point of interchange was at the harbour, or at least towards the sea-ward end. In addition, some railways such as the Talyllyn, and some roads, were built specifically to connect with the main line. Rail transport of slate remained economically viable in some circumstances until the 1960s, with the result that several mid-Victorian slate-carrying railways remained in use until well within living memory. By then, two of them, the Festiniog and the Talyllyn, had already found a new lease of life as visitor attractions. The overland transport of finished slate from the remaining productive quarries has been carried out exclusively by road lorry since 1965.

4.2 Roads

4.2.1 Historical context to slate roads

No indication survives of the routes by which slate was transported overland in the Roman period or the Medieval. Documentary evidence is only available from the mid-18th century, and road transport of finished slate only predominates thereafter until the early/mid 19th century. Documentary and archaeological evidence confirms that such roads include routes for pack-horses, characterised by minimal engineering, and roads for horse-drawn carts which have been successively upgraded to accommodate motor vehicles. Other than a few dedicated roads in very remote areas, most have been improved since they were last used to transport slate. Instances of roads that may include evidence of this industrial function are probably confined to a few examples where the quarry was remote and closed early, or where it developed other transport links. *Ffordd yr Iuddew mawr*, and the upper stretches of the roads to Hafod y Llan, Cwm Eigiau and Cedryn quarries are probably little changed since the 1860s.

4.2.2 Archaeology of slate roads

4.2.2.1 Engineering

Within the confines of the project, only a rapid assessment of the engineering of identified slate roads is possible. In some cases, zig-zag routes were employed to gain height such as at the Dinoriwc 'drag' and at Hafod y Llan, and it is no surprise to read that horses were attached behind carts to act as a brake. In the absence of detailed gradient surveys, it is not clear to what extent road-builders worked to understood principles of engineering, or how their skill levels compare to those from other regions.

4.2.2.2 Bridges

Stone bridges vary from the very simple – clapper bridges formed out of slate slabs – to the unusual four-arch Pont Penllyn, built in 1826 to carry carts from Fachwen quarry to the turnpike (SH 55944 62333, listed Grade II, ID 21856).

It is unlikely that the fine cast-iron bridge by the Penydarren Ironworks dated 1824 at Abercegin (NPRN 43080, SH 6106 7215) was ever associated with the road movement of slate even though it lies on the route between the creeks of Abercegin and Aberogwen, but it is mentioned here for completeness' sake.

4.2.2.3 Infrastructure

Very little in the way of infrastructure was noted; records speak of horses pulling slate carts being hired in by the day from local farms, and specific facilities to stable or to shoe them would not have been needed.

At Llwyn y Gwalch south of Caernarfon there survives an attractive farm dwelling of markedly 'polite' architecture, which lies on the Cilgwyn quarry road (SH 4747 5637) and may have been where the horses were grazed. Ty Mawr, a large estate-sponsored farm complex near Tywyn (SH 5971 0087), is identified by Boyd (1988) as where the horses pulling carts of Bryneglwys slate were changed for the comparatively brief period in the 1860s before the railway was completed.

The village of Pen y Groes is believed to have grown up at the intersection of the quarry road to Cloddfa'r Coed and the north-south turnpike when a smithy and wheelwright's establishment for the slate carts were set up there.

4.2.2.4 Accommodation and settlement

Roads, cross-roads and level crossings with railways (see below) often served as a focus for workers' housing.

Linear developments along quarry roads include the early quarrymen's housing built by Lord Penrhyn along *Ffordd y Lord* between Hen Durnpike and Coed y Parc by the 1790s. The same process can be identified as what ultimately became the town of Ffestiniog evolved in the period 1830-1870, though here the quarrymen themselves and their families seem to have been the principal agents. Four Crosses in Blaenau Ffestiniog, the point where Lord Street crosses the pre-industrial trackway to Rhiwbryfdir (SH 7040 4583), became a focus for the growing settlement (Gwyn 2002). The road junction at Pen y Groes is noted above.

4.3 Water-transport

4.3.1 Historical context to slate water-transport

Transport along navigable inland waters is attested from the mid-18th century to the late 19th. This includes the tidal waters of the Mawddach, the Dwyryd and the Conwy, and an inland lake, Llyn Padarn.

Understanding of the history and archaeology of these sites varies. Those on the Dwyryd have been recorded archaeologically by the PTyB group and the results published in Lewis 1989. One of them, Cei Tyddyn Isa (PRN 2593, NPRN 95498) is a SAM (ME108). Documentary research has been carried out on the Conwy river wharves but no archaeological survey has been undertaken. The Porth yr Aur papers in BU indicate boat-building to transport Dinorwic slate on Llyn Padarn, but paintings suggest that the loading and unloading points were in no sense engineered (Plate 5) (McElvogue 1999, Gisborne 1789).

4.3.2 Archaeology of water transport

4.3.2.1 Cemlyn canal

This was the only slate canal in Gwynedd. 285 metres long, it was constructed in or shortly before 1823, to serve a wharf which not only shipped a limited amount of slate but also functioned as a coalyard, and boasted a limekiln and a general warehouse, both of which continued to function until the 1850s (Lewis 1989).

4.3.2.2 Wharves and quays

Wharves and quays were identified on the tidal Conwy, Dwyryd, Maddwach and Dyfi rivers.

The quay at Trefriw, the main export point on the Conwy, is located at SH 780 639 and is believed to date from 1811-2. It formed part of a local entrepot for trade which included other quays for timber and lime, lead, corn, fulling, woollen and saw mills, a flax industry, a peat-processing plant, a limekiln and a shipyard, as well as slate-mills powered by the Crafnant stream (Lewis and Williams 1989).

Other Conwy slate quays were Cei Goed/Cei'r Ynys (SH 7763 6775), a simple wooden jetty of which no trace is believed to be evident, and two others, both stone-built, identified here as Tal y Cafn 1 and Tal y Cafn 2, the first of which (SH 7863 7188) served the Cedryn and Cwm Eigiau quarries from perhaps the 1820s until the building of their rail systems in 1863, the other of which (SH 7879 7183) served Cwm Machno up to the 1860s. Both survive well, though the up-river side of Tal y Cafn 1 has suffered some dilapidation; Tal y Cafn 2 retains a small dwelling or office which may have accommodated a shipping clerk, and a turning space which may reflect the use of the quarry's traction engine.

The wharves and quays along the Dwyryd have been examined archaeologically by Dr M.J.T. Lewis and by the PTyB group.

On the Mawddach, Ty'n y Coed quarry is believed to have had a wharf in the vicinity of SH 6518 1603, served by a railway system, including several inclines.

Plate 5 Slate boats at Cwm y Glo with the Dinorwic quarry in the background (Gisborne 1789; BM)

Of the wharves on the Dyfi, only Pennal/Llyn Bwtri lies within Gwynedd (SH 7029 9951). It is likely that the small quarries on the north bank may have used the river, but sites have not been identified.

4.3.2.3 Vessels

Three vessels for carrying slate in tidal waters have been identified.

A boat sunk with a cargo of 'countesses' and 'ladies' was raised from Llyn Padarn in January 1978 and is preserved in the National Slate Museum at Llanberis. It is a flat-bottomed keel-less boat of the type known as a *bateau*, dory, or flatner, a style of construction attested in Britain and Europe over many centuries and which was also used by trappers and lumbermen in most parts of North America in the 18th and 19th centuries. It measures 6.03 metres by 2.16 metres. It has a completely flat carvel bottom but its use of clinker sides, unusual in a Welsh context, suggests that it has more in common with the double-ended skiffs and yoles of the western seaboard of England and Scotland and of the Isle of Man, possibly as a result of boat-building influences in the port of Caernarfon. It had a capacity of one and a quarter tons (McElvogue 1999). Archives in Bangor University confirm the building of boats for the Dinorwic quarry partnership in 1788–89 for rowing cargoes of slate from Cei Llydan to Cwm y Glo and to Penllyn, and it has generally been assumed that the Padarn wreck is one of these, though Lord Newborough's Nantperis quarries also used boats on Llyn Padarn (Plate 5) (BU: Porth yr Aur 29085; Illsley 1979; Roberts 1979; Hyde-Hall 1952).

The remains of another were observed briefly during tunnel construction work near Conwy in December 1988, where it had been truncated by earthmoving machinery near its mast, revealing a cargo of stacked 'narrow ladies', presumably from one of the Nantconwy quarries. It was photographed by GAT and a cross-section sketch made, but no detailed measurements could be

taken. It was only about 2.7 metres in width; the carvel sides were apparent, though the flat bottom was buried. It probably predates the building of Telford's bridge at Conwy in 1826 since the mast could not be lowered.

The third was also discovered in 1988, in the saltings at Traeth Bach, below the mouth of the river. It measures 7.92 metres long by 2.9 metres in beam and about 1 metre deep from gunwale to keel, 'cod's head and mackerel tail' in shape, hybrid in construction – clinker sides and carvel bottom. A socket survives for a single mast, which could evidently be lowered; its position, about a third of the way back from the bow, suggests fore-and-aft rig. Fragments of slate were found in the hull, together with sprigs of heather for use as packing, but since the saltings seem to have grown up around the boat in the 1880s, when it was presumably abandoned, it had no doubt lived out its last years carrying other cargoes after slate traffic on the Dwyryd came to an end in the 1860s (Lewis 1989; McElvogue 2003).

4.4 Railways

4.4.1 Historical context to slate-carrying railways

The overland rail transport of slate in Gwynedd (and indeed anywhere in the world) begins with the construction of the *Penrhyn railroad*, an iron edge-railway to serve Penrhyn quarry, in 1800-1801. The lower part of the route may have been operating from 1798 or 1799 to serve a flint mill at Llandygai, but this is unconfirmed. The Penrhyn railroad adapted existing South Walian practice by using cast-iron bars, but adopted an impractical oval section for the double-flanged wheels, which caused them to grip the rails rather than roll along them. It was nevertheless the first overland iron edge-railway of any length in the world, and an early example of the use of a railway to move a compact mineral.

For twenty-four years this was the only overland railway in the Gwynedd slate industry. When the *Dinorwic railroad* from Assheton Smith's quarries to y Felinheli/Port Dinorwic opened in March 1825, the technology was very similar to the Penrhyn – cast-iron bar rails, horse traction on the level sections, and counter-balance inclines elsewhere.

The 'speculative year' of 1825, when plans for many fanciful commercial enterprises were in the air, also saw the passage of the *Nantlle Railway* act, when pro-active Liverpool investors stepped in to put an end to the inconclusive wrangling between local landowners which had for some years held up plans to connect the Nantlle quarries with the sea at Caernarfon. It was constructed by a local contractor, William Owen of Gwaunfynydd on Anglesey, who may previously have been a contractor on Telford's post road, and with the help and advice of Robert Stephenson the elder, brother of George and uncle of his more famous namesake. It opened in 1828.

The Nantlle was the first public railway in Gwynedd, reflecting the fact that it served a multiplicity of businesses, mainly slate quarries but also lead and copper workings, and that it transported coal to Caernarfon gasworks and lime to kilns and storage points. It also, from at least 1829, carried passengers, in a designated vehicle running to a timetable designed to meet road coaches plying into Eifionydd (Gwyn 2001). Passenger carriage was quite common on railways by the 1820s (Lewis 2014), but what makes the NR significant in this respect is the survival of the station building at Pen y Groes, a public house which predates the railway by a number of years, but which is the oldest building in the world to have served to direct passengers on and off trains and to provide waiting

Plate 6 Possibly the world's oldest railway station, the former station building at Penygroes.

facilities (Plate 6).[2] As such, it merits comparison not only with the far more lavish provision at Liverpool Road on the Liverpool and Manchester Railway completed in 1830 but also with other contemporary forms of 'station' on stage coach and canal routes.

The Nantlle Railway also marks another break with the past in that, although it was initially to be built as a plateway, using cast-iron, on Robert Stephenson's advice it made use of wrought-iron fishbelly edge rails, the technology that he and his brother were vindicating on the other railways with which they were involved – the Stockton and Darlington, the Canterbury and Whitstable, the Liverpool and Manchester and the Bolton and Leigh (Skempton 2002). The gauge was 1.07m/3' 6", which may reflect its original conception as a plateway, or may have been intended to make end-on connection with existing internal systems in the Nantlle quarries, or both.

Robert Stephenson the younger (1803-1859) advised on the construction of the most ambitious of the railway systems built in the slate industry, the *Festiniog Railway*, authorised by Act of Parliament in 1832 and opened in 1836. Whereas the Nantlle's backers were from Liverpool, the Festiniog was funded by Dublin bankers; it was only the second railway to be set up with Irish capital, after the

[2] Known earlier passenger services in Wales ran on the Oystermouth, Sirhowy, Trefil-Tredegar, Dr Griffiths', Monmouth, Portreath, Llanvihangel, Merthyr, Monmouthshire Canal Company lines and on the Duffryn Llynvi & Porthcawl; in the border areas, on the Grosmont, Severn & Wye, Hereford and the Hay; in England on the Radstock, Plymouth & Dartmoor, Mansfield & Pinxton, Stockton & Darlington, Stratford & Moreton; in Scotland, on the Kilmarnock & Troon and on the Monkland & Kirkintilloch/Ballochney. The Nantlle was followed by the Brampton, the Canterbury & Whitstable, the Pentewan and the Liverpool & Manchester in England, and by the Baltimore & Ohio and the Charleston & Hamburg in the USA – Lewis 2014.

Dublin & Kingstown (incorporated 1831), and was followed by the Ulster Railway (incorporated in 1836) and the Dublin & Drogheda (incorporated in 1839). The Festiniog's later history as a locomotive-worked railway (from 1863), as a passenger carrier (from 1865) and its pioneering use of bogie locomotives (1869) and carriages (1872) has tended to obscure the significance of its original conception as a horse-and-gravity mineral line. It certainly made an impression on contemporaries; a visitor to the area when it was under construction stated that it was in his opinion:

> … one of the most magnificent works in the Kingdom. Indeed while we admire the Liverpool railroad for the immensity of the undertaking, the Menai bridge for its symmetry of magnificence & the Aquaducts (sic) at Llangollen & Chirk for similar reasons, no person I am certain having viewed these & inspected the Quarry railway will for a moment hesitate to admit that its proportion of these desiderata to be less (which admits a question), the deficiency is amply compensated by the extraordinary beauty of the scenes through which it leads you. (Letts, [unknown date]; NLW MSS 22341B)

The Festiniog was certainly built through a challenging environment of steep-sided valleys, dropping down 700' from its upper terminus to the sea, but the skill with which it was surveyed and built is only apparent from a detailed knowledge of the route – for instance, the near-uniform grade of 1/80 designed to enable wagons to run downhill by gravity according to a strict timetable involves some slightly steeper sections on the curves to ensure that the run increased speed at these points. This was also achieved by some spectacular civil engineering works, including the *cei mawr*, believed to be the highest dry-stone embankment in Europe (SH 6305 4058). It is a far more ambitious and capably-executed undertaking than its immediate predecessor, the Nantlle Railway. Robert Stephenson visited the railway when it was under construction. It may be that it was his influence that led it to adopt wrought-iron fishbelly rails on stone sleeper blocks (though these were accepted technologies of the time) and it was certainly at his suggestion that a temporary incline system was constructed over the Moelwyn col until the tunnel anticipated in the original plan could be cut. This system represented a hark-back to his father's Hetton colliery railway of 1822 in County Durham, with its combination of level sections and rope-worked inclines over intervening high ground.

During the depression of the 1840s, only the great slate magnates of Caernarvonshire could afford to upgrade their rail systems. The Penrhyn railroad was rebuilt with wrought-iron flat-bottom rails in 1849, an early instance of the use of what is now the standard form of rail (though rolled from steel) world-wide. More significant was the decision of Thomas Assheton Smith III (1776-1858) to replace his 1825 quarry system, a 4' gauge line, which passed its first run in 1842. It was initially horse-worked but equipped with steam locomotives five years later. The principal contractor was Owen Jones of Penmachno, 'Gethin', who later built the viaduct for the LNWR at Dolwyddelen. William Allcard (1809-1861), of the Grand Junction Railway, who had been with the Stephensons since 1825, was the consulting engineer, and the surveyor was Dr William Harland (1787-1866), another member of the Stephenson circle, whose son was one of the founders of Harland and Wolff in Belfast. The Spooners, father and son, were responsible for the design and hence for the use of transporters for the narrower-gauge quarry wagons, a technique that Charles Easton Spooner had observed on the Bargoed coal road in South Wales when serving his apprenticeship with Brunel (Bailey 2003 [Allcard]; *DNB* [Harland]; CRO: XD97/6487). Of the two steam locomotives, one, *Fire Queen*, survives in near-original condition, at the Penrhyn Castle Industrial Railway Museum; its significance is set out in Bailey 2014. It is one of perhaps sixteen locomotives surviving world-wide from the 1840s and one of thirty-six which remain from the formative period of locomotive design from 1802 to 1850.

The *Gorsedda railway* was constructed in 1855-7 by James Brunlees, who already had a distinguished career in railway-building in Britain and Ireland to his credit and who went on to build

the São Paulo Railway from the port of Santos to the coffee districts in Brazil and was involved with the Mt Cenis Pass Railway in France and Italy. It was 0.915m/3' gauge, which was also employed on a slate-carrying railway in North-east Wales at much the same time – a gauge broader than 2' made sense where there was likely to be a significant slab output. 0.915m/3' gauge was used at Penmaenmawr granite quarries and the Llanddulas limestone quarries. Gorsedda track was typical of its period, T-section wrought iron rails held in chairs on wooden sleepers.

Another development of this period is the Corris, Machynlleth and River Dovey Tramway, built in 1858-9 for horse and gravity operation by George Vane-Tempest, fifth Marquess of Londonderry, who managed, and subsequently inherited, lands in the area through his marriage in 1848 to Mary Cornelia, daughter of Sir John Edwards of Garth (1770-1850). George Vane-Tempest was the son of Charles William Vane, third Marquess of Londonderry, who developed Seaham harbour and coalfield in County Durham by building the Londonderry Railway to connect them. In terms of its engineering, it was lightly built and follows the turnpike for much of its route. Its lower section lies outside the county of Gwynedd.

The developments in the slate-carrying railways of Gwynedd in the period from 1860 to 1879 are complex and have been described many times by railway historians, though mainly on a railway-by-railway basis with little attempt to contextualise them within the region and as adjuncts to the industry they served. In essence, the expansion of the slate trade in this period called for overland transport systems with a higher and more varied capacity. This meant either the replacement of a road or an earlier railway system with a new railway, or the upgrading of existing railways, so that could not only handle a slate but also cope with increased back-carriage to the quarries (such as coal and machinery) and to the communities which housed the rapidly-growing workforce (such as household goods), and operate passenger trains.

Although it was the boom in the slate industry that prompted these changes, they were also made possible by the ambitions of Charles Easton Spooner, effectively the manager and engineer of the Festiniog Railway, who seized both the technical and the marketing initiative. Spooner's fear was that what happened to the Nantlle Railway, which lost its separate identity and was cut back to a short length near the quarries feeding into the new standard gauge network, could also happen to the Festiniog. To forestall this, he transformed the railway from a well-run but relatively simple mineral line into a fully-fledged smaller version of a post-1830 main line system. The changes therefore included not only mechanical motive power and new rolling stock but also the provision of dedicated station facilities, signalling systems and uniformed staff. Narrow gauge railways on these lines had recently been built in continental Europe, most notably those built to 1.07m/3' 6" gauge by Carl Pihl in Norway. These were scaled-down versions of a British branch line. Spooner showed how the same approach could be used on a much smaller gauge still (hence even less costly – Ransome 1996), and there seems no doubt that Spooner wanted to launch himself as an international consulting engineer on this basis. The global transfer of technology from the FR is set out in Appendix III.

The boom years also made possible the building of branch railways and inclines from the FR into many of the quarries, and the building of additional quays at Porthmadog. The most intense period of development runs from 1861 to 1869. The new systems connecting on to the FR were all to the same gauge but were technically varied. Terrain and traffic dictated that many of them represented a return to the early 19th-century tradition of railway engineering represented within the Gwynedd region by the Penrhyn and Dinorwic systems, of near-level sections worked by horses interspersed with rope-worked inclines. Such are the *Rhiwbach railway* and the *Croesor railway*. The pretentiously-named *Gorsedda Junction and Portmadoc Railways* made use of part of the original Gorsedda trackbed to reach slate quarries and copper mines in Cwm Dwyfor. It terms of its

construction and archaeology, it makes use of a typically sinuous course avoiding heavy engineering wherever it can, and was set out for locomotive operation – though its one locomotive never had much work to do, and the whole scheme proved a costly failure. The *Festiniog and Blaenau Railway* was designed and built from the start to be what the FR had become, a locomotive-worked goods and passenger railway. Its assets have been almost entirely obliterated by the standard gauge railway constructed by the GWR along its course in 1883.

Several other locomotive worked railways were built from new in this period, and each calls for comment.

The *Talyllyn Railway* was constructed in 1865-6 to serve the Bryneglwys quarry in southern Gwynedd, part of a package of investment in the slate industry locally by the McConnwl brothers of Manchester that also included the new quarrymen's village of Abergynolwyn. Whereas practically nothing remains of the Festiniog and Blaenau, the Talyllyn remains fully operational and preserves a great deal of its original infrastructure, its original locomotives and carriages and many of its slate wagons. Its engineer was James Swinton Spooner, Charles' brother.

The *Penrhyn Quarry Railway* was designed by Charles Easton Spooner and built to replace the Penrhyn quarry railroad of 1801 by providing a through locomotive railway to the port, at the price of some severe gradients. It was completed in 1879.

The North Wales Narrow Gauge Railway was promoted by Charles Easton Spooner, and served the slate industry of Moel Tryfan and Cwm Gwyrfai. Its very name suggests a branding exercise on the part of Spooner, anxious to win a name for himself as an international consulting engineer, and it is also possible that it was built to show how a 0.6m gauge railway could surmount gradients and be built through difficult terrain with a comparative minimum of earthworks. This is reflected in the comparatively light engineering of the railway.

The survey has identified two railways serving the Gwynedd slate industry that were only completed in the inter-war period. One is the *Welsh Highland Railway*, which connected the southern terminus of the NWNGR with an upgraded lower section of the Croesor railway, and the other is a short line at Blaenau Ffestiniog which gave Oakeley quarry direct access to the LMS goods yard. The Welsh Highland Railway has a particularly complicated history which need not be repeated here (Richards and Jones 2004) but it is of interest as the last major narrow gauge public railway built in the United Kingdom and for the way in which the formation was originally laid out on a very steep gradient for Ganz three-phase electric traction, requiring it to be re-aligned when the decision was taken to stick with steam locomotives. It forms a chapter in the advent of electrical power to Gwynedd, which affected the slate industry, but the 20th-century section of the WHR is unlikely to have carried any significant quantities of slate, as the Moel Tryfan and Cwm Gwyrfai quarries continued to export along the former NWNGR to the LNWR at Dinas, and the Croesor quarries to the GWR at Porthmadog.

The Oakeley quarry link was a very short length of line, but a blend of the old and the new in that it included a counter-balanced incline but was also purpose-built on the level section for diesel locomotive operation.

In addition, inter-modal transport sites have been identified. Harbours themselves are inter-modal sites (land transport/riverine transport to sea-transport) but it is clear that slate products were transferred between different forms of overland transport at various points within Gwynedd.

4.4.2 Slate railway archaeology

4.4.2.1 Earthworks, cuttings, tunnels

Earthworks, cuttings and tunnels on the railways considered here take a variety of different forms. The aim of engineers was to minimise these as much as possible but the challenging terrain within which some were laid has meant that some impressive formations had to be constructed.

In two instances these predate the railway which later ran on them. Both examples are in the Glaslyn/Traeth Mawr area. One is the embankment on which the WHR now runs, designed and built by James Creassy, a drainage engineer from the fens who also worked in Bengal. The other is the cob, built 1808-1813, along which the FR now runs (ID 5234, Grade II*, SH 58021 38037).

Otherwise, formations are purpose-built. Those of the Penrhyn and Dinorwic railroads are comparatively slight and in some locations can barely be identified, consisting of very shallow embankments or a shelf cut into the hillside. Nevertheless, the greater part of the route in both cases can be followed on the ground. The Nantlle Railway makes use of some taller embankments which, unusually for the area, are made of unconfined tipped spoil from cuttings, and are not confined between stone walls. Tunnels survives at Caernarfon and at Dinas, the latter of these on a particularly fine stretch of original formation that contrasts with the 1860s track-bed of the LNWR Caernarfon to Afonwen line now used by the WHR, and which includes the bridge at Bontnewydd and the station building nearby (see below).

The most impressive formations are those associated with the FR, including the dry-stone *cei mawr* and the sinuous course of the railway on an even gradient. In some instances it is possible to see where the original formation of the 1830s has been eased to allow locomotives and longer items of rolling stock. The section between Dduallt and the Moelwyn tunnel, which has been superseded by a new section of line built between 1965 and 1978 is a fine example of early railway embankment-building, using large blocks of granite to confine the fill. Along with the 1842 tunnel through the Moelwyn col, the traces of the inclines over the col that operated from 1836 to 1842 and the 20th-century route, this section offers an object lesson in the various ways in which a narrow-gauge railway can cope with difficult topography (Plate 7).

A number of instances were observed of railways being laid for horse or horse-and-gravity operation with ferociously steep gradients employing minimal earthworks, presumably in anticipation of very light traffic indeed, or in the hope of fooling shareholders. These include the Foel railway, aptly described as ‘vertiginous’ (Williams and Lewis 1989), with its gradients of 1/9 between its six inclines, the Hendre Ddu railway (Cozens, Kidner and Poole 2004) and the Cwm Eigiau railway.

As described above, the formation of the NWNGR and the WHR include some historically significant sections, such as the Cwm Cloch cutting and the uncompleted works at Beddgelert, which indicate how narrow-gauge railway-building was attempting to take advantage of continental European developments in electric traction, which would have permitted much steeper gradients.

The distinctive *crawiau* (slate slab fencing) along the Ratgoed railway have been listed (ID 22743, Grade II, SH 75707 08089).

Plate 7 A distinctive FR embankment and bridge at Coed y Bleddiau

4.4.2.2 Inclines

In many cases, inclines were used on the overland railway from a quarry.

The earliest example is the Marchogion incline on the Penrhyn railroad, which may date from the late 18th century if not the very early 19th. This is particularly remarkable in that the winding house survives as a dwelling; it is a remarkably 'polite' instance of functional architecture, recalling the ceremonial entrance to a park or demesne, as well as the common arrangement of lock-keeper's cottages on a canal (Grade II listed, ID 4085, SH 59307 71924). It is amongst the oldest surviving incline winding houses in the world.

The trace of two counter-balance inclines is evident on the Dinorwic railroad at Craig Lwyd (SH 5782 6241-5785 6263-5770 6273), though much of the course of another incline, at Nant y Garth (SH 5470 6806-5439 6815), has been largely quarried away

The trace of two inclines over the col of Moelwyn Bach on the FR is evident (SH 6775 4335-6788 4294). These were built as a temporary measure following the advice of Robert Stephenson, and operated from 1836 until the tunnel was opened in 1842. The more northerly one was powered by a waterwheel fed from the stream; the dam built to power it survives, but has been pierced by the rebuilt route of the railway (see Plate 8). The use of inclines to surmount a col in this manner recalls the work of Robert Stephenson's father on the Hetton Colliery railway, and anticipates the comparable arrangements on the Rhiwbach railway, built in 1863.

Counter-balance inclines were an effective way of moving loads from a high-altitude starting point to a sea-level lower terminus when they could be combined with near-level sections worked by horses, with their limited capacity, but were less helpful when the option was available of using locomotives,

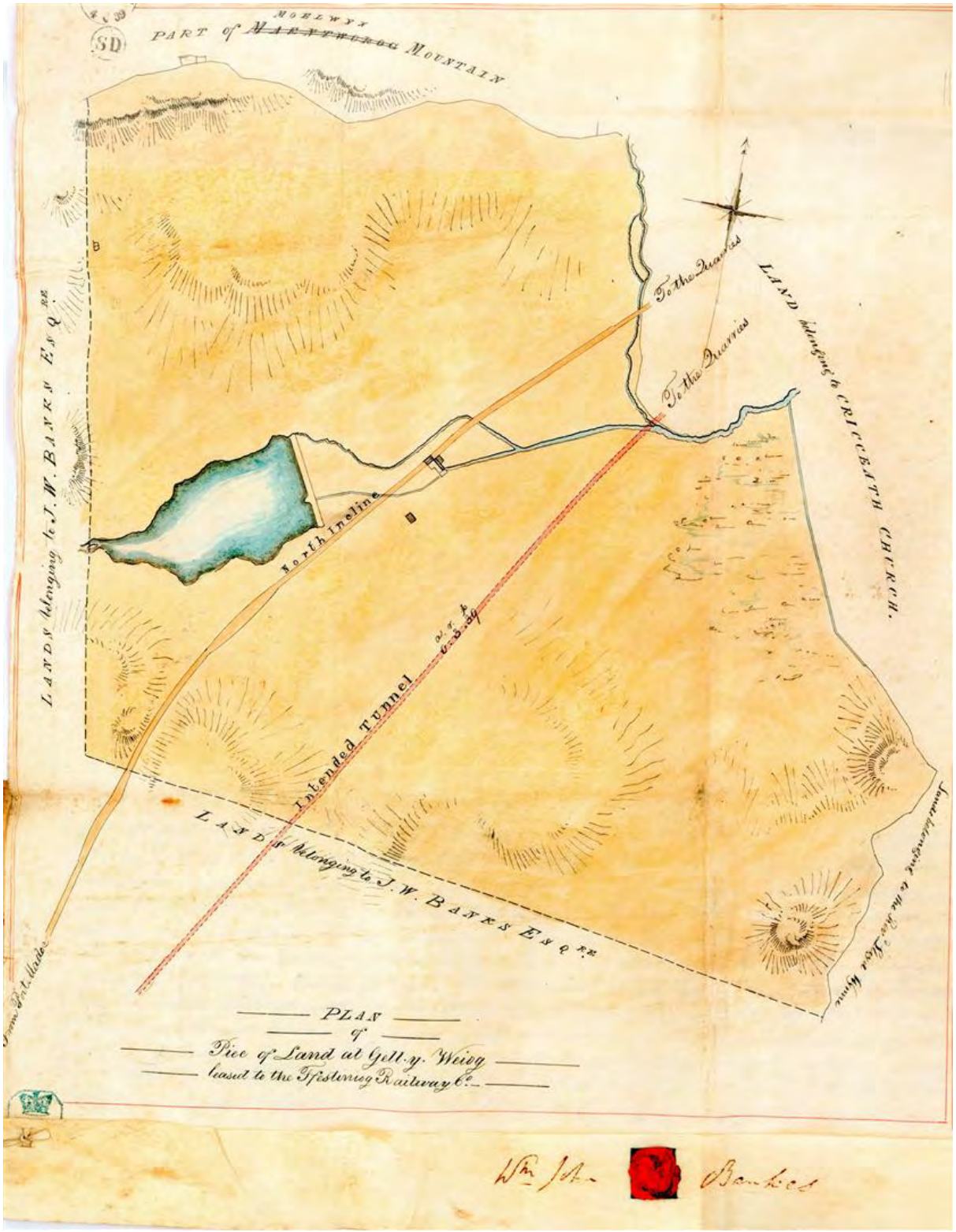

Plate 8 Plan of FR Moelwyn inclines. The plan demonstrates the 'Stephenson' style way of getting a railway over a col and the tunnel that replaced it.

with their longer effective range. The high-capacity locomotive systems – the Dinorwic Quarry Railway, the rebuilt Festiniog, the Talyllyn, the Festiniog and Blaenau, the Penrhyn Quarry Railway – either made no use of inclines or relegated them to the end of their systems. The Alltwyllt incline on the Talyllyn is one such, with some surviving rails and ironwork. The Talyllyn also includes the

remains of the incline down to Abergynolwyn, used to supply household goods and provisions to the village, though it may have formed the means by which slate was exported to a cart loading-point before the lower part of the railway was completed. The course of the incline is evident and some rails survive. The winding drum has been left near the site but the winding house itself was demolished.

However, the boom years of the 1860s also saw the construction of some railway systems where topography left no choice but to make use of inclines, some of which show up as spectacular landscape features – above all the Rhiwbach, mentioned above. These also include the many other branch lines laid to the FR, as well as the Cedryn railway and the very lightly-laid railway to Rhos and Moel Siabod quarries, where the six inclines are interspersed with steep sections that were not rope-worked.

4.2.2.3 Bridges

Significant surviving masonry bridges include the Marchogion bridge, a multi-arch bridge over the Cegin, one of the oldest such structures built for a rail system surviving anywhere in the world (PRN 12143, SH 5926 7239, SAM CN380), and a single-arch bridge over the Gwyrfai river at Bontnewydd on the course of the Nantlle Railway (SH 4800 5994). Many of the FR's surviving under-bridges date from the 1830s; a common pattern is for a single arch to be built out of shaped stone as a free-standing structure within an embankment built of rougher materials.

Two important iron bridges survive. One is a cast-iron bridge of which the trusses have been dismantled, but apparently retained, at Port Penrhyn, in use as early as 1803 to give the Penrhyn railroad access to the warehouse on the western bank of the Cegin. The other is the cast-iron bridge on the FR carrying the railway over the Maentwrog to Rhyd road (SH 64761 41511, Grade II) on which the date of 1854 is cast, though railway tradition states that it might have been re-cast at Boston Lodge (see below) in the 1920s and it has now been strengthened with concrete beams.

An unusual structure in regional terms is Dolgoch viaduct on the Talyllyn Railway, which is built of red brick with stone dressings, consisting of three segmental spans carried on two tapered piers (SH 65046 04504, listed Grade II, ID 23900), presumably the work of James Swinton Spooner.

Steel bridges are found on the former NWNGR track-bed, now forming part of the operational WHR.

Pedestrian and road over-bridges are a feature of the Dinorwic Quarry Railway.

4.2.2.4 Workshops

The slate railways of Gwynedd are unusually rich in terms of surviving workshops, stations and depots, particularly from the period 1801 to 1870.

A small detached smithy near the course of the Penrhyn railroad at SH 5980 7068 in Llandygai village may have housed a blacksmith/farrier responsible for the operation of the railroad between the Dinas and Marchogion inclines. A fine smithy building complete with horse trough at the foot of the Craig Lwyd inclines on the Dinorwic railroad was converted into a private house in the 1990s with the loss of original features (SH 5767 6283).

No workshop facilities have been identified on the Nantlle Railway, where the maintenance of wagons and other rolling stock was the responsibility of the railway's various users.

The Dinorwic Quarry Railway preserves a remarkable stable-depot which presumably dates from 1842-3, at Craig y Dinas (SH 5518 6337). The substitution of locomotives for horses on the railway five years later presumably curtailed its working life, and although the stables themselves have long been converted into private houses, the administrative block survives, and the general scale and arrangements of the complex are little changed.

It is the FR that preserves the finest examples of early/hybrid railway maintenance facilities. At Cae Ednyfed near Minffordd, the stables, smithy and policeman's dwelling survive adjacent to the main running line, a complex which there is every reason to believe dates from the railway's construction in 1832-6. It was here that every horse on the railway was accommodated on a regular basis for one night in order to ensure it received the attention it needed.

The FR's Boston Lodge works are believed to constitute the world's oldest railway maintenance depot in the world still in use. The earliest part, on the north-eastern extremity of the site, dates from the 1840s and was built around the common courtyard plan found elsewhere on early railway systems (Hughes 1990). The main engineering complex in the centre of the works dates from the 1890s, with 20th century structures on the south-western periphery. As such, it exemplifies the development of narrow-gauge railway engineering facilities over a period of nearly 170 years and the transition from horse to steam to internal combustion traction. The adjacent locomotive shed contains work from the 1860s, possibly from the introduction of steam locomotives in 1863, which might give it a claim on the oldest surviving motive power depot for a narrow gauge railway. The nearby locomotive turntable is an unusual feature in a British narrow gauge context.

Tywyn Pendre on the TR preserves the original locomotive shed of the mid-1860s, which also remains in use.

The maintenance facilities on the Dinorwic Quarry Railway formed part of the quadrangular engineering complex at Gilfach Ddu which now forms part of the Slate Museum. However, a shed and a water tower/coalbunker survive at Gilfach Ddu at SH 5835 6065. The Penrhyn Quarry railway's engineering complex and loco shed survive and are in use to serve the short relaid section. The buildings are believed mostly to date from the 1890s but include a small shed from the 1870s.

Locomotive facilities on the WHR at Dinas are of recent construction.

On a much smaller scale, the 'white shed' on the Hendre Ddu railway, a structure built in the 20th century to house one of the line's internal combustion locos, is believed to survive.

4.2.2.5 Stations

Stations – in the sense of structures and other arrangements to manage the flow of passengers on and off trains – are found on several slate-carrying railways, whether to accommodate public passengers, quarrymen or both. The carriage of workers on private industrial railways was common in the United Kingdom and beyond.

As noted, the earliest appears to be the Penygroes station on the Nantlle Railway, a pre-existing public house which found itself conveniently situated to operate passenger services on both the railway and the turnpike (listed Grade II, ID 23704, SH 47031 53196). Whilst it is clearly a highly significant structure, and merits the accolade of the world's oldest surviving railway station, its significance derives as much from what it anticipates as much as from what it represents. It is on a much smaller scale than its immediate successor, Liverpool Road on the Liverpool and Manchester Railway (Fitzgerald 1980), it is not purpose-built and in all probability was not operated directly by

the railway company. It is likely that the publican saw the opportunity to operate a profitable side-line in the form of a coach service, using the railway from Caernarfon and a road vehicle for anyone wishing to travel further. This much seems to be implied by Samuel Holland's famous account of his meeting with Henry Archer there (Holland 1952) and other scattered references.

It is possible, but unconfirmed, that the adjacent funeral directors' establishment may include fabric from a station built by Edward Preston, the lessee of the Nantlle Railway from 1856 (SH 4702 5318). The caretaker's house associated with the adjacent Calfaria chapel is believed to stand on the site of the shed for the carriage (ms in private possession). The small dilapidated structure adjacent to the track bed near Bontnewydd (SH 4797 5948) may be a Preston-era station building. A small structure now used as a garage at Groeslon may also be a former station/ticket office (SH 4732 5600). Un remarkable though these buildings might appear, they are probably among the oldest surviving railway stations on a narrow-gauge railway.

Facilities for quarrymen to join and leave trains on the Penrhyn and Dinorwic quarry railways were simple. Since they did not pay fares, there was no need for a booking office, and since carriages were low, and catered for at least moderately agile working men, no need for platforms. A feature of the station at Pont Rhyddallt on the Dinorwic Quarry Railway is the long shed for the carriages, which were uncoupled at each station and then hand-shunted onto a siding after the last down train (SH 54840 363633, Grade II listed, ID: 22648).

Early steam-era station buildings are found on the FR and the TR, where they marked the narrow-gauge railway's coming-of-age as a multi-purpose public railway. Dolgoch, Brynglas (Grade II, ID 23889, SH 62829 03110) and Rhydyronnen on the TR are simple slate-built shelters, Tywyn Pendre a wooden structure, Tywyn Wharf a more ambitious brick building, its original ambience altered by the erection of a canopy and of the Narrow Gauge Railway Museum nearby. Station buildings on the course of the Corris Railway survive at Corris itself, now a museum, Esgairgeiliog, cosmetically restored, and in part at Llwyngwern (as well as the lower passenger terminus at Machynlleth, in Ceredigion). It is not clear whether anything remains above ground level of the station buildings erected on the FR for the introduction of passenger services in 1865, but impressive structures by narrow gauge standards survive in every-day use at Porthmadog (1880s), Minffordd (1872; listed Grade II, ID 26859, SH 60016 38540), Penrhyndeudraeth (1880s; listed Grade II, ID 26857, SH 61318 39511), Tan y Bwlch (1870s) and Diffws (1870s, now a public lavatory; listed Grade II, ID 5208, SH 70251 45925).

4.2.2.6 Depots and goods sheds

Goods sheds (in the sense of a building designed to store high-value goods as part of an intermodal facility) are only found on those railways which in addition to slate also carried general goods as public railways – the Nantlle, the Festiniog, arguably the Talyllyn, and the North Wales Narrow Gauge/Welsh Highland.

On the course of the Nantlle Railway, the remains of a shed were identified at Pen y Groes, adjacent to the former station (SH 47031 53196). It is suggested that this may have been to store lime, as its proportions are similar to sheds identified as such on the Brecon Forest tramroad; the Nantlle Railway connected with a bank of limekiln, now demolished, at SH 4803 6131 (tithe map; Hughes 1990).

On the FR, substantial goods sheds were identified at Porthmadog, now part of the railway's catering facilities, but externally little altered, and at Minffordd (SH 5974 3862), where it forms part of the interchange with the former CR/GWR (see Intermodal facilities below). A smaller goods shed at

Penrhyndeudraeth retains its rail access by means of a turntable, and forms an attractive illustration of the way in which household goods were handled on the railway (listed Grade II, ID 26857, SH 61318 39511). The goods shed at Tan y Bwlch (SH 6492 4150) has been turned into a cafe and windows have been knocked into the valley-side longitudinal wall. One of the two tiny goods sheds at Tan y Grisiau survives, in neglected condition (SH 6840 4495).

No shed for the storage of goods on the main Talyllyn route was identified (and secondary sources suggest none was ever built or considered necessary), but it is possible that some may survive at the foot of the village incline at Abergynolwyn. It is recorded that beer, coal and household necessities were delivered to the village by this means and that return traffic included nightsoil.

A substantial goods shed survives at Dinas station on the NWNGR/WHR (SH 4770 5869).

4.2.2.7 Intermodal facilities

Related specifically to the question of depots and goods sheds, and more generally to the relationship between different transport modes, are intermodal facilities for the transfer of slates and sometimes other goods as well. The ports and harbours which these railways served are not noted here, though it is pointed out that these served not only as rail-ship intermodal facilities but also in the case of Caernarfon, y Felinheli and Port Penrhyn to transfer goods from rail to rail. Goods for back-carriage (that is, against the main flow of slate from the quarries) might include steam, household and blacksmith coal, machinery, timber, sand, consumer durables and groceries.

Rail-rail sites are the most complex. The outstanding example is Minffordd yard on the FR (SH 5974 3862), set out in 1872 where standard and narrow gauge tracks are ingeniously arranged on a challenging site to ensure that respective sidings offer a level between the floors of the different wagons. The remains of a mechanical coal tippler survive, as does a yard crane. The sites of some of the sunken sidings have been filled in but it appears that the slate slab edgings indicate their location. The site remains in everyday use as an infrastructure yard and for storage of the railway's fleet of restored slate wagons (see below).

Llechwedd quarry's Pant yr Afon wharf (PRN: 25298; SH 697 468) near the upper terminus of the FR has been compromised by the building of a road across much of the site, but it retains its dilapidated weigh-bridge house and its relocated crane; the value of the site is increased by its proximity to the 1904 hydro-electricity power house. The adjacent 'London wharf' (SH 696 469), which was the means by which the Oakeley quarry shipped directly onto the LMS, survives only as a level slate-built platform, and other examples in Blaenau Ffestiniog (at the former LMS station, the former GWR town station and at Manod Road station) are now barely evident.

Tywyn Wharf station on the TR preserves the wharf itself alongside the standard gauge track-bed and a small display of slate rolling stock, though the CR/GWR sidings has been removed. At the station throat, a weighbridge house has been conserved and re-erected.

Other rail-rail sites with some archaeological potential include Tyddyn y Bengam (SH 4697 5425), where slates were transferred from the Nantlle Railway to the LNWR, though this now heavily overgrown, and Aberangell, between the Hendre Ddu system and the Mawddwy Railway (SH 8465 0999). Others appear to have been effectively obliterated.

4.2.2.8 Permanent way

Examples have been identified, in some cases in preservation, in some cases in use, of most of the historic types of permanent way used on Gwynedd slate railways.

Few examples are known to survive of the cast-iron edge rails used on the Penrhyn and Dinoriwc railroads of 1801 and 1825 respectively. It is believed that some may be preserved at Ironbridge as part of Dr Michael Lewis' collection of early track components. Cast-iron, however, was easily melted down in furnaces to provide new components (or might end up in the precipitation pits at Mynydd Parys). The wrought-iron fishbelly rails used on the Nantlle and the Festiniog made useful fence-posts once their original function was past, and many examples survive. Stone sleeper blocks have been identified in re-use and occasionally *in situ*, such as near the Bontnewydd station on the Nantlle Railway (SH 4797 5948).

The Talyllyn was unusual, though not unique, in using flat-bottom rail in chairs; again some examples survive, though the railway's permanent way has been completely renewed since preservation in 1951. The FR's bullhead was also an unusual choice of rail in narrow gauge terms (part of Spooner's 'real railway' approach), and much of it is still in use, along with similar rail from the Penrhyn Quarry Railway, acquired when it was dismantled in 1965. The heavy traffic the FR carries means that much of this will have to be replaced in the near future.

4.2.2.9 Signalling, level crossings

Most of the systems considered here worked on the one-engine-in-steam principle and had no need of signalling, other than simple banners displaying the level crossing gates in the case of the Penrhyn and Dinorwic railways. The only one to make considerable use of signalling systems was the FR. Several of the distinctive disc signals installed in the 1860s survive, and it is believed that the railway is now the only one in the world still making use of this distinctive early main line technology. In addition the railway has recreated one of its slotted post signals at Tan y Bwlch station and continues to make use of semaphores to the McKenzie and Holland design of the 1870s. Traditional wooden level crossing gates are still opened and shut by hand at Penrhyn crossing (SH 6149 3969), and an early crossing-gate keeper's dwelling remains in use by a member of the railway's staff at SH 59538 38519 (Grade II, ID 5211). On the Penrhyn Quarry Railway a crossing-keeper's hut survives at SH 6101 6761.

4.2.2.10 Accommodation and settlement

Accommodation and settlement for workers are noted above as growing up along road routes; the same is true of railways. The settlements of Clwt y Bont, Pen y Groes, Tal y Sarn and Tan y Grisiau in some cases follow the track bed of a quarry railway, reflecting the comparative lack of reliable roads in newly-formed industrial communities and the convenience of informal use of railway routes (Gwyn 2002) Dedicated accommodation for railway workers can only be found on the FR, at Boston Lodge (PRN: 12733; SH 5848 3879; 5870 3807), the railway policeman's dwelling at Cae Ednyfed (SH 6010 3857), the station house at Tan y Bwlch (Grade II, ID 84020, SH 64986 41585) and the house at Coed y Bleddiau (SH 6643 4176).

4.2.2.11 Mechanical motive power and rolling stock

Motive power and rolling stock are not normally considered as part of the archaeology of a railway system within an assessment but a prospective bid for World Heritage status requires that they be included. The archaeology of such self-propelling or movable items has been discussed by

comparatively few authorities (Bailey and Glithero 2000; van Laun 2001; Gwyn, Jarman and Rees 2010) but requires consideration here.

Locomotives from Gwynedd slate-carrying railways survive in considerable numbers. The earliest are those associated with the Dinorwic Quarry Railway. They include the man-powered velocipedes or *ceir gwyllt* first introduced in the 1840s, of which examples survive at the Slate Museum and at the Penrhyn Castle Industrial Railway Museum. Also from Dinorwic and of this period is the remarkable locomotive *Fire Queen*, also preserved at the Penrhyn Castle Industrial Railway Museum, of which Bailey 2014 gives a full description.

Of the FR's six original locomotives by George England of the Hatcham Ironworks of 1863-1867, four survive in working order, albeit much rebuilt and with very few original components. The Talyllyn's two original locomotives by Fletcher Jennings of Whitehaven have seen less rebuilding but again it is unlikely that much if anything survives of the original machine. This should not detract from the historical significance of these assets, as replacement of components is part of their normal service condition.

Of the double fairlie locomotives on the FR, the first one, *Little Wonder* of 1869, was surrounded by much hype when it was first put into service, yet was broken up early on. Later examples gave good service to the railway, which has built two others in the preservation era, *Earl of Meirioneth* in 1979 and *David Lloyd George* in 1992, as well as a single fairlie to the design of a lost FR prototype, *Taliesin*, in 1999.

Of the Penrhyn Quarry Railway's three Hunslet locomotives, two operate in much rebuilt condition on the FR, and the third is preserved in near-original condition at Penrhyn Castle Industrial Railway Museum.

No attempt can be made in such a report as this to quantify the surviving slate-era rolling stock on these railways, which is known to be extensive. It is noted that the FR regularly recreates the downhill gravity runs that from 1836 to 1940 carried slates from the quarries to the lower end of the line, with a fleet of restored wagons. The FR also operates its original carriages built in 1864 as well as its 1872 bogie stock and surviving quarrymen's carriages, as well as replicas of historic rolling stock. The TR regularly uses its Brown Marshall original carriages, and retains a number of historic slate wagons. The Museum at Tywyn preserves the one surviving example of a 4' gauge Dinorwic Quarry Railway host wagon designed to carry four 0.6m gauge quarry wagons. Other examples of slate wagons are preserved either as static exhibits or as operational items at the Welsh Highland Heritage Railway, Penrhyn Castle Industrial Railway Museum, the Bala Lake Railway and Llechwedd's Quarry Tours venture. Various examples of Penrhyn workmen's carriages survive, one of them coupled to Lord Penrhyn's private 0.6m gauge saloon at Penrhyn Castle.

5 CONCLUSIONS

The transport systems associated with the Gwynedd slate industry are significant as essential components of a globally-significant industrial landscape now on the Tentative List for World Heritage status.

In addition to enabling the export of Welsh slate as a constructional material, these transport systems have exerted a profound impact on the landscape, urban morphology and built heritage of the quarrying districts.

The railways associated with the Gwynedd slate industry are particularly significant as a technology which evolved in this globally-significant industry, and which itself had a profound world-wide impact. The 0.6m gauge railway is the only significant macro-invention associated with this industry.

The significance of this technology has been recognised by the inscription of the Darjeeling Himalayan Railway as a World Heritage site.

The two fully operational railways (FR and TR) no longer carry slate but retain a remarkable number of structures and items from the period when they did so. These structures and items include formation; buildings; rolling stock and locomotives. They are of international significance in their own right for this reason.

The FR illustrates the evolution of an early/hybrid railway connecting a mineral export sump to a harbour into a smaller version of the main line railway with multiple functions including access to other railway systems and the carriage of other goods and of passengers. It is of international significance in its own right for this reason.

The TR represents the oldest surviving example globally of a narrow-gauge railway on the model of the upgraded FR which was purpose built for locomotive haulage, passenger carriage and connection to the main line railway rather than to navigable water. It is of international significance in its own right for this reason.

The TR and the FR are also of international significance as the first railways in the world to be preserved by voluntary effort.

Other important heritage assets have been identified on the other railways which are disused or have been partly revived railways.

Wales' railway heritage has hitherto been insufficiently valorised as heritage by the archaeological community, despite Welsh Government support for railways in Wales.

Despite the many publications available on Welsh railway history, many aspects of its past remain unclear and misunderstood.

Extending statutory protection to operational systems is problematic. Many of the existing buildings on the FR and the TR have been listed.

5.1 Recommendations

It is recommended that the working party on the Gwynedd County Council World Heritage bid consider the inclusion of the historic slate transport routes through the Ogwen valley *ie* Ffordd y Lord, the Penrhyn quarry railroad and the Penrhyn Quarry Railway within the core zone.

It is recommended that the working party on the Gwynedd County Council World Heritage bid consider the inclusion of part of the historic slate transport routes associated with the Dinorwic quarry *ie* the Dinorwic quarry roads, the Dinorwic quarry railroad and the Dinorwic Quarry Railway within the core zone.

It is recommended that the working party on the Gwynedd County Council World Heritage bid consider the inclusion of part of the Gorsedda quarry railway within the core zone.

It is recommended that the working party on the Gwynedd County Council World Heritage bid consider the inclusion of the historic slate transport routes through the Ffestiniog area *ie* the Festiniog Railway, the Cwmorthin quarry road (part), ffordd Casson (part) and the Lord quarry road, as well as the associated turnpike network to the Dwyryd quays, as part of the core zone.

It is recommended that the working party on the Gwynedd County Council World Heritage bid consider the inclusion of the Talyllyn Railway and the associated Bryneglwys quarry railway as part of the core zone.

The following lengths of disused track-bed are considered to be of national significance:

The Gorsedda railway between Gorsedda quarry (SH 5696 4541) and Ty Mawr Ynysypandy (SH 5509 4331)

The Bryneglwys quarry railway, including the scheduled Alltwyllt incline (ME205), the level section from its summit (SH 6816 0648) to the foot of the Cantrybedd incline (SH 6858 0602) and to its summit (SH 6868 0591)

The incline connecting the Talyllyn Railway to Abergynolwyn village (part of the Talyllyn Railway but non-operational) (SH 6783 0679 to SH 6777 0688)

The Wrysgan quarry railway

The Cwmorthin quarry railway

It is recommended that topographical survey, to include desk-top research, be carried out on the following lengths of track-bed also considered to be of national significance:

The Nantlle Railway between Dinas (SH 4764 5865) and Sarn Dwr Garw (SH 4786 6068).

The Penrhyn quarry railroad between Port Penrhyn (SH 5923 7256) and the summit of the Marchogion incline (SH 5932 7193).

The Penrhyn quarry railroad between Tyddyn Dicwm (SH 6073 6896) and the summit of the Dinas incline (SH 6106 6827).

The Festiniog Railway between Dduallt (SH 6788 4223) and Llyn Ystradau (SH 6776 4397) (both incline and tunnel routes).

It is recommended that scheduling be completed of the no 2 incline on the Rhiwbach railway, as recommended in 1997.

It is recommended that Cadw give further consideration to transport features within the immediate quarry environment *eg* the inclines connecting the Ffestiniog quarries to the Festiniog Railway, and to the appropriate extent of statutory protection.

It is recommended that Conservation Area status be considered for the stable-depot on the Dinorwic Quarry Railway at Craig y Dinas (SH 5517 6337).

It is recommended that consideration be given to a community archaeological excavation of the Top Yard at Boston Lodge on the Festiniog Railway.

It is recommended that means be explored by which the professional archaeological community can liaise with relevant personnel on the heritage railways identified in this report.

It is recommended that Cadw give consideration to further assessment of the archaeology of industrial transport systems and public railways throughout Wales.

5.3 World Heritage – some considerations

As noted, the slate quarry road systems, and the one canal, do not constitute significant technical achievements in their own right but are of interest and significance as contributing to the development of an industry that became the global standard. Selected routes should form part of a comprehensive bid, as set out above.

The case of the slate quarry railways is different. They were clearly crucial to the development of the slate quarries and to their transformation from a comparatively small industry of at best northern European significance to a global industry. However, they are also immensely significant to the development of transport technology on a world-wide scale. The Festiniog and perhaps the Talyllyn would have a strong claim to Outstanding Universal Value in their own right. This is because it is clear that the 0.6m nominal gauge offered an effective transport technology system in some circumstances. The means by which this transfer of technology became possible - the visit to the Festiniog Railway by an Imperial Russian Commission in 1870, as well as other delegates from, Poland, Hungary, India, Mexico, Prussia and France is set out in Appendix III. It led to the building of the World Heritage Darjeeling Himalayan Railway.

The extent to which movable heritage can be considered attributes of a World Heritage site is unclear and it may be that the case needs to be made clearly and persuasively for items such as locomotives and rolling stock to be considered as such. Certainly the distinctive ‘B’ class locomotives of the Darjeeling Himalayan Railway (themselves the immediate design-descendants of the Hunslet locomotives on the Penrhyn Quarry Railway) were identified as part of the site’s ‘signature’. What is above all striking about the Festiniog and the Talyllyn railways is the survival of a complete traction system – civil and mechanical engineering, station facilities *etc* - within the powerful landscapes of the slate industry.

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7 BIBLIOGRAPHY

Archival sources

CRO
XD97/6487 (Charles Easton Spooner's draft CV)

Bangor University
Porth yr Aur mss

Institution of Civil Engineers
Accession 1803DunnC

National Library of Wales
Letts, T [date unknown] 'Journals of tours, 1833-1834', NLW MSS 22341B.

Secondary sources

Armstrong J 2003. *The Companion to British Road Haulage History*. London: Science Museum.
Bailey MR (ed.) 2003. *Robert Stephenson – The Eminent Engineer*. Aldershot: Ashgate.
Bailey MR 2014. *Loco Motion. The World's Oldest Steam Locomotives*. Stroud: The History Press.
Bailey MR and J Glithero 2000. *The engineering and history of* Rocket*: a survey report*. London: National Railway Museum.
Barany G 1968. *Stephen Széchenyi and the awakening of Hungarian nationalism, 1791-1841*. Princeton, New Jersey: Princeton University Press.
Biographisches Lexikon des Kaisertums Österreich 1880. Wien: Druck und verlag der k.k. hof und Staatsdruckerei.
Boyd JIC 1975a. *Festiniog Railway 1 History and Route*. Blandford: Oakwood Press.
Boyd JIC 1975b. *Festiniog Railway 2 Locomotives and Rolling Stock Quarries and Branches: rebirth 1954-74*. Blandford: Oakwood Press.
Boyd JIC 1981. *Narrow Gauge Railways in North Caernarvonshire Volume 1.* Trowbridge: Oakwood Press.
Boyd JIC 1985. *Narrow Gauge Railways in North Caernarvonshire Volume 2.* Oxford: Oakwood Press.
Boyd JIC 1986. *Narrow Gauge Railways in North Caernarvonshire Volume 3.* Oxford: Oakwood Press.
Boyd JIC 1988. *The Talyllyn Railway.* Oxford: Wild Swan.
Bradley VJ 1992*. Industrial Locomotives of North Wales*. London: Industrial Railway Society
Carter I 2008. *British Railway Enthusiasm*. Manchester: Manchester University Press.
Coulls AC Divall and R Lee 1999. *Railways as World Heritage Sites*. Paris: ICOMOS.
Coulls A 2006. 'The Corris, Machynlleth and River Dovey Tramroad', in *Early Railways 3*. Sudbury: Six Martlets.
Cozens L, Kidner RW and B Poole 2004. *The Mawddwy, Van and Kerry Branches*. Usk: Oakwood.
Davies WJK 1964. *Light Railways*. London: Ian Allen.
Decauville P 1884. Portable Railways, *Scientific American Supplement*, 446, 19 July 1884.
Dodd AH 1990. *The Industrial Revolution in North Wales*. Wrexham: Bridge Books.
Duncan RH: *Maximilian and Mexico's First Steps toward the Global Marketplace (1864-1866)*, http://www.economia.unam.mx/amhe/memoria/simposio21/Robert%20DUNCAN.pdf.
Dunn R 1990. *Narrow Gauge to No Man's Land*. Los Altos: Benchmark Publications.
Fitzgerald RS 1980. *Liverpool Road Station, Manchester*. Manchester: Manchester University Press.
Gamst FR 1997. *Early American Railroads: Franz Anton Ritter von Gerstner's* Die inner Communicationen *(1842-1843)*. Stanford, California: Stanford University Press.
Genealogisches Handbuch der baltischen Ritterschaften 1930. Estland: Görlitz.

Gray A 2003. *Spooner Album*. Garndolbenmaen: Link.
Gwyn D 1999. 'From Blacksmith to Engineer: Artisan Technology in North Wales in the Early Nineteenth Century', in *Llafur* 7, 51-65.
Gwyn D 2001. 'Transitional Technology – the Nantlle Railway', *Early Railways.* London: Newcomen Society, 46-62.
Gwyn D 2002. 'The Industrial town in Gwynedd', *Landscape History.*
Gwyn D 2005. 'Landscape Archaeology of the Vale of Ffestiniog – *Industrial Archaeology Review: Understanding the Workplace: A Research Framework for Industrial Archaeology in Britain*, 129-136.
Gwyn D 2010. '"What passes and endures": the Early Railway in Wales', in *Transactions of the Fourth Early Railways Conference*.
Gwyn D 2014. 'Railways in Gwynedd 1759-1848', *Early Railways 5: Papers from the Fifth International Early Railways Conference.* Sudbury: Six Martlets Publishing, 97-111.
Gwyn D, Rees J and P Jarman 2010. 'The Conservation of Operational Steam Locomotives', in *Industrial Archaeology Review* 32 2, 91-102.
Haigh AJ 2005. *Robert Hudson Ltd*. Privately published.
Hazareesingh S 2007. *'Chasing commodities over the surface of the globe': Shipping, port development and the making of networks between Glasgow and Bombay, c.1850-1880*. Ferguson Centre for African and Asian Studies, Open University, Commodities of Empire Working Paper No 1, ISSN: 1756-0098.
Hilton GW 1990. *American Narrow Gauge Railroads*. Stanford: Stanford University Press.
Holland S 1952. *The Memoirs of Samuel Holland*. Merionethshire Historical and Record Society extra publications 1 (1).
Holmes A 1986. *Slates from Abergynolwyn*. Caernarfon: Gwynedd Archives Service.
Hughes HD 1866. *Hynafiaethau Llandegai a Llanllechid*. Bethesda: privately printed.
Hughes S 1990. *The Archaeology of an Early Railway System: the Brecon Forest Tramroads*. Aberystwyth: Royal Commission on the Ancient and Historic Monuments of Wales.
Hyde-Hall E 1952. *A Description of Caernarvonshire 1809-1811*. Caernarfon: Caernarvonshire Historical Society.
Illsley JS 1979. 'Trade and transport in Llyn Padarn in the late eighteenth century', in *Transactions of the Caernarvonshire Historical Society* 40, 87-104.
Johnson P 2009. *An Illustrated History of the Welsh Highland Railway*. Hersham: OPC.
Jones E 1988. *Stiniog*. Caernarfon: Gwasg Gwynedd.
Jones GP 1996. *The Economic and Technological Development of the Slate Quarrying Industry in the Nantlle Valley, Gwynedd*. Ph.D thesis, University of Wales.
Kemper F 1971. 'The Origins of Orenstein and Koppel', in *The Industrial Railway Record* 40, 156-61.
Kreitner G 1881: *In fernen Osten: Reisen des Grafen Bela Széchenyí In Indien, Japan, China, Tibet und Birma.* Vienna: Alfred Hölder.
Lewis MJT 1968. *How Ffestiniog Got its Railway*. Caterham: Railway and Canal Historical Society.
Lewis MJT 1970. *Early Wooden Railways*. London: Routledge and Kegan Paul.
Lewis MJT 1988. Quarry Feeders, *Festiniog Railway Heritage Group Journal* 13, 4-8.
Lewis MJT 1989. *Sails on the Dwyryd*. Plas Tan y Bwlch: Snowdonia National Park.
Lewis MJT 1999. 'The Railway in Industry', in RW Amber (ed.), *The History and Practice of Britain's Railways*. Aldershot: Ashgate.
Lewis MJT 2003. Bar to Fish-belly: The Evolution of the Cast-Iron Edge Rail, Early *Railways 2*. London: Newcomen Society, 102-17.
Lewis MJT 2014. 'Early Passenger Carriage by Rail' in *Early Railways 6.* Sudbury: Six Martlets
Lewis MJT (forthcoming) *Gorseddau: a portrait of a slate quarry and its railway*.
Lewis MJT and J Denton 1974. *Rhosydd Slate Quarry*. Shrewsbury: Cottage Press.
Lewis MJT and MC Williams 1989. *Gwydir Slate Quarries*. Plas Tan y Bwlch: Snowdonia National Park.
Lindsay J 1974. *A History of the North Wales Slate Industry*. Newton Abbot: David and Charles.

McElvogue D 1999. The Forgotten Ways: evidence for water-borne transport in Nant Peris, Gwynedd, *Industrial Gwynedd* 4, 8-15.
McElvogue D 2003. Cwch Talsarnau: a boat from the Afon Dwyryd, *Cymru a'r Môr* 24, 41-49.
Martin T 2000. Halfway to Heaven: Darjeeling and its Wonderful Railway. Chester: Rail Romances, 2000.
Moody LW 1998. ed. R.C. Jones. *The Maine Two-Footers*. Forest Park: Heimburger.
Morriss R 1999. *The Archaeology of Railways* Stroud: Tempus
Oeynhausen C von and H von Dechen 1971. *Railways in England 1827 and 1827*. Cambridge: Newcomen Society.
Mulvany WT 1868: *Germany: progress in coal and iron dependent on Railways.* Dusseldorf: Dietz.
O'Sullivan JJ 2004. Breaking Ground: The Story of William T. Mulvany. Tower.
Pritchard DD 1935. *The Slate Industry of North Wales: A Study of the Changes in Economic Organisation from 1780 to the Present Day*. MA University College of North Wales, 1935.
Quartermaine J, Trinder B, Stuart B and RC Turner 2003. *ThomasTelford's Holyhead Road*. Council for British Archaeology.
Ransome JPG 1996. Narrow Gauge Steam: Its Origins and World-wide Development. Sparkford: OPC.
Richards AJ and GP Jones 2004. *Cwm Gwyrfai; The quarries of the North Wales Narrow Gauge and the Welsh Highland Railways*. Llanrwst: Gwasg Carreg Gwalch.
Roberts OTP 1979. 'The Llyn Padarn Slate Wreck', in *Maritime Wales/Cymru ar Mor* 4, 62-76.
Rolt LTC 1971. *Talyllyn Adventure*. Newton Abbot: David and Charles.
Sandberg CP 1869. *The Manufacture and Wear of Rails*. London: Clowes and Sons.
Skempton AW 2002. *A Biographical Description of Civil Engineers*. London: ICE and ThomasTelford.
Spooner CE 1871. *The Narrow Gauge.* London: Spon and Co.
Stanfel D 2008, K.u.k. Militärfeldbahnen im Ersten Weltkrieg. Hövelhof: DGEG, 2008).
Sylwedydd, n.d.. *Chwarelau Dyffryn Nantlle a Chymdogaeth Moel Tryfan*. Conwy: RE Jones.
Taylorson K and A Neale 1987. *Narrow Gauge at War*. Croydon: Plateway Press.
Tucker N 1928. Sailing up the Conwy, *North Wales Pioneer*, 29 November.
Van Laun J 2001. *Early Limestone Railways*. London: Newcomen Society.
Williams D 'Hanesydd' 1869. *Hanes Gwaen Gynfi er Dechreuad y Ganrif Bresenol*. Ebenezer: Undeb Llenyddol Deiniolen.
Williams MC and MJT Lewis 1989. *Gwydir Slate Quarries*. Maentwrog: Snowdonia National Park Study Centre.
Williams WG 1983. *Moel Tryfan i'r Traeth: erthyglau ar hanes plwyfi Llanwnda a Llandwrog.* Penygroes: Cyhoeddiadau Mei.
Wolmar C 2010. *Engines of War.* London: Atlantic Books

Visual material

(note: only images consulted as part of this project are included here)

British Museum
Rev. Thomas Gisborne, 'View of Snowdon and Lake of Llanberis'; view from the edge of the lake, two figures in a boat near the water's edge, Mount Snowdon in the distance. 1789 Watercolour

National Library of Wales
Illustration from Letts, T [date unknown] 'Journals of tours, 1833-1834'', NLW MSS 22341B.

Unpublished archaeological reports

Gwyn D, Cossons N, S Rees 2012. *Astudiaeth Gwaelodlin a Gwerthusiad Technegol*
Safle Treftadaeth y Byd Arfaethedig Diwydiant Llechi Gogledd Cymru (Govannon report 295)
Gwynedd Slate Quarrying Landscapes 1994 (GAT report 129)
Gwynedd Slate Quarries 1995 (GAT report 154)
Gwynedd Slate Quarries: mills, power systems, haulage technology, barracks 1997 (GAT report 252)
Ports and Harbours 2005-7 (GAT report 641)
Pwll Fanog Wreck, Menai Strait, Anglesey. Designated Site Assessment: Archaeological Report,
Wessex Archaeology unpublished report, 2007. ref: 53111.03vv.

APPENDIX I: Gazetteer of sites

PRN: **59296** SITENAME: **Cwmorthin quarry road**

SITETYPE: ROAD DATE CONSTRUCTED: 1827

NGR: SH 6821 4615

DESCRIPTION:

A road initially constructed c. 1827 to connect Cwmorthin slate quarry (PRN: 20290) with Ffordd Casson (the Diffwys quarry road), to provide access to the slate qyays on the river Dwyryd and with the slate mill at Rhyd y Sarn. Much of the course has been subsumed into the A469.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a road designed to connect a remote slate quarry with navigable water and outside markets.

BIBLIOGRAPHY:

Dr Michael Lewis, research notes.
GJ Williams, Hanes Plwyf Ffestiniog pp. 124-5.
Isherwood, G. 1995. Cwmorthin Slate Quarry. Mold: Adit Publications.

PRN: **59297** SITENAME: **Dinorwic quarry drag**

SITETYPE: ROAD DATE CONSTRUCTED: 1776

NGR: SH 5904 6108

DESCRIPTION:

A steeply-graded cart road in existence by the 1770s which was used to connect the early slate workings around (PRN: Allt Ddu 20089) that evolved to become the Dinorwic slate quarry with a loading point for boats on Llyn Padarn.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as the earliest known engineered road that enabled the Dinorwic slate quarry to export its products.

BIBLIOGRAPHY:

Caernarfon Record Office: Vaynol collection
Bangor University: Porth yr Aur mss
Illsley, J.S. 1979. Trade and transport in Llyn Padarn in the late eighteenth century, Transactions of the Caernarvonshire Historical Society 40, 87-104.

PRN: **59298** SITENAME: **Dinorwic quarry road**

SITETYPE: ROAD DATE CONSTRUCTED: 1810

NGR: SH 5904 6108

DESCRIPTION:

A cart road in operation c. 1810 which connected the Dinorwic quarries (PRN: 20091) and Allt Ddu (PRN: 20089) with the quay at y Felinheli

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as an early industrial road in re-use which enabled the Dinorwic slate quarries to connect with navigable water and outside markets.

BIBLIOGRAPHY:

E. Hyde Hall: A Description of Caernarvonshire; Vaynol estate papers

PRN: **59299** SITENAME: **Ffordd Casson**

SITETYPE: ROAD DATE CONSTRUCTED: 1801

NGR: SH 7078 4585

DESCRIPTION:

A road built in two stages, the earlier, from Diffwys quarry (PRN: 20305) to Congl y Wal in 1801, the later, from Congl y Wal to Rhyd y Sarn in 1827-9. It transported slate from Diffwys to the turnpike and ultimately to the quays on the river Dwyryd, and slate slabs for sawing to Rhyd y Sarn, as well as later to the quarry's mill at Pant yr Ynn.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as an early industrial road connecting the Diffwys slate quarry with its surviving slab mill at Pant yr Ynn.

BIBLIOGRAPHY:

Dr Michael Lewis, research notes; GJ Williams, Hanes Plwyf Ffestiniog pp. 124-5.

PRN: **59300** SITENAME: **Ffordd yr Iuddew Mawr**

SITETYPE: ROAD DATE CONSTRUCTED: 1826

NGR: SH 6609 4408

DESCRIPTION:

A cart road built at the instructions of Nathan Meyer Rothschild (hence the name 'Ffordd yr Iuddew Mawr', 'the road of the great Jew'), to serve his quarry and mining interests on Molewyn mawr and to provide them with access to the turnpike from Tan y Bwlch to Pont Aberglaslyn. The road simply stops at Bwlch Drws Elen, the summit, with no evident connection to any workings, suggesting that its construction was more of a political gesture in the litigious circumstances of the 1820s. GJ Williams refers to one Rogers as the contractor who built the road. The engineer was possibly Benjamin Smith, Rothschild's manager, who was from the English Black Country and had worked in collieries in Canada.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a road supposedly giving acccess to slate quarries on Moelwyn, as an example of how slate quarry transport links could be no more than 'gesture politics' and for its association with Nathan Meyer Rothschild.

BIBLIOGRAPHY:

Dr Michael Lewis, research notes; GJ Willians, Hanes Plwyf Ffestiniog p. 95.

PRN: **59301** SITENAME: **Ffordd y Lord**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 6165 6618

DESCRIPTION:

A cart road connecting Penrhyn quarry to the sea at Abercegin/Port Penrhyn (PRN: 18452), apparently built in the 1790s, reflecting the greater use made of the shipping point at Abercegin rather than Aberogwen. The builder was Richard Pennant, Lord Penrhyn, hence the name 'ffordd y Lord', 'the Lord's road'. It is likely to represent a successive up-grading of earlier cart roadsalong the western side of the Ogwen valley. Part appears to have been overlain by Telford's post road, now the A5.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as an early industrial road in re-use which enabled the Penrhyn slate quarries to connect with navigable water and outside markets.

BIBLIOGRAPHY:

Penrhyn estate maps; Hugh Derfel Hughes, Hynafiaethau Llandegai a Llanllechid p. 123.

PRN: **59302** SITENAME: **Hafod y Llan quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 6134 5242

DESCRIPTION:

A winding cart road which connected Hafod y Llan slate quarry (PRN: 20255) with the turnpike at Cwm Llan and which forms a spectacular contrast to the quarry railway built in the 1860s (PRN: 59329). The lower part of the road is shown on the 1841 1" ordnance survey, connecting with the copper mine at Lliwedd. It is possible that the road was extended to the slate quarry by Alan Searell, the Devonian mining engineer who worked here in the 1840s and the 185Os. As the 'Watkin path' up Snowdon, it was traversed by the Rt Hon. W.E. Gladstone at the invitation of Sir Edward Watkin, Liberal Member of Parliament and railway entrepreneur who built a chalet here, in 1892. This was the first designated footpath in Britain. It stood in for the the North West frontier of India and the border with the emirate of Afghanistan in the 1968 film 'Carry on up the Khyber'.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a road serving a remote slate quarry.

BIBLIOGRAPHY:

David Bick, The Old Copper Mines of Snowdonia, pp. 69-73.

PRN: **59303** SITENAME: **Lord quarry road**

SITETYPE: ROAD DATE CONSTRUCTED: 1826

NGR: SH 7040 4615

DESCRIPTION:

The road connecting Lord quarry on the Newborough/Glynllifon estate with the parish/turnpike road at Ffour Crosses in Blaenau Ffestiniog. Its lower section survives as Lord Street. The engineer was probably John Hughes of Pen y Groes, 'John y Gof', the manager-engineer of this and other Newborough quarries. The grid reference given above reflects the upper end of the present street in Blaenau Ffestiniog, since the upper alignment of the roadis unclear nad has been buroed and quarried away.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as an industrial road in re-use associated with early developments in the Ffestiniog slate industry.

BIBLIOGRAPHY:

CRO: Glynllifon papers

PRN: **59304** SITENAME: **Pant Mawr quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 6570 4449

DESCRIPTION:

A wide and substantially engineered cart road along the contours of Moelwyn Mawr, constructed on a stone embankment, from Pant Mawr slate quarry (PRN: 20280) to the summit of Ffordd yr Iuddew Mawr.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a well-engineered upland road associated with one of the Cwm Croesor slate quarries.

BIBLIOGRAPHY:

Plas Tan y Bwlch archives.

PRN: **59305** SITENAME: **Rhosydd quarry road**

SITETYPE: ROAD DATE CONSTRUCTED: 1853

NGR: SH 6657 4634

DESCRIPTION:

A road which gave Rhosydd quarry (PRN: 20283) access to the Ffestiniog Railway by connecting it to the Cwmorthin quarry road (PRN: 59296). It was built in 1853 partly by upgrading existing tracks, partly by new construction.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as an upland road associated with one of the Cwm Croesor slate quarries.

BIBLIOGRAPHY:

MJT Lewis and J Denton, Rhosydd Slate Quarry, pp. 72-8.

PRN: **59306** SITENAME: **Cefn Du quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 5499 6014

DESCRIPTION:

A road system which connected the Chwarel Fawr quarry (PRN: 20065) and Cefn Du quarries (PRN: 20475) on the ridge between the Llanberis area and Cwm Gwyrfai with the turnpike from Beddgelert to Caernarfon. The quarry road is assumed to have been built in the late 18th century when the Porth yr Aur legal practice ran the quarries.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a slate quarry road associted with the Nantperis quarries dating from the lease to to the local welksh entrepreneurs from the Porth yr Aur legal practice.

BIBLIOGRAPHY:

Bangor University: Porth yr Aur mss

PRN: **59307** SITENAME: **Cedryn quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 7194 6359

DESCRIPTION:

A length of road which gave access to the Cedryn slate quarry (PRN: 20106) from the parish road system, enabling the quarry to export to a wharf on the river Conwy. The road may date from the 1820s, when the quarry was first leased and may therefore have been constructed under the auspices of Samuel Holland.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a slate quarry road in the small Nantconwy group of slate quarries.

BIBLIOGRAPHY:

Caernarfon Record Office: Glynllifon papers

PRN: **59308** SITENAME: **Cwm Eigiau quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 7024 6361

DESCRIPTION:

A length of road which gave access to the Cwm Eigiau slate quarry (PRN: 20100) from the parish road system, enabling the quarry to export to a wharf on the river Conwy. The road may date from the 1820s, when the quarry was first leased and may therefore have been constructed under the auspices of the Rigby family of Hawarden, a firm of iron-founders, or may have been upgraded by them.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a road designed to connect a remote slate quarry with navigable water and outside markets.

BIBLIOGRAPHY:

Bangor University, Baron Hill papers; Caernarfon Record Office, Glynllifon papers.

PRN: **59309** SITENAME: **Melynllyn quarry road**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 7061 6563

DESCRIPTION:

A winding road that connects the slate and honestone quarry at Melynllyn (PRN: 21007) with the parish road. It may date from c. 1869, when the quarry seems first to have been in lease.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as an upland road associated with a small quarry.

BIBLIOGRAPHY:

The National Archives, Kew, leases of crown wastes in Llanbedr y Cennin parish for quarrying.

PRN: **59310** SITENAME: **Cemlyn canal**

SITETYPE: CANAL DATE CONSTRUCTED: 1823

NGR: SH 6629 4028

DESCRIPTION:

A short (285m) canal connecting the navigable stretch of the river Dwyryd with a quay at Maentwrog known as Parry's wharf. The wharf included a limekiln, a general purpose warehouse, aslate quay and a coal-yard. The canal seems to have been in existence by 1823. At the mouth of the canal was the Cemlyn quay, built 1811-2.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

A short canal, the only one associated with the Gwynedd slate industry, which fed the long-lived traffic in slate from Ffestiniog down the Dwyryd river.

BIBLIOGRAPHY:

MJT Lewis, Sails on the Dwyryd, pp. 26-36.

PRN: **59311** SITENAME: **Blaen y Cwm quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 7335 4630

DESCRIPTION:

A short length of railway comprising an uphaulage incline connecting the Blaen y Cwm slate quarry (PRN: 14624) with the Rhiwbach quarry railway. Unusually, the power source (a fixed steam engine) was at its foot. Built in the period 1872-6 according to GR Jones and MJT Lewis.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short uphaulage incline associated with the east Ffestiniog group of slate quarries and for its association with the Rhiwbach quarry railway.

BIBLIOGRAPHY:

GR Jones, Chwarel Blaenycwm, p. 50; MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 7.

PRN: **59312** SITENAME: **Braich quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 5111 5537

DESCRIPTION:

A short length of 0.6 metre (2') gauge railway connecting Braich quarry (PRN: 20175) to the Bryngwyn incline.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short incline associated with the Braich slate quarry, connecting to the Welsh Highland Railway.

BIBLIOGRAPHY:

Boyd JIC 1981. Narrow Gauge Railways in North Caernarvonshire Volume 1. Trowbridge: Oakwood Press.
Boyd JIC 1985. Narrow Gauge Railways in North Caernarvonshire Volume 2. Oxford: Oakwood Press.
Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire Volume 3. Oxford: Oakwood Press.

PRN: **59313** SITENAME: **Bryneglwys quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 6868 0591

DESCRIPTION:

A short contour and incline system that forms the part of the 'mineral extension' of the public Talyllyn Railway, which is not currently used by trains; and which leads to Bryneglwys quarry (PRN: 9186). It is built to the same 0.685 metre (2' 3") gauge as the Talyllyn. It includes two inclined planes, the lower known as the Alltwyllt incline, the upper known as the Cantrybedd incline, between which is a near-level contour section. It was possibly operational before the main public railway; it has been suggested that slate was drawn along its length to the village incline on the Talyllyn Railway and carted thence to Aberdyfi. The rails have been removed from the summit of the Alltwyllt incline, but wooden sleepers and track-spikes survive in a number of places, and the formation is intact. This has been built up on the downslope side on shallow embankments built out of slate rags, and by a shallow cutting made into the hillside on the upslope side.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as part of the Talyllyn Railway system.

BIBLIOGRAPHY:

Boyd, J.I.C. 1988. The Talyllyn Railway. Oxford: Wild Swan.

PRN: **59314** SITENAME: **Bryngwyn to Fron railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1881

NGR: SH 5126 5486

DESCRIPTION:

An 0.6 metre (2') gauge railway connecting Fron quarry (PRN: 20178) to the Bryngwyn incline, replacing the earlier Talysarn to Fron railway as the quarry's main exit route. Believed to have been built in 1881.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a railway associated with the Moel Tryfan group of slate quarries and for its association with the Welsh Highland Railway.

BIBLIOGRAPHY:

Boyd JIC 1981. Narrow Gauge Railways in North Caernarvonshire Volume 1. Trowbridge: Oakwood Press.
Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire Volume 3. Oxford: Oakwood Press.
Bradley VJ 1992. Industrial Locomotives of North Wales. London: Industrial Railway Society

PRN: **59315** SITENAME: **Cedryn quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1864

NGR: SH 7190 6358

DESCRIPTION:

An 0.6 metre (2') gauge railway connecting the Cedryn slate quarry (PRN: 20106) with a wharf on the river Conwy. Most of the route is a near-level contour, with a counter-balanced incline from the quarry to a slab mill, a further counter-balance at Pwlldu and an impressive rake of three more through Coed Dolgarrog. Most of the route was completed in 1864; the Cedryn incline was built 1866-7. Part of the route was re-used by contractors' railways serving the water-catchment system in the 20th century.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a slate quarry railway in the small Nantconwy group of slate quarries, engineered by the Spooner family.

BIBLIOGRAPHY:

E Jones and D Gwyn, Dolgarrog: An Industrial History.

PRN: **59316** SITENAME: **Corris Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1859

NGR: SH 7791 1173

DESCRIPTION:

An 0.69 metre (2' 3") gauge railway built to serve the Corris quarries, opened in 1859 for horse and gravity operation. The lower sections, which gave access to quays on the river Dyfi and to the main line at Machynlleth station, lie outside Gwynedd. Much of the route follows the Dolgellau to Machnynlleth turnpike. The greater part of the railway was converted to locomotive operation in 1878, with horse traction beiung retained on some of the branches. Passengers were carried from 1883 to 1930, and the greater part of the system was closed in 1948. A short section has been revived between Maespoeth and Corris as a heritage railway.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

A railway system serving the quarries in the Aberllefenni and Corris areas, which mostly followed the turnpike road down the Dulas valley. Assigned to category B rather tha n higher because of the loss of part of the route and many of itsassets.

BIBLIOGRAPHY:

Boyd JIC 1970. Narrow Gauge Railways in Mid Wales. Lingfield: Surrey.

PRN: **59317** SITENAME: **Craig Ddu quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1865

NGR: SH 7230 4532

DESCRIPTION:

An 0.6 metre (2') gauge system serving the Craig Ddu quarries (PRN: 20308). The three inclines from the quarry to the main road were built in 1865; the fourth incline was probably built after 1883. A characteristic of the inclines to the main road was that they were long and shallow, enabling use of the 'car gwyllt', a distinctive form of vehicle used by the quarrymen on their journey home.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a slate quarry incline system in the Ffestiniog group of quarries.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), pp. 7-8.
Lewis, M.J.T. 1968b. The Car Gwyllt, Industrial Archaeology 5. Newton Abbot: David and Charles, 135-139, 145.

PRN: **59318** SITENAME: **Croesor railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1864

NGR: SH 6565 4559

DESCRIPTION:

An 0.6 metre (2') gauge railway completed in August 1864 which connected the slate quarries in Cwm Croesor to the sea at Porthmadog. Noteworthy features include the two inclines at Parc, the upper one of which includes a drum-house remodelled by Clough Williams-Ellis as a banqueting hall for the Aberconway family, and the embankment from this point to Croesor village.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance, recognised by the Scheduling of one of its tributary inclines, as a late example of a horse- and counter-balanced incline railway, associated with the Cwm Croesor group of slate quarries.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 7.
Boyd JIC 1988, Narrow Gauge Railways in South Caernarvonshire volume 1.

PRN: **59319** SITENAME: **Cwm Ebol quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 7024 6361

DESCRIPTION:

A railway system presumed to be of 0.6 metre (2') gauge which connected the Cwm Ebol quarry (PRN: 20429) with a wharf on the north bank of the Dyfi near Pennal. Date of construction unknown.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short slate quarry railway system, connecting the Cwm Ebol quarry with the Dyfi river at Pennal, and as the last such railway built to connect with navigable water.

BIBLIOGRAPHY:

Boyd JIC 1970. Narrow Gauge Railways in Mid-Wales. Lingfield: Oakwood.

PRN: **59320** SITENAME: **Cwm Eigiau quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1865

NGR: SH 7024 6361

DESCRIPTION:

An 0.6 metre (2') gauge railway built over several years from 1861 to 1865, an extension of the Cedryn quarry railway (PRN: 59315) to enable Cwm Eigiau quarry to export its slate by means of the Cedryn system to a wharf on the river Conwy. The Cwm Eigiau quarry railway is characterised by mimimal engineering and a very steep gradient.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a minimally-engineered narrow gauge railway designed to connect a remote slate quarry with navigable water and outside markets.

BIBLIOGRAPHY:

Bangor University, Baron Hill mss, Guildhall Library, archive of British Slate Company.

PRN: **59321** SITENAME: **Cwmorthin quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1862

NGR: SH 6817 4571

DESCRIPTION:

A 0.6 metre (2') gauge railway built in the period July 1861 to September 1862 which connected the Cwmorthin quarry (PRN: 20741) with the Ffestiniog Railway (PRN: 59325).

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international historic significance as a direct rail link to the Festiniog Railway, for its association with the Ffestiniog slate industry and for the use of Spooner's catenary principle on a counter-balanced incline.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 5.
Isherwood, G. 1995. Cwmorthin Slate Quarry. Mold: Adit Publications.

PRN: **59322** SITENAME: **Cwt y Bugail quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 7335 4676

DESCRIPTION:

A short 0.6 metre (2') gauge branch built between 1863 and 1867 from the Rhiwbach quarry railway to Cwt y Bugail quarry (PRN: 20311). Although it was on a very shallow gradient, this went against the load, and for a while it operated as a rope-haulage system.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short narrow gauge railway designed to connect a remote slate quarry with the Rhiwbach railway.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 7.

PRN: **59323** SITENAME: **Dinorwic quarry railroad**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1825

NGR: SH 5922 6053

DESCRIPTION:

An 0.6 metre gauge railway/railroad using cast-iron rails, completed in 1825 to connect the Dinorwic slate quarry (PRN: 20091) with y Felinheli (PRN: 20741). For much of its course it ran along the Dinorwic quarry road (PRN: 59298). The course included two inclines at Graig Lwyd, of which the trace is evident, and a further incline at Nant y Garth, of which little remains. A stable-depot at Graig Lwyd has been incorporated into a modern dwelling. The settlement of Clwt y Bont is partly set out along its course.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as a late example of an edge railway using cast-iron rails, as an example of regional technology, closely following the neighbouring Penrhyn quarry railroad, and as enabling the Dinorwic quarries to develop.

BIBLIOGRAPHY:

Caernarfon Record Office, Vaynol papers
Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire Volume 3. Oxford: Oakwood Press.

PRN: **59324** SITENAME: **Dinorwic Quarry Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1843

NGR: SH 6889 0173

DESCRIPTION:

A 1.22 metre (4') gauge railway from Dinorwic quarry (PRN: 20091) to y Felinheli (PRN: 20741) completed for horse traction in 1843 and which used steam locomotives from 1848, operating until October 1961. An unusual feature was the use of 1.22 metre gauge wagons to carry 0.6 metre gauge quarry wagons, a technique which may have been inspired by the Bargoed Coal Road. The stable depot at Craig y Dinas is a noteworthy feature. One of the two original locomotives of 1848 survives in the Penrhyn Castle Industrial Railway Museum. One of the 1.22 metre gauge wagons is preserved at the Narrow Gauge Museum in Tywyn.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as an early steam-locomotive worked industrial railway, for the involvement of major engineers such as William Allcard, James Spooner and Dr William Harland, as the railway that enabled Dinorwic slate quarry to grow to a significant scale, and for the survival of infrastructure, an early locomotive and an item of rolling stock.

BIBLIOGRAPHY:

Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire 3. Headfington: Oakwood.

PRN: **59325** SITENAME: **Festiniog Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1836

NGR: SH 7035 4604

DESCRIPTION:

An 0.6m (2') gauge railway opened in 1836 which connected the slate quarries at Ffestiniog with the sea at Porthmadog, as well as with the Cambrian Railways at Minffordd (from 1872) and with the Great Western and London and North Western railways at Blaenau Ffestiniog from the 1880s. Closed in 1946, and part of the route drowned by a pumped-storage scheme; re-opened in stages from 1955, reaching Blaenau Ffestiniog by means of a new route (the Ffestiniog Railway deviation, PRN: 59326) in 1982.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

The Festiniog Railway is of international historic significance for the way in which it:

Is a transformational creative work indicative of genius which carried forward the technology of the unimproved narrow-gauge horse-drawn mineral line into the era of the locomotive-worked public passenger railway
Made pioneering, innovative and influential use of steam locomotives
Made pioneering, innovative and influential use of articulated locomotives and vehicles
Represents an important global interchange of human values as an appropriate transport solution for developing countries following trials on the railway in 1870
Is outstanding in its preservation and continued use of engineering/infrastructure from the 1830s-1900

It is of international significance as a source of evidence for/knowledge of:

1830s-1900 railway engineering and technology

BIBLIOGRAPHY:

Boyd, J.I.C. 1975a. Festiniog Railway 1 History and Route. Blandford: Oakwood Press.
Boyd, J.I.C. 1975b. Festiniog Railway 2 Locomotives and Rolling Stock Quarries and Branches: rebirth 1954-74. Blandford: Oakwood Press.

PRN: **59326** SITENAME: **Festiniog Railway deviation**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1965

NGR: SH 6790 4222

DESCRIPTION:

A 4km long section of railway built by volunteer effort between 1965 and 1978 to connect the already-reopened section of the Festiniog Railway with the then-dormant upper section and replacing a sectino of the line flooded by the Llyn Ystradau pumped storage lake.Unusually, this length of line includes a spiral to gain height.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

The Festiniog Railway deviation is of international historic significance for the way in which it:

Forms part of the route of the Festiniog Railway (qv), as an example of technology (aspiral to gain height) borrowed from the narrow-gauge railways of India, in particular the World Heritage Darjeeling Himalayan Railway, itself influenced by Festiniog Railway practice

BIBLIOGRAPHY:

http://www.festipedia.org.uk/wiki/Deviation

PRN: **59327** SITENAME: **Gorsedda Junction and Portmadoc Railways**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1875

NGR: SH 5404 5043

DESCRIPTION:

A 0.6 metre (2') gauge railway built partly on the track-bed of the former Gorsedda railway (PRN: 59328) and partly on a new formation to connect the slate quarries at Bwlch y Ddwy Elor (Prince of Wales quarry [PRN: 20221]) and other workings (peat and copper) with Porthmadog. Opened in September 1875 but saw little traffic and dismantled in the 1890s. It was built for locomotive operation.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a railway born out of false hopes of the profitability of locally-quarried slate and locally-mined copper using Festiniog Railway technology on a smaller scale.

BIBLIOGRAPHY:

Boyd JIC 1988, Narrow Gauge Railways in South Caernarvonshire volume 1

PRN: **59328** SITENAME: **Gorsedda railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1857

NGR: SH 5720 4539

DESCRIPTION:

A 0.91 metre (3') gauge railway connecting Gorsedda quarry (PRN: 20238) with its slab mill at Ynys y Pandy (PRN; 220) and with the sea at Porthmadog. It was built 1856-7, but carried very little traffic. Much of its course was re-used by the Gorsedda Junction and Portmadoc Railways (PRN: 59327).

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as a railway which refelcts the investment in slate quarrying from the mid-1850s in Gorsedda and other quarries and for the assocation with James Brunlees and Daniel Makinson Fox.

BIBLIOGRAPHY:

Lewis, M.J.T. (forthcoming) Gorseddau: a portrait of a slate quarry and its railway.

PRN: **59329** SITENAME: **Hafod y Llan quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 6129 5253

DESCRIPTION:

A 0.6 metre (2') gauge railway built partly on the level and partly on two inclined planes, one of them on a spectacular catenary section, to connect the Hafod y Llan quarry (PRN: 20255) with a rail-road interchange at Cwm Llan thereby giving the quarry access to the sea at Porthmadog. The date of construction is unclear but was evidently in the late 1860s.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a railway serving a remote slate quarry.

BIBLIOGRAPHY:

Boyd JIC 1988, Narrow Gauge Railways in South Caernarvonshire volume 1

PRN: **59330** SITENAME: **Manod/Bwlch y Slaters quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1884

NGR: SH 7322 4555

DESCRIPTION:

A short and steeply graded 0.6 metre (2') gauge branch railway which included a reversing neck, giving the Manod/Bwlch y Slaters quarry (PRN: 20309) a rail link to the Ffestiniog Railway (PRN: 59325) by means of the Rhiwbach quarry railway (PRN: 59453). It is believed to have been built in 1884 and was disused by the 1930s.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short and minmially engineered railway with an unusual switchback formation, associated with the east Ffestiniog group of slate quarries and for its association with the Rhiwbach quarry railway.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 8.

PRN: **59331** SITENAME: **Moel Tryfan quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 5135 5588

DESCRIPTION:

An 0.6 metre (2') gauge railway including an incline plane, conecting the Moel Tryfan quarry (PRN: 20179) with the North Wales Narrow Gauge Railway/Welsh Highland Railway (PRN: 59457). Believed to have been built in the late 1870s.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short slate quarry railway associated with the Welsh Highland Railway.

BIBLIOGRAPHY:

Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire Volume 3. Oxford: Oakwood Press.
Bradley VJ 1992. Industrial Locomotives of North Wales. London: Industrial Railway Society

PRN: **59332** SITENAME: **Moelwyn quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1864

NGR: SH 6612 4430

DESCRIPTION:

An 0.6 metre (2') gauge railway made up of a series of inclined planes connecting the Moelwyn quarries (PRN: 20286) with the Ffestiniog Railway (PRN: 59325). This railway was built by May 1867 but carried no traffic until 1867.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as an impressive rake of inclines connecting a slate quarry to the Festiniog Railway; considered category B owing to the fact that the upper lake of the pumped stoarage scheme has drowned part of the route.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 6.

PRN: **59449** SITENAME: **Nantlle Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1828

NGR: SH 5079 5361

DESCRIPTION:

A 1.07 metre (3' 6") gauge railway, the first public railway in North Wales, established by Act of Parliament of 1825 and opened in 1828. Designed as a plateway, but built, on the advice of Robert Stephenson I, as an edge-railway using wrought-iron fishbelly rails on stone blocks. The Nantlle Railway connected the Nantlle quarries with the sea at Caernarfon but also carried other goods and passsengers. The railway fell foul of the railway politics of the 1850s and 1860s and eventually became part of the Euston empire. It was cut back from Caernarfon to Tyddyn y Bengam in 1866 and to Tal y Sarn in 1872, leaving only a short stump which remained in operation until November 1963. Much of the course survives, as well as several important structures, including the former pub at Pen y Groes which provided passenger facilities.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as the first public railway in North Wales, for the involvement of Robert Stephenson the elder in its design and construction, for the early use of wrought-iron rails and stone blocksleepers, for the survival of what may be the world's oldest railway station, and as the means by which slate from the Nantlle valley was exported.

BIBLIOGRAPHY:

Gwyn, D. 2001. Transitional Technology; the Nantlle Railway, Early Railways. London: Newcomen Society, 46-62.
Boyd JIC 1981. Narrow Gauge Railways in North Caernarvonshire Volume 1. Trowbridge: Oakwood Press.

PRN: **59450** SITENAME: **Pant Mawr and Fron Boeth quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1878

NGR: SH 6538 4459

DESCRIPTION:

An 0.6 metre (2') gauge system connecting the Pant Mawr and Fron Boeth quarries (PRN: 20289 and PRN: 20276) with the Croesor railway (PRN: 59318). Noteworthy features are the two inclines on the south-eastern flanks of Cwm Croesor. The Pant Mawr incline was completed in February 1878 and the Fron Boeth by 1890.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a slate quarry railway associated with the Croesor Railway and which includes some impressive inclines.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 8.

PRN: **59451** SITENAME: **Penrhyn quarry railroad**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 6167 6618

DESCRIPTION:

An 0.6 metre (2') gauge iron railroad which adapts existing south-Walian edge-rail practice. It ran from the Felin Fawr slab mill complex (PRN: 21947) to Port Penrhyn (PRN: 15856). At the time of its completion in 1801, the longest iron edge railway in the world, and one of the earliest applications of a railway system to the quarrying industry. Thomas Dadford's background in canal construction may be evident in the design of the inclines, of which there were three, at Marchogion, Dinas and Ty'n y Clwt. The gauge and the general engineering of this system established much of what was to become standard practice in the slate industry and as such is the ultimate progenitor of the Ffestiniog system. Its course includes the Cegin viaduct (PRN: 12143, SAM)

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as the longest overland iron railroad in the world when built, as an early example of the use of a railway system within a quarrying industry, for the influence of canal engineering in its construction and as the means by which Penrhyn slate was exported from 1801 to the 1870s.

BIBLIOGRAPHY:

Boyd, J.I.C. 1985. Narrow Gauge Railways in North Caernarvonshire Volume 2. Oxford: Oakwood Press.
Oeynhausen, C. von and Dechen, H. von. 1971. Railways in England 1827 and 1827. Cambridge: Newcomen Society.

PRN: **59452** SITENAME: **Penrhyn Quarry Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 6154 6615

DESCRIPTION:

An 0.6 metre (2') gauge locomotive-operated railway build in stages in the 1870s to replace the Penrhyn quarry railroad of 1801. Though the route does not involve any major civil engineering features, it is steely graded. It was designed by Charles Easton Spooner on the lines of the Ffestiniog Railway. It operated until 1962. It ran from the Felin Fawr slab mill complex (PRN: 21947) to Port Penrhyn (PRN: 15856). The railway's facilities for day-to-day operaiton were situated at Port Penrhyn and survive in good condition (PRN: 18456-18458).

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as an application of Ffestiniog Railway technology to a purely mineral-carrying system, for the contrast with its predecessor system, the Penrhyn quarry railroad, and as the means by which Penrhyn slate was exported from the 1870s to 1962.

BIBLIOGRAPHY:

Boyd, J.I.C. 1985. Narrow Gauge Railways in North Caernarvonshire Volume 2. Oxford: Oakwood Press.

PRN: **59453** SITENAME: **Rhiwbach quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1863

NGR: SH 7389 4612

DESCRIPTION:

An 0.6 metre (2') gauge railway built to connect quarries in the parish of Penmachno, particuarly Rhiwbach quarry (PRN: 8897), with the Ffestiniog Railway (PRN: 59325), which invoved crossing an upland tract. It was built for horse traction on the level sections but included three counter-balanced incline planes on the Ffestiniog side and one powered incline to raise wagons on the Rhiwbach side. The final section, the no 2 counter-balance incline, was operational until 1976 and remains partially intact. The inclines are impressive features.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as part of the network of narrow gauge railways that fed the Ffestiniog Railway, as the means by which slate from Maenofferen quarry and the quarries in Penmachno parish were exported, and as a late example of early railway engineering mixing level sections for horse-working with both powered and counter-balanced inclined planes.

BIBLIOGRAPHY:

Jones GR 2005. Rhiwbach Quarry.

PRN: **59454** SITENAME: **Rhosydd quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1864

NGR: SH 6632 4626

DESCRIPTION:

The 0.6 metre (2') gauge Rhosydd quarry railway consists of a length of level track from the Rhosydd quarry (PRN: 20283) premises to the summit of a catenary section incline, of which the upper section is practically 1/1. This gives access to the upper terminus of the Croesor railway (PRN: 59318), and hence to the sea at Porthmadog. The designer was Charles Easton Spooner, and the railway was brought into use in August 1864.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as part of the network of narrow gauge railways that connected the Croesor quarries with the sea, and for the work of Charles Easton Spooner.

BIBLIOGRAPHY:

MJT Lewis and J Denton, Rhosydd Slate Quarry, pp. 81-.

PRN: **59455** SITENAME: **Talyllyn Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1866

NGR: SH 6811 0666

DESCRIPTION:

A 0.685 metre (2' 3") gauge railway, purpose-built for steam locomotive operation, intended to connect the railway to the independent mineral line to Bryneglwys quarry and to the main line attywyn. The Talyllyn Railway was the first of the Welsh slate quarry railways not to be built to give access to navigable water and was one of the first two (along with the Festiniog and Blaenau Railway) to be designed for locomotive operation. It was opened for freight in July 1866 and to passengers in October 1866. it was the first railway in the worldto be revived by an enthusiast group.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance as the first instance of a narrow gauge railway built from the outset as a public railway for locomotive operation, and as the first railway in the world to be rescused from closure and operated by enthusiasts.

BIBLIOGRAPHY:

Boyd, J.I.C. 1988. The Talyllyn Railway. Oxford: Wild Swan.
Rolt, L.T.C. 1971. Talyllyn Adventure. Newton Abbot: David and Charles.

PRN: **59456** SITENAME: **Tal y Sarn to Fron quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1868

NGR: SH 5124 5484

DESCRIPTION:

A 1.07 metre (3' 6") gauge railway connecting the Nantlle Railway at Tal y Sarn with the Fron quarry (PRN: 20178). Completed in 1868.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a short-lived part of the network of railways that connected the Fron quarry with the Nantlle Railway.

BIBLIOGRAPHY:

Guildhall Library, records of British Slate Company.

PRN: **59457** SITENAME: **Welsh Highland Railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 4808 6248

DESCRIPTION:

An 0.6 metre (2') gauge railway with a complicated history. As the North Wales Narrow Gauge Railway, it connected the Moel Tryfan and Cwm Gwyrfai slate quarries with the London and North Western Railway at Dinas. In the 20th century, after the failure of attempts to complete an electrically-powered railway, it was extended to join the Ffestiniog Railway at Porthmadog along the trackbed of the Croesor railway. Closed in 1937 and dismantled in 1941, it was since been re-opened as a heritage railway from Caernarfon through Dinas to Porthmadog. The branch line to Bryngwyn (the last sectino of which operated as a counter-balanced incline), which served the Moel Tryfan quarries, has been made into a footpath between Tryfan Junction and Rhostryfan.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

The Welsh Highland Railway is of international historic significance for the way in which it:

Exemplifies influence and application of the Ffestiniog Railway's innovative technologies to provide a cost effective transport system suitable for developing countries
Makes innovative use of modern steam locomotives
Demonstrates engineering/infrastructure from the 1870s-1920s

It is of international significance as a source of evidence for/knowledge of:
19th/early 20th railway engineering and technology
20th/21st century railway engineering and technology

BIBLIOGRAPHY:

Johnson, P. 2009. An Illustrated History of the Welsh Highland Railway. Hersham: OPC.

PRN: **59458** SITENAME: **Wrysgan quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED:

NGR: SH 6779 4554

DESCRIPTION:

Practically the whole length of this 0.6 metre (2') gauge railway is a counter-balance incline connecting the quarry to the Ffestiniog Railway. Unusually, it passes through a tunnel. It was constructed in 1864 to a design by Charles Easton Spooner.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international historic significance as a highly visible direct rail link to the Festiniog Railway, for its association with the Ffestiniog slate industry and for the early use of Spooner's catenary principle on a counter-balanced incline.

BIBLIOGRAPHY:

MJT Lewis 'Quarry Feeders' in (Ffestiniog Railway) Heritage Group Newsletter 13 (Spring 1986), p. 7.

PRN: **59459** SITENAME: **Alexandra quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1881

NGR: SH 5210 5612

DESCRIPTION:

A sinuous course designed for locomotive operation connecting Alexandra quarry (PRN: 20181 [Cors y Bryniau, chwarel y gors]) with the Bryngwyn incline, laid c. 1881, and exemplifying the approach pioneered on the Ffestiniog Railway and currently being applied on the Darjeeling Himalayan Railway.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: A**

Of national significance as a sinuous locomotive-worked contour railway exemplifying the approach to railway engineering pioneered on the Ffestiniog Railway and currently being applied on the Darjeeling Himalayan Railway.

BIBLIOGRAPHY:

Boyd JIC 1981. Narrow Gauge Railways in North Caernarvonshire Volume 1. Trowbridge: Oakwood Press.
Boyd JIC 1986. Narrow Gauge Railways in North Caernarvonshire Volume 3. Oxford: Oakwood Press.
Bradley VJ 1992. Industrial Locomotives of North Wales. London: Industrial Railway Society

PRN: **59460** SITENAME: **Fachwen quarry road**

SITETYPE: ROAD DATE CONSTRUCTED: 1826

NGR: SH 5808 6176

DESCRIPTION:

A road built to connect the quarries at Fachwen (PRN: 20072; PRN: 20080; PRN 20082: PRN 20083) with the turnpike to Caernarfon. This route includes the attractive listed bridge at Penllyn.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as an early industrial road in re-use which enabled the smaller local slate quarries to connect with the turnpike.

BIBLIOGRAPHY:

Caernarfon Record Office: Newborough (Glynllifon) papers

PRN: **59461** SITENAME: **Festiniog Railway inclines**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1836

NGR: SH 6795 4270

DESCRIPTION:

The course of two temporary inclines built as a stop-gap on the advice of Robert Stephenson before the Festiniog railway could cut atunnel through the Moelwyn col, one for uphaulage powered by a waterwheel, the other acounter-balance.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: AA**

Of international significance aspart of the originalroute of the Festiniog Railway and for the link with Robert Stephenson.

BIBLIOGRAPHY:

PRN: **59462** SITENAME: **Rhos quarry railway**

SITETYPE: RAILWAY DATE CONSTRUCTED: 1863

NGR: SH 7280 5630

DESCRIPTION:

The course of a railway serving the Rhos quarry at SH 7280 5630 as well as the small Foel (Moel Siabod, Trewydir or Bryn Cyple) quarry at SH 7170 5550. Rhos was connected to this rail system in 1874 but it was originally built in 1861-3 by the lessees of Foel. It is beleived to have been used until the 1940s. The upper section is laid on a remarkably steep gradient for a horse-worked railway, up to 1/9 between its six inclines. At its lower terminus the railway served a road transport yard and a slab mill at Pont Cyfyng.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as a cheaply-built railway serving two slate quarries.

BIBLIOGRAPHY:

Williams MC and Lewis MJT 1989, Gwydir Slate Quarries

PRN: **59463** SITENAME: **Penrhyn quarry to Aberogwen slate route**

SITETYPE: ROAD DATE CONSTRUCTED:

NGR: SH 6257 6595

DESCRIPTION:

The route believed to have been taken by slate-carrying pack horses from the penrhyn quarry to the landing place at Aberogwen in the 18th century, superseded in the late 18th century by ffordd y lord.

STATEMENT OF SIGNIFICANCE: **SIGNIFICANCE CATEGORY: B**

Of regional significance as the assumed course of an early industrial road in re-use which enabled the Penrhyn slate quarries to connect with navigable water and outside markets in the very early capitalised period.

BIBLIOGRAPHY:

Penrhyn estate maps; Hugh Derfel Hughes, Hynafiaethau Llandegai a Llanllechid p. 122.

APPENDIX II: Summary of archaeological and historical significance

The various sites have been categorised according to their archaeological and historical significance: **AA** - internationally significant; **A** - nationally significant; **B** - regionally significant; **C** - locally significant.

PRN	Name	Category
59296	Cwmorthin quarry road	B
59297	Dinorwic quarry drag	A
59298	Dinorwic quarry road	A
59460	Fachwen quarry road	B
59299	Ffordd Casson	A
59300	Ffordd yr Iuddew Mawr	B
59301	Ffordd y Lord	AA
59302	Hafod y Llan quarry road	B
59303	Lord quarry road	A
59304	Pant Mawr quarry road	B
59305	Rhosydd quarry road	B
59306	Cefn Du quarry road	B
59307	Cedryn quarry road	B
59308	Cwm Eigiau quarry road	B
59309	Melynllyn quarry road	B
59310	Cemlyn canal	A
59459	Alexandra quarry railway	A
59311	Blaen y Cwm quarry railway	B
59312	Braich quarry railway	B
59313	Bryneglwys quarry railway	AA
59314	Bryngwyn to Fron quarry railway	B
59315	Cedryn quarry railway	B
59316	Corris Railway	B
59317	Craig Ddu quarry railway	B
59318	Croesor railway	A
59319	Cwm Ebol quarry railway	B
59320	Cwm Eigiau quarry railway	B
59321	Cwmorthin quarry railway	AA
59322	Cwt y Bugail quarry railway	B
59323	Dinorwic quarry railroad	A
59324	Dinorwic Quarry Railway	AA
59325	Festiniog Railway	AA
59326	Festiniog Railway deviation	?AA
59461	Festiniog Railway inclines	?AA
59327	Gorsedda Junction and Portmadoc Railways	B
59328	Gorsedda railway	A
59329	Hafod y Llan quarry railway	B
59330	Manod/Bwlch y Slaters quarry railway	B
59331	Moel Tryfan quarry railway	B
59332	Moelwyn quarry railway	B
59449	Nantlle Railway	AA
59450	Pant Mawr and Fron Boeth quarry railway	B
59451	Penrhyn quarry railroad	AA

59452	Penrhyn Quarry Railway	AA
59453	Rhiwbach quarry railway	A
59454	Rhosydd quarry railway	A
59455	Talyllyn Railway	AA
59456	Talysarn to Fron quarry railway	B
59457	Welsh Highland Railway	AA
59462	Rhos quarry railway	B
59458	Wrysgan quarry railway	AA
59463	Penrhyn quarry road to Aberogwen	B

APPENDIX III: The 1870 visit to the Festiniog railway by an Imperial Russian Commission.

A visit to the Festiniog Railway by an Imperial Russian Commission in 1870, accompanied by guests drawn from the political, technical and financial elites of Russia, Poland, Hungary, India, Mexico, Prussia and France, focused attention on the possibilities of the Welsh slate quarry gauge.[3]

Narrow gauge railways were cheap to build but could carry less traffic. In Britain, a Royal Commission had reported in 1845 in favour of a standard gauge of 4' 8½",[4] and the Irish Railway Commission and the Board of Trade had interested themselves in the vexed question of the optimal gauge for the growing network of Ireland. By the 1860s and 1870s the option of comparatively inexpensive narrower gauge lines was becoming increasingly attractive for governments and private investors aware of the potential of remote areas.

Heading the guest-list was George Granville William Sutherland Leveson-Gower, third Duke of Sutherland (1828-1892), one of the richest men in Britain. Despite this, or because of it, his Grace was no slave to convention in any form, and liked few things better than driving locomotives, a passion he could indulge as a hereditary director of the London and North Western Railway and deputy chairman of the Highland Railway. His schooling was at Eton, but then went on to King's College, London rather than to Oxford or Cambridge. Though he was in some respects an eighteenth-century Whig grandee in outlook, in his interest in industry and in transport he also anticipates the more modern hands-on but ultimately landless aristocrats of the twentieth century, seeking out a new role in a changing society.

Count Aleksey Pavlovich Bobrinsky (1826-1894) was the nephew of Count Aleksey Alekseyevich Bobrinsky (1800-1868), whose grandfather was the illegitimate (but acknowledged) offspring of the Empress Catherine the Great. Aleksey Alekseyevich is remembered as the founder of the sugar-processing industry in Imperial Russia. After a brief and uneventful career at the royal court, he settled in Bogoroditsk, establishing one of the first Russian sugar refineries there, before moving his operations to the Ukraine. He enabled Russia to become self-sufficient in sugar. He also published a treatise on economic theory and set up a society to promote and finance railway development. He had supported the first, almost experimental, main line in Russia, built 1836-7 from St Petersburg to Zarskoe Selo and Peterhof.[5] Aleksey Pavlovich was to go on to serve as Minister of Transportation from 1871, succeeding his cousin, Count Vladimir Alekseyevich (1824-98), Aleksey Alekseyevich's second son.[6]

Béla Graf (Count) Széchenyi von Sárvár-Felsővidék (1837-1908) was a Magyar aristocrat of progressive views; as a deputy in the Hungarian parliament diet of 1861 he had firmly supported the removal of civil disabilities from the Jewish population. His most notable characteristic, however, seems to have been an inordinate wanderlust, which ultimately took him India, China and Burma.[7] His father, the late Count István, an Anglophile and a moderniser, had been an enthusiast for

[3] C.E. Spooner: *The Narrow Gauge* (London: Spon and Co., 1871).

[4] The act was passed the following year; 9 and 10 Victoria, cap. 57, 'An Act for Regulating the Gauge of Railways'

[5] F.R. Gamst, 'The Long Road to a Terminus in America: The Railroad Engineering Career of Franz Anton von Gerstner' in Gamst (ed.) *Early American Railroads: Franz Anton Ritter von Gerstner's* Die inner Communicationen *(1842-1843)*, (Stanford, California: Stanford University Press, 1997), 18.

[6] http://en.wikipedia.org/wiki/Bobrinsky.

[7] See *Biographisches Lexikon des Kaisertums Österreich* (Wien: Druck und verlag der k.k. hof und Staatsdruckerei, 1880), S. 224–226; Béla Graf Széchenyi: *Amerikai utam. Kivonatok 1862-ki naplómbol* (Pest, 1863); and Gustav Kreitner: *In fernen Osten: Reisen des Grafen Bela Széchenyí In Indien, Japan, China, Tibet und Birma* (Vienna: Alfred Hölder, 1881).

railways from as early as 1825, and though he is better chiefly remembered for establishing steam-boat communication on the Danube and the Theiss (Tiza), and for the suspension bridge which links Buda and Pesth. He worked hard to integrate Hungary's growing transport systems. He became Minister for Transport and Social Affairs after the Hungarian revolution of 1848.[8]

Count Andrzej Zamoyski (1800–1874) was a member of an aristocratic Polish family, an agricultural improver and founder of a steamship company on the Vistula. He had been forced to take a very anti-Russian stance in the uprising of 1863 (having originally tried to tread a path of compromise between loyalty to the powers-that-be and Polish national feeling), for which he had been exiled.[9] It would be interesting to know what conversation he had with another guest on the FR, Count Alexander von Berg (1803-1884), the younger brother of Count Frederik Vilhelm Rembert von Berg, who had been appointed viceroy (*Namestnik*) of Poland in May 1864 by the Tsar after the Grand Duke Konstantin Nikolayevich had proved disappointingly liberal in his response to the uprising.[10]

Several directors of Russian railways and some attendant engineers and professors filled out the Eastern European contingent. They were (spellings as in *Narrow Gauge Railways*): Col. Statkowski, Russian Imperial Engineer; Professor Saloff, Russian Institute of Imperial Engineers; M. Roehrberg, Chief Engineer of the Nigne Moscow Railway; M. Schuberski, Locomotive Superintendent of the Wornesch Rostow Railway; M. Kislinksi, Russian Imperial Engineers; M. Von Desen, Imperial Russian Engineer of the Seratoff Railway; M. Sementechymoff; M. Sachnoffski .[11]

A delegate of humbler origins was William T. Mulvany, a character not unlike Spooner himself. Born in Limerick, he assisted in the first ordnance survey of Ulster and Connaught, supervised the drainage of the Shannon, and planned the Shannon-Erne waterway, before setting up the 'Hibernia', 'Shamrock' and 'Erin' collieries in the Ruhr, becoming one of the leading industrialists of Prussia. [12] In 1868 he published a volume in which he argued that it was the business of railways to increase, even create traffic, by making industries profitable which would otherwise not pay their way.[13]

A Mr Power, Vice Chairman of the Poti and Tiflis Railway in Georgia, as he is described in *The Narrow Gauge*, is credited with being a Member of Parliament in the local press. This suggests that he was Edmond de la Poer, the Liberal MP for County Waterford from 1868 to 1873, a grander individual than Mulvany, a member of the Anglo-Irish ascendancy, though a Roman Catholic. Spooner's press-release confuses matters by identifying him as 'connected with the Mexico and Vera Cruz Railways', an organisation which had had more than its fair share of the challenges that can afflict a railway in the building. Its imperial patron, Maximilian I, had been put in front of a firing squad at Santiago de

[8] For István (Stephen) Széchenyi, 'the greatest of the Magyars', see George Barany: *Stephen Széchenyi and the awakening of Hungarian nationalism, 1791-1841* (Princeton, New Jersey: Princeton University Press 1968), esp. p. 112, pp. 338-9 (railways), pp. 248-254 (steamships), 273-4 (bridge, Liverpool and Manchester railway) and p. 356 (integration).

[9] Information from Count Adam Zamoyski.

[10] *Genealogisches Handbuch der baltischen Ritterschaften* (Estland, Görlitz, 1930). *The Narrow Gauge* simply calls him 'Count Berg' – p. 45 and 'Count Alexander Berg' – p. 59. In the local press he is referred to ambiguously as 'Count Alexander Berg, son of the generalissimo of the Russian army, and Viceroy of Poland' implying that the FR visitor was himself the Viceroy. The Viceroy had no sons of his own but adopted Alexander's sons, one of whom, Count Friedrich Georg Magnus von Berg (1845-1938) studied at the Sorbonne, worked as clerk in London and as farmer on Scotland, and became famous for developing strains of rye, willow and potatoes, and breeds of fish and horses, and for building canals on his Estonian estate.

[11] 'Nigne Moscow' is presumably Nizhni (Novgorod)-Moscow, and 'Wornesch Rostow' presumably Voronezh-Rostov. Von Desen is promoted to 'Count' in one of the local papers. Count Ivan Tlabroburr of Moscow also appears in the press releases but not in the narrow gauge. He has proved impossible to identify.

[12] John J. O'Sullivan: *Breaking Ground: The Story Of William T. Mulvany* (Tower, 2004).

[13] William T. Mulvany: *Germany: progress in coal and iron dependent on Railways* (Dusseldorf: Dietz, 1868)

Querétaro three years previously, and the Liberal President Benito Juárez, who had signed the death warrant, was determined to make the railway prove its political reliability before granting any more concessions. So far it had only completed fifty miles of track from the coast as far as Atoyac.[14] It maybe that De la Poer was associated with railways not only in Georgia but also in Mexico, though the ambiguity may reflect the fact that another of the party, G.B. Crawley (1833-1879), was contractor for both.[15]

From France came M. Genty, President of the La Vendée Railway, M. Duval, its Engineer, and M. Kremer, *Directeur* of the Poti and Tiflis.

The two Scandinavian delegates were Carl Pihl, who had introduced 3' 6" railways to Norway from 1857 onwards, and Christer Peter Sandberg, whom Spooner describes as 'of the Swedish Consulate' but who was a major industrialist in his own right. He had come to England in 1860 as a consulting and inspecting engineer for the Swedish State Railways, to check the quality of rails that were being purchased, and he established a permanent way consultancy in London. The early years of his practice coincided with the introduction of the Bessemer process for steel and he was associated with its experimental use on the LNWR.[16] From Switzerland came Carl Burckhardt.

General Sir William Erskine Baker of the Public Works Department, was a consulting engineer on railways to the Government of India, and a Member of the Council of India. Juland Danvers, Government Director of Indian Railways and W.T. Thornton, Corresponding Secretary of the Public Works, Railway and Telegraph Department of the India Office were also present. A private individual with interests in India was Fleming of the Glasgow-Bombay firm of Smith, Fleming and Co.[17]

From nearer at hand came George Allen CE, James Samuel CE, Director of the Railway Working Association, Mr Tolmé and A.P. Hobson, also both of the Railway Working Association, Mr Preston CE, another Preston who was Solicitor to the LNWR, Mr Patchett, Superintendent of the LNWR in Wales, also Messrs Elias, Walker and Owen, General Manager, Locomotive Superintendent and Engineer respectively of the Cambrian Railways, and Mr Poole, the local traffic manager, Mr Broughton, GM of the Mid Wales Railway, Messrs Roberts and Caulfield, Engineers respectively of the Brecon and Merthyr and the Neath and Brecon, and Mr Henshaw, General Manager of the Neath and Brecon. The FR was represented not only by Spooner himself but also by Livingston Thompson, a

[14] Robert H. Duncan: *Maximilian and Mexico's First Steps toward the Global Marketplace (1864-1866)*, http://www.economia.unam.mx/amhe/memoria/simposio21/Robert%20DUNCAN.pdf, accessed 27 February 2011.

[15] Dates from Bob Gwynne, NRM. Barings invested in both – Baring archive House Correspondence (HC) 10 (Russia) 10:49 – Duncan.

[16] Christer Peter Sandberg: *The Manufacture and Wear of Rails* (London: Clowes and Sons, 1869 – excerpt from the *Minutes of the Proceedings of the Institution of Civil Engineers*). He later he became involved with the development of variable transmission drives and fluid flywheels. http://www.sandberg.co.uk/history/history.html, accessed 25 January 2011.

[17] Fleming is either James Nicol Fleming, the son of a Glasgow merchant, an investor in the Racine and Mississippi Railroad, which became the Western Union in 1865, or his brother John ('Bombay Jock'), with whom he had made a fortune cornering cotton stocks during the American civil war supply famine. With this they had purchased tracts of reclaimed land around Bombay port to develop exports of Indian cotton to Britain, on which a terminus of the Great Indian Peninsula Railway was built. Their firm was to collapse shortly after the failure of the City of Glasgow bank in 1878, which brought down several City and Far East finance houses – Sandip Hazareesingh: *'Chasing commodities over the surface of the globe': Shipping, port development and the making of networks between Glasgow and Bombay, c.1850-1880* (Ferguson Centre for African and Asian Studies, Open University, October 2007, Commodities of Empire Working Paper No 1, ISSN: 1756-0098), 11-16. *Sunday Herald*, 21 December 2008.

solicitor of Donaghadee in County Down (reflecting that the FR's original capital in 1832-6 had come from Ireland), and Charles Easton's brother, James Swinton Spooner 'Engineer. Talyllyn Railway'. The national and the technical press were represented by Mr Dallas of the *Times* and Mr Thomas Cargill, engineer and reporter of the *Engineering Gazette* – another instance of the Spooner-Fairlie publicity machine at work.

This extraordinary cosmopolitan and polyglot group was sent off to the Sportsman Hotel in Portmadoc and at the Tanybwlch hotel (the Oakeley Arms) in Maentwrog, except for the Duke of Sutherland, who was prevailed upon to accept Spooner's hospitality at Bron y Garth.

Trials took place that afternoon and the next day. At 4am on the Monday, the Russians fired up *Little Wonder*, but were defeated by frozen plumbing, before the whole party left for Mid-Wales to inspect the standard-gauge Neath and Brecon Railway and its own fairlie, *Progress*. They had the choice of a visit to Dowlais ironworks or a further session on *Progress* the following morning. The Russians and French re-appeared at Porthmadog on the 16th to conduct further trials.

What made this group of very well-connected men join together and spend a week in Wales in the depths of winter, enduring not only terrible weather but also no doubt indifferent cooking and plumbing? It was an extraordinarily high-ranking group, and it was quite a coup for Spooner, a provincial middle-class professional, that the Duke of Sutherland should stay in his house.

Spooner goes some way to explaining this. Apparently Power and Crawley had been so impressed with the Fairlie locomotive that they endeavoured to persuade the Russian government to use them on the Poti to Tiflis railway and to build it to 2' 6" gauge instead of the Russian standard as planned, and Fairlie had gone to St Petersburg to argue the case. Count Vladimir Alekseyevich Bobrinsky, as Minister for Public Works, agreed that his cousin should head a commission to investigate the locomotives' potential, and he took with him Berg and Zamoyski, who were personal friends and who had some general interest in railways. Coincidentally, the British administration in India accepted an invitation from Fairlie to visit Wales, and others such as Pihl took advantage of the opportunity to visit in an official capacity, since the Russians were proposing to see his lines in Norway on their way home, after a visit to the Antwerp-Ghent railway. Széchenyi came as a private individual.[18]

It was clearly the arrival of the Russian that prompted the visit. The Imperial government was taking railway-building very seriously indeed, and it is not hard to see why. Though Tsar Nicholas I had given active support to the first main line railway in Russia, he was a deeply conservative monarch, for whom the orthodox church and Holy Mother Russia were the only true guiding principles; some western fads like industrialisation were to be examined very closely, others, like liberalism, rejected with contempt.[19] However, the humiliating terms imposed on Russia at the end of the Crimean war, and Nicholas' death, had strengthened the hand of westernisers. The cautiously reformist Tsar Alexander (whose coronation the Duke of Sutherland attended) not only freed Russia's serfs in 1861 but gave his blessing to a further programme of railway-building. Men like the Bobrinsky dynasty were crucial to this process – landed aristocrats with links to the court but more interested in

[18] C.E. Spooner: *The Narrow Gauge* (London: Spon and Co., 1871), pp. 59-60.

[19] F.R. Gamst, 'The Long Road to a Terminus in America: The Railroad Engineering Career of Franz Anton von Gerstner' in Gamst (ed.) *Early American Railroads: Franz Anton Ritter von Gerstner's* Die inner Communicationen *(1842-1843)*, (Stanford, California: Stanford University Press, 1997),16-23

Plate 9 The global influence of the Festiniog Railway. A Darjeeling Himalayan Railway train on a spiral.

developing their own resources and those of their country than in intriguing or socialising in the salons of St Petersburg. Limited and controlled modernisation was the key to maintaining the power of the imperial centre. Every Russian ruler leader faced a challenge from his non-Russian subjects; in the 1860s this came most acutely from Poland, with moderate national leaders like Count Zamoyski treading a difficult path between co-operation and resistance.

How much the FR actually did influence railway development from 1870 onwards is difficult to say. Spooner and Fairlie's arguments were soon challenged, and they shifted their ground, arguing first in favour of 2' 6", then of 3' as the optimum narrow gauge. The three Russian lines built following the Commission's visit in the early 1870s were indeed 3' gauge (1067 mm), each between 60 and 200 km long, but their capacity was lower than expected. Also, it would seem that they were hastily and poorly built, with consequent high maintenance costs. The Fairlie locomotive proved to be useful only in some circumstances, and it was left to the twentieth century to devise other, more effective, types of articulated steam engine. By the time Spooner and Fairlie had shifted their ground on the gauge question, from 2' to 2' 6" to 3', it was unclear whether the way forward was an enlarged Festiniog or a further reduced version of the Pihl system, effectively what was introduced on the Isle of Man and in Ireland. 3' 6" and metre gauge proved more practical in the long run. By the time Everard Calthrop had devised a practical 2' 6" railway in the 1890s, the public narrow gauge railway had little life left in it. Where the FR did prove enormously influential was in some long-haul industrial railways, in internal industrial systems and in military railways during the First World War – a conflict which spelt the end for the old Europe of counts and dukes.

As it was, comparatively few public railways were ever built to 0.6m gauge – a mere 216 miles in the USA, compared to its 17,608 miles of 3' gauge, and only 26½ in England.[20] One Festiniog offshoot was the Darjeeling Himalayan Railway in West Bengal, a World Heritage site since 1999 (Plate 9).[21] Longer systems totalling between them many thousands of kilometres ran in France, Hungary, Pomerania, the Union of South Africa and German South West Africa, Venezuela, New Guinea, the Belgian Congo and above all in Morocco. More often, however, wherever anything less than the Stephenson standard were considered desirable, such as for the main networks in Japan, New Zealand, Western Australia and South Africa, 1.067m (3' 6") was adopted, deriving from Carl Pihl's work in Norway and Sweden rather than from the Festiniog.[22]

The patentee, Robert Francis Fairlie, and Spooner argued that the load-to-weight ratio on a 0.6m or a slightly larger gauge railway made such systems a more attractive proposition in developing countries than Pihl's gauge, more so still compared to standard gauge. This was soon challenged by engineers who pointed out that only by carrying a single heavy commodity such as slate, and running a few slow passenger trains, could such railways be justified.

0.6m, however, was a gauge very frequently adopted all over the world for private industrial railways. These might sometimes be laid to transport finished goods over a distance or to bring raw materials to a processing area, but more often was restricted to an internal yard system. It came to be found in practically every and any type of site – agricultural estates, factories, prisons, hospitals, saw-mills, sewage farms, collieries, as well as on short-term operations which might be anything from archaeological digs or clearing wartime bomb-sites to major tunnel and reservoir contracts. Four firms in particular were responsible for these developments, all based in Europe but with branches and agencies in every continent. The French engineer Paul Decauville (1846–1922) claimed that the Festiniog had inspired him to more imaginative development of his company's portable

[20] Hilton 91.
[21] Terry Martin: *Halfway to Heaven: Darjeeling and its Wonderful Railway* (Chester: Rail Romances, 2000).
[22] W.J.K. Davies: *Light Railways* (London: Ian Allen, 1964), Hilton.

railway system of ready-made track fastened to steel sleepers.[23] His work in turn influenced the Germans Orenstein and Koppel in Berlin, Robert Hudson Ltd in Leeds.[24] The combined global mileage of these barely recorded railways is beyond calculation, though the Australian sugar cane industry still operates about 4,000km of 0.6m track. It also became the favoured gauge for fortification systems such as the Maginot line, and for trench railways during the First World War, which again ran to many thousands of kilometres.[25] Much of this military equipment was to see re-use after 1918, some of it indeed on Welsh slate-carrying systems.

Paul Decauville: 'Portable Railways', *Scientific American Supplement*, 446, 19 July 1884 acknowledges the inspiration of the Festiniog on his system; his firm and other manufacturers of commercial narrow-gauge equipment, Hudson, Fowler, Hudswell Clarke and Hunslet, all of Leeds, dominated the world market. The longest systems were on the sugar plantations of Queensland in Australia, which amounted to 4,500km of track.

[23] Paul Decauville, 'Portable Railways', *Scientific American Supplement*, 446, 19 July 1884. He may also have been influenced by William Croskill's system of wooden rails faced with angle iron for farms originally advertised in 1848.

[24] F. Kemper: 'The Origins of Orenstein and Koppel', *The Industrial Railway Record* 40 (December 1971), 156-61; A.J. Haigh: *Robert Hudson Ltd.* (privately published, 2005).

[25] The British laid about 2,909km of 0.6m gauge railway on the Western front in 1917, the French a total of 3,000km from 1914 to 1918, the United States light railway regiments a total of 200.5km – Keith Taylorson and Andrew Neale: *Narrow Gauge at War* (Croydon: Plateway Press, 1987), 10; W.J.K. Davies: *Light Railways* (London: Ian Allen, 1964), 277; Richard Dunn: *Narrow Gauge to No Man's Land* (Los Altos: Benchmark Publications 1990), 27. The German, Austro-Hungarian and Russian armies also laid extensive systems – Christian Wolmar: *Engines of War* (London: Atlantic Books, 2010), 151-226 and Dieter Stanfel: *K.u.k. Militärfeldbahnen im Ersten Weltkrieg* (Hövelhof: DGEG, 2008).

MAPS

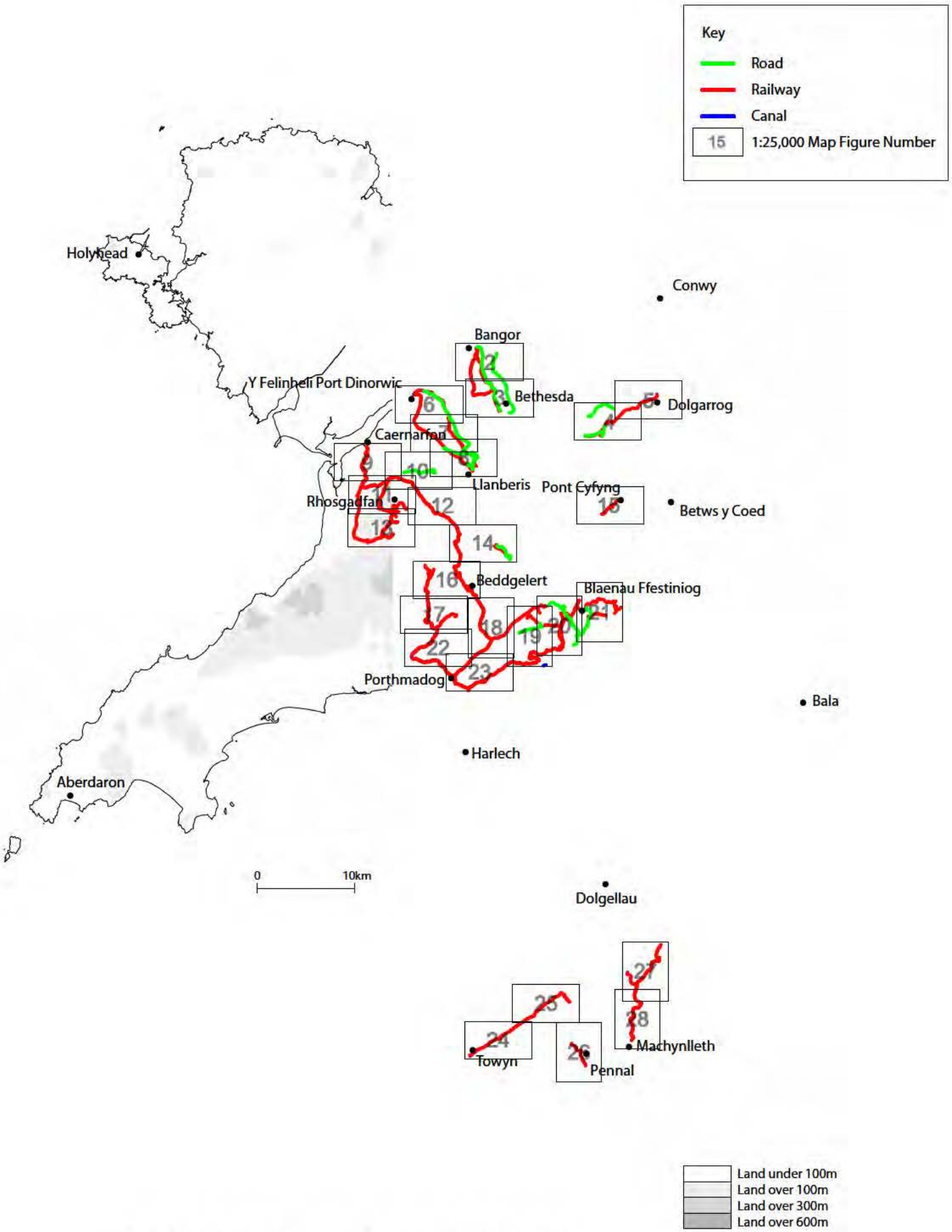

Figure 1 Index map of Gwynedd showing site map locations

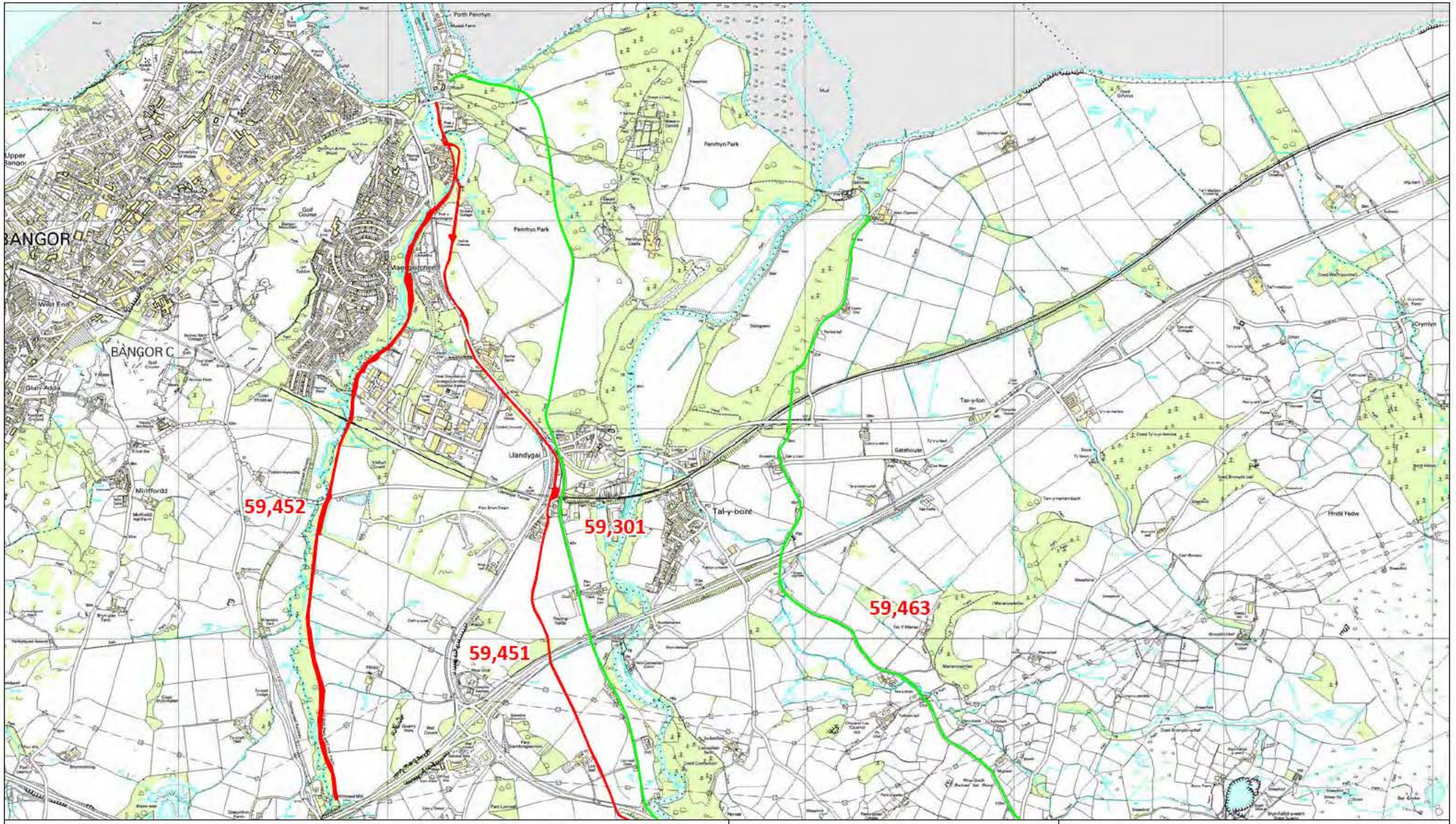

Figure 2 Bangor East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

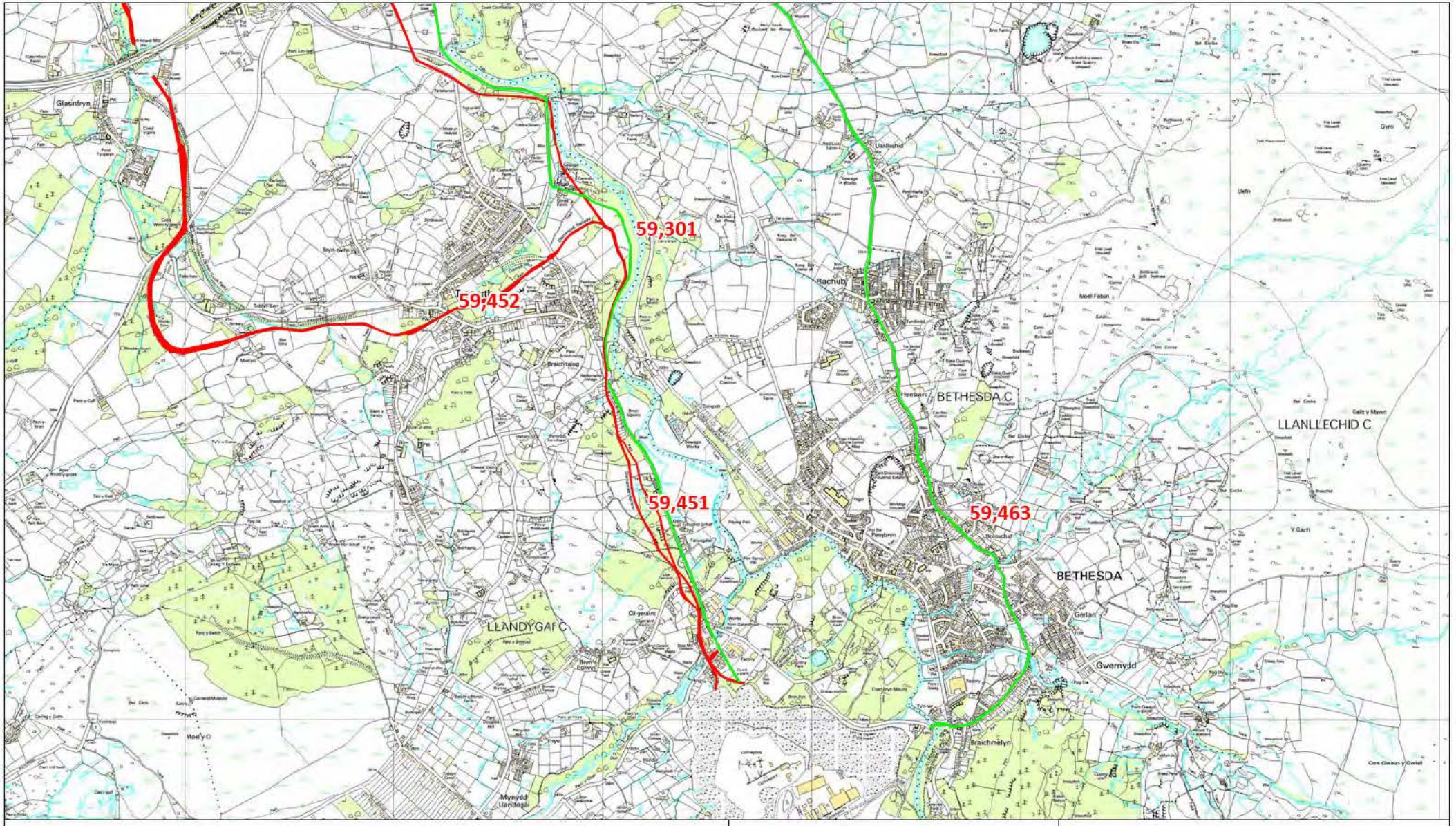

Figure 3 Bethesda

KEY

Railway

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Canal

59, 298 GAT PRN

Scale 1:25000

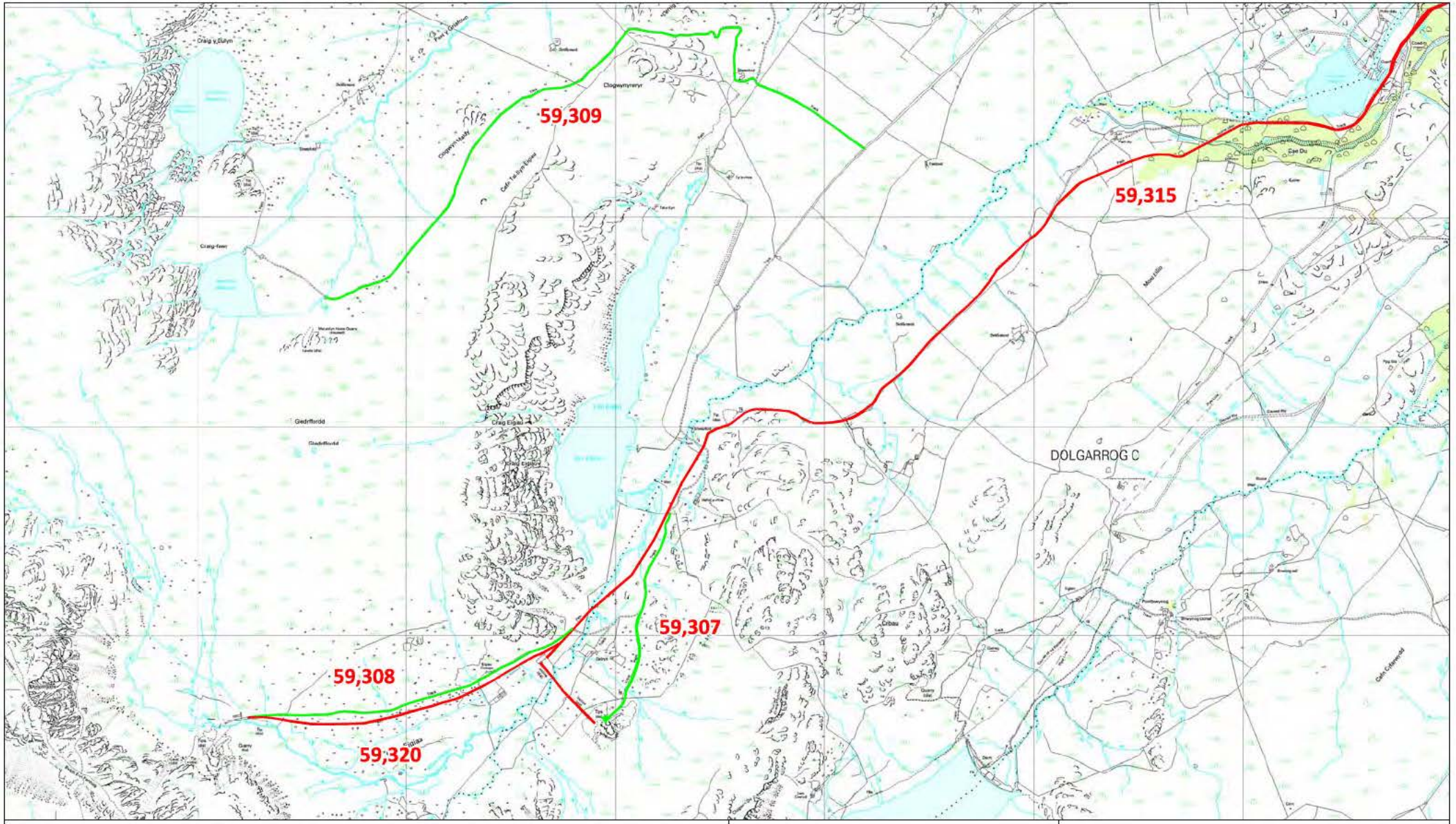

Figure 4 Dolgarrog South West

KEY

Railway

Road

Canal

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Scale 1:25000

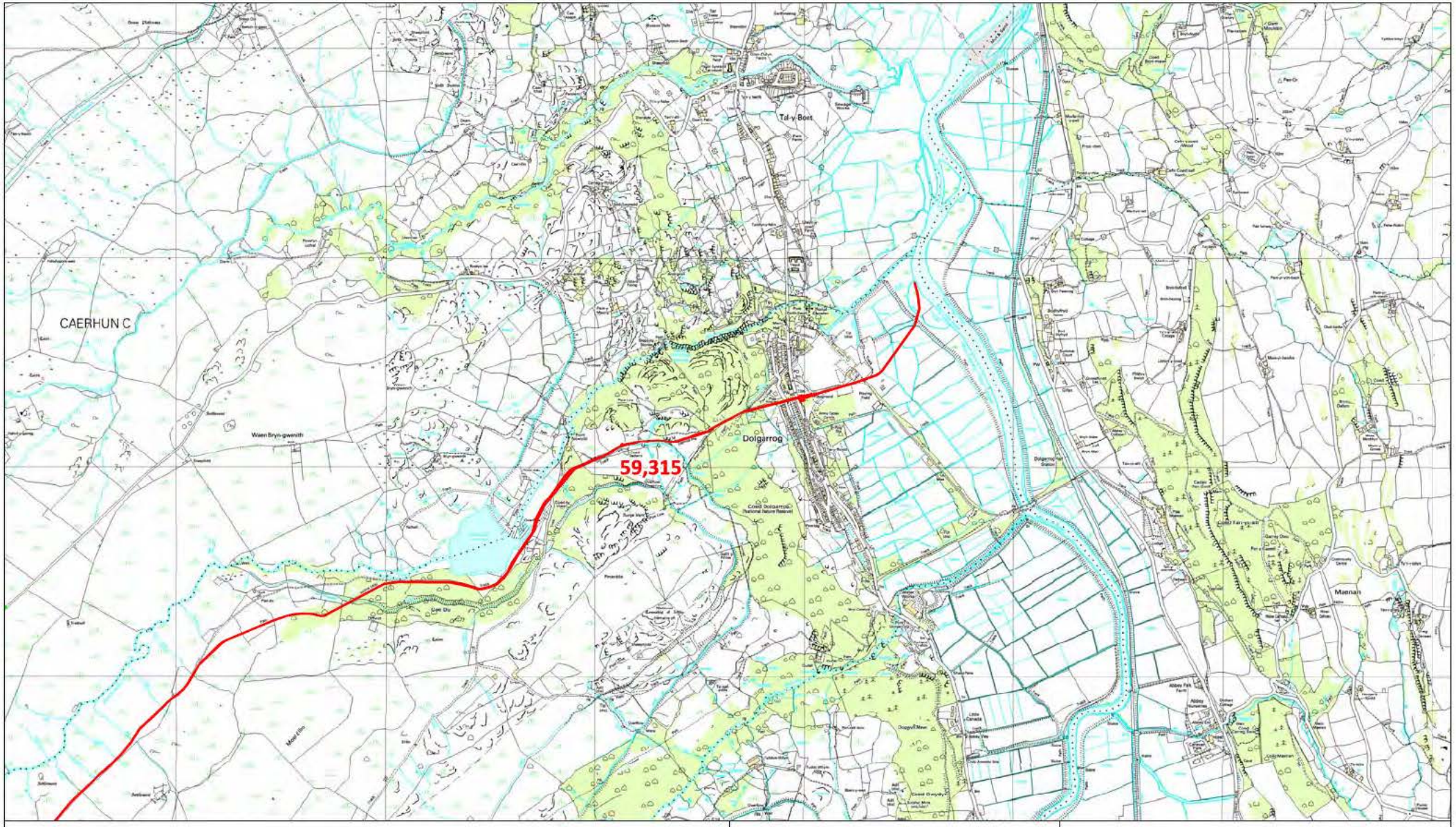

Figure 5 Dolgarrog

KEY

Railway

Road

Canal

59, 298 GAT PRN

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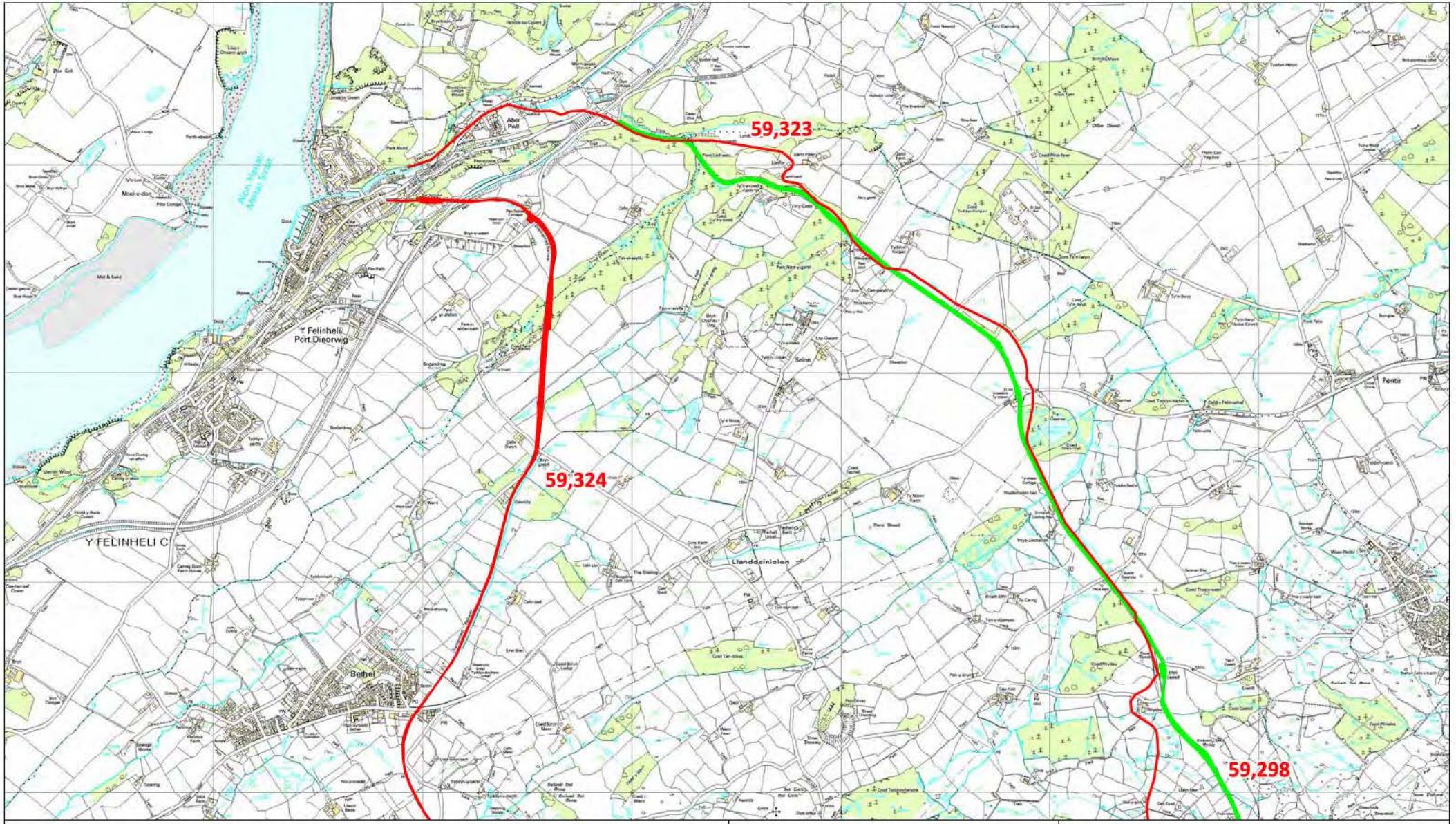

Figure 6 Y Felinheli Port Dinorwic South East

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Railway

Road

Canal

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Scale 1:25000

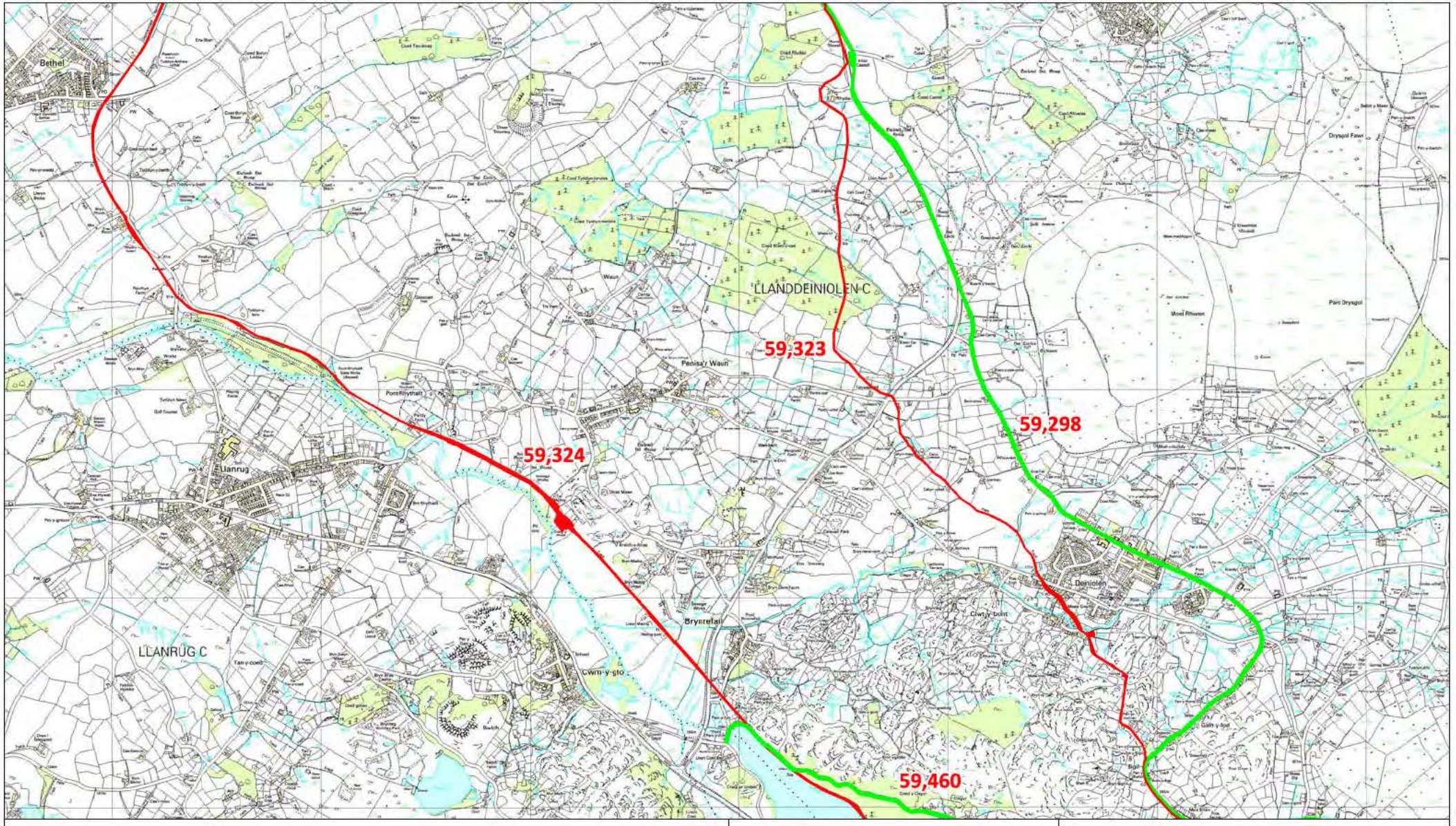

Figure 7 Llanrug East

KEY

- Railway
- Road
- Canal

59, 298 GAT PRN

Scale 1:25000

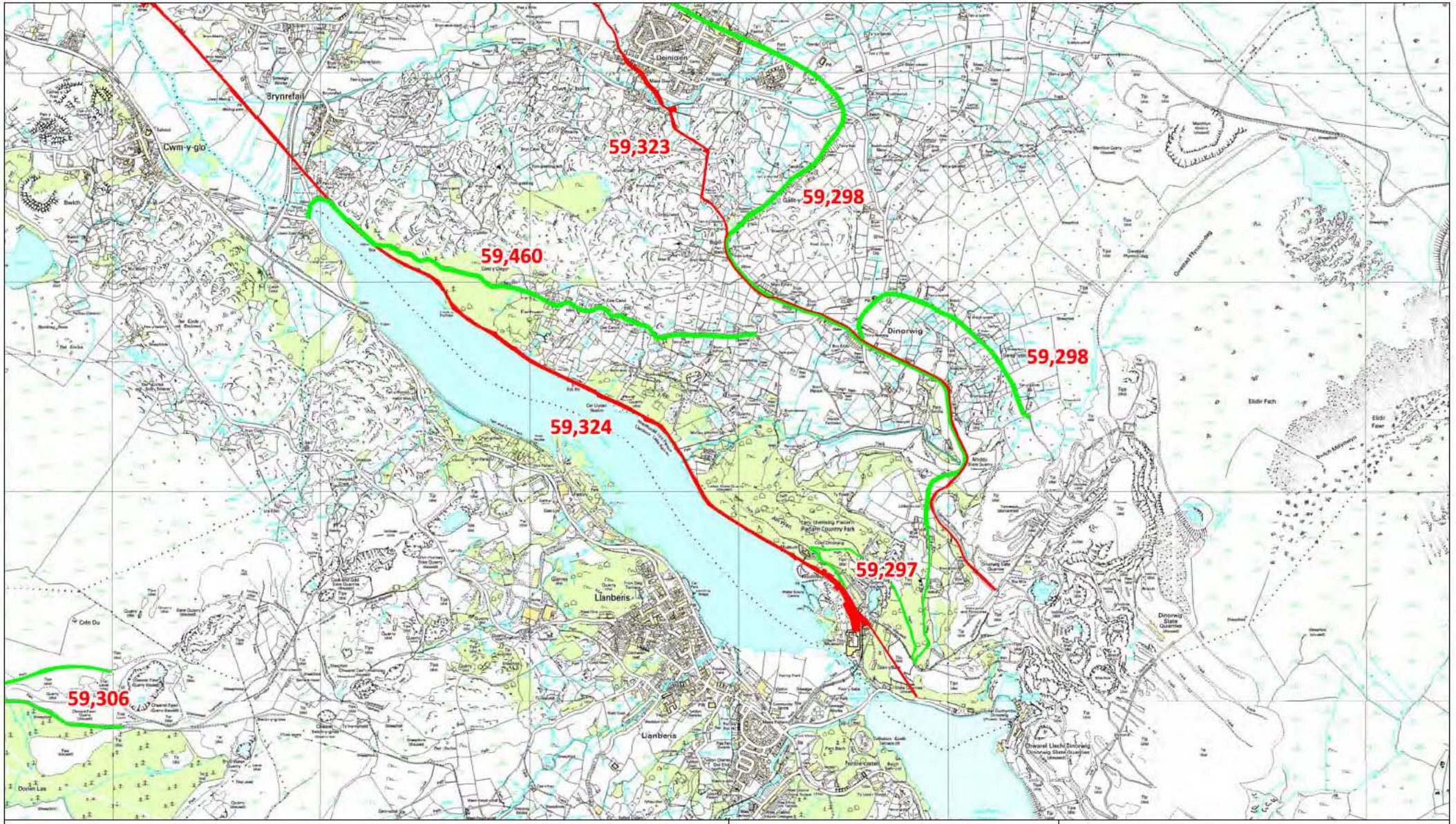

Figure 8 Llanberis

KEY

Railway

Road

Canal

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Scale 1:25000

Figure 9 Caernarfon South

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

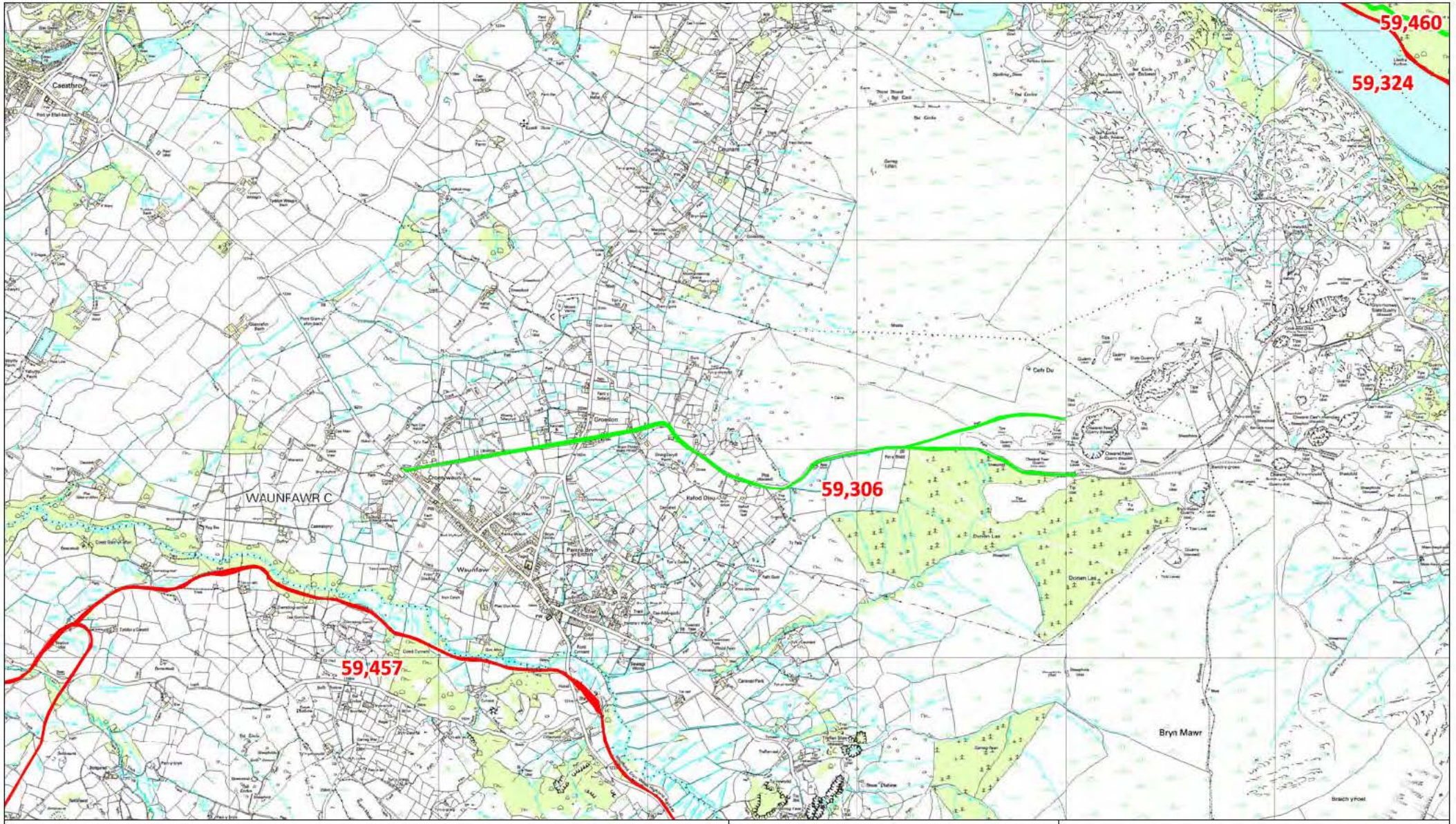

Figure 10 Waunfawr

KEY

Railway

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Canal

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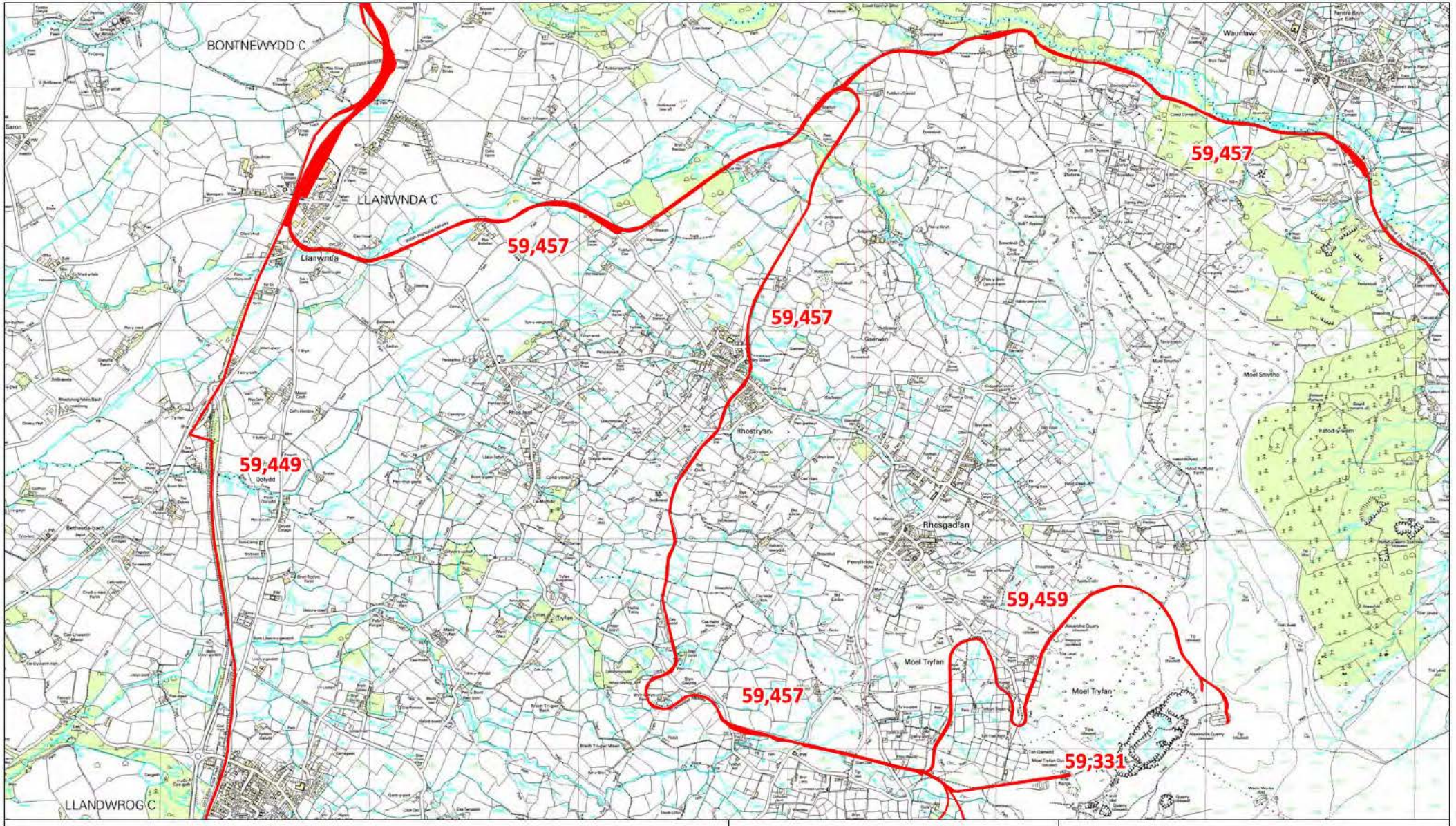

Figure 11 Rhostryfan

KEY

Railway

Road

Canal

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Scale 1:25000

Figure 12 Betws Garmon

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

Figure 13 Penygroes North East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

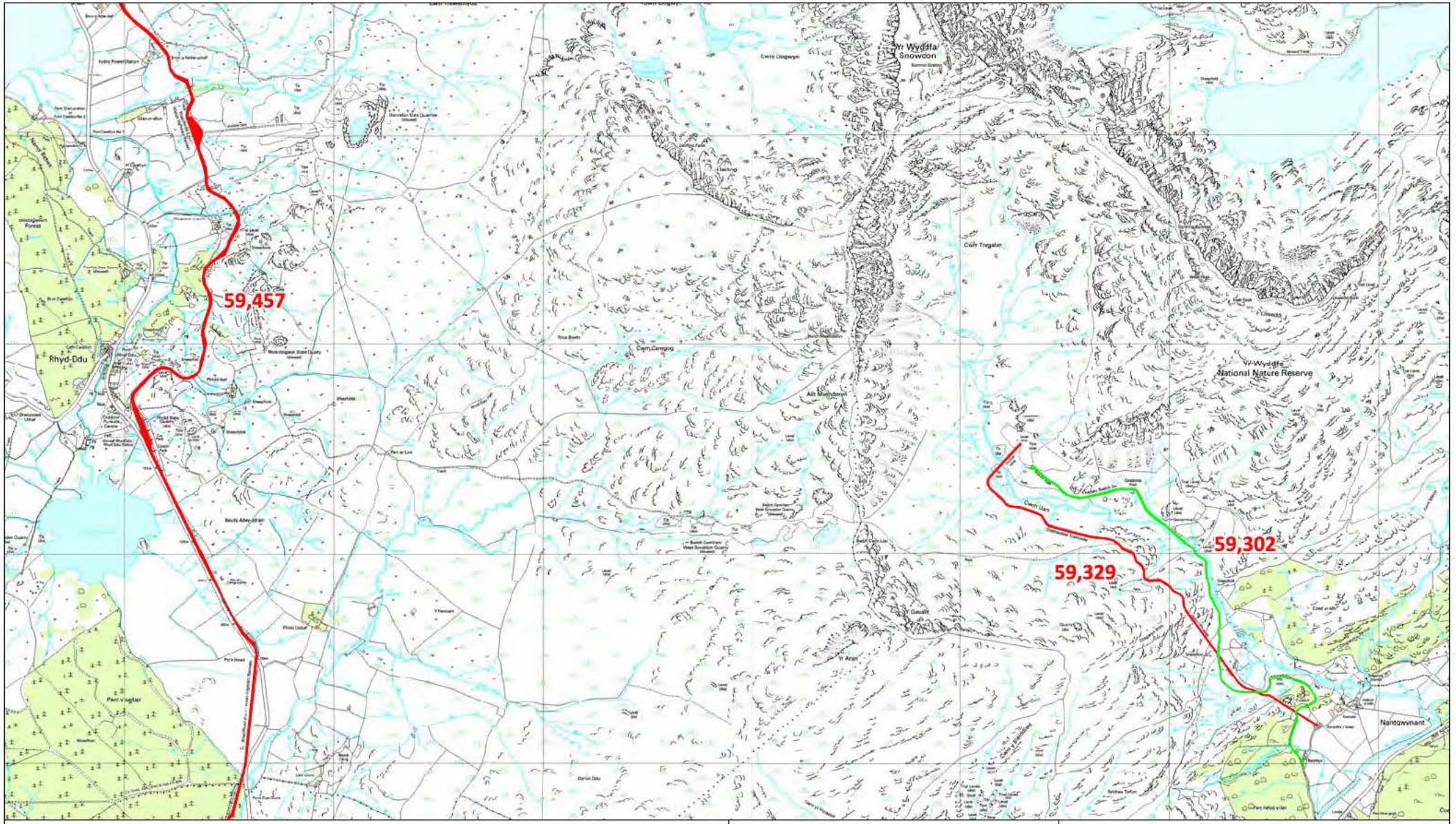

Figure 14 Rhyd Ddu East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

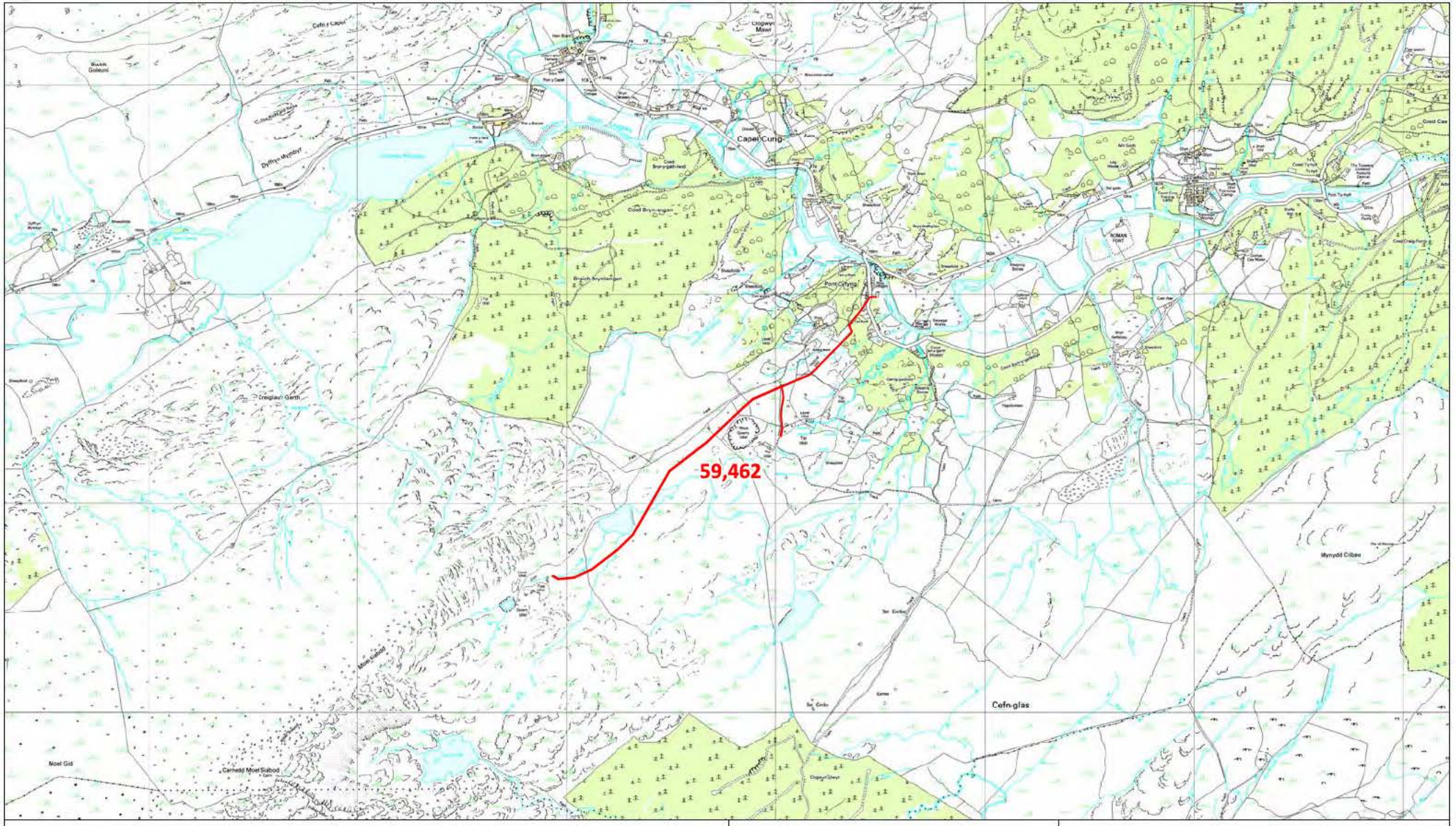

Figure 15 Pont Cyfyng

KEY

Railway

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Canal

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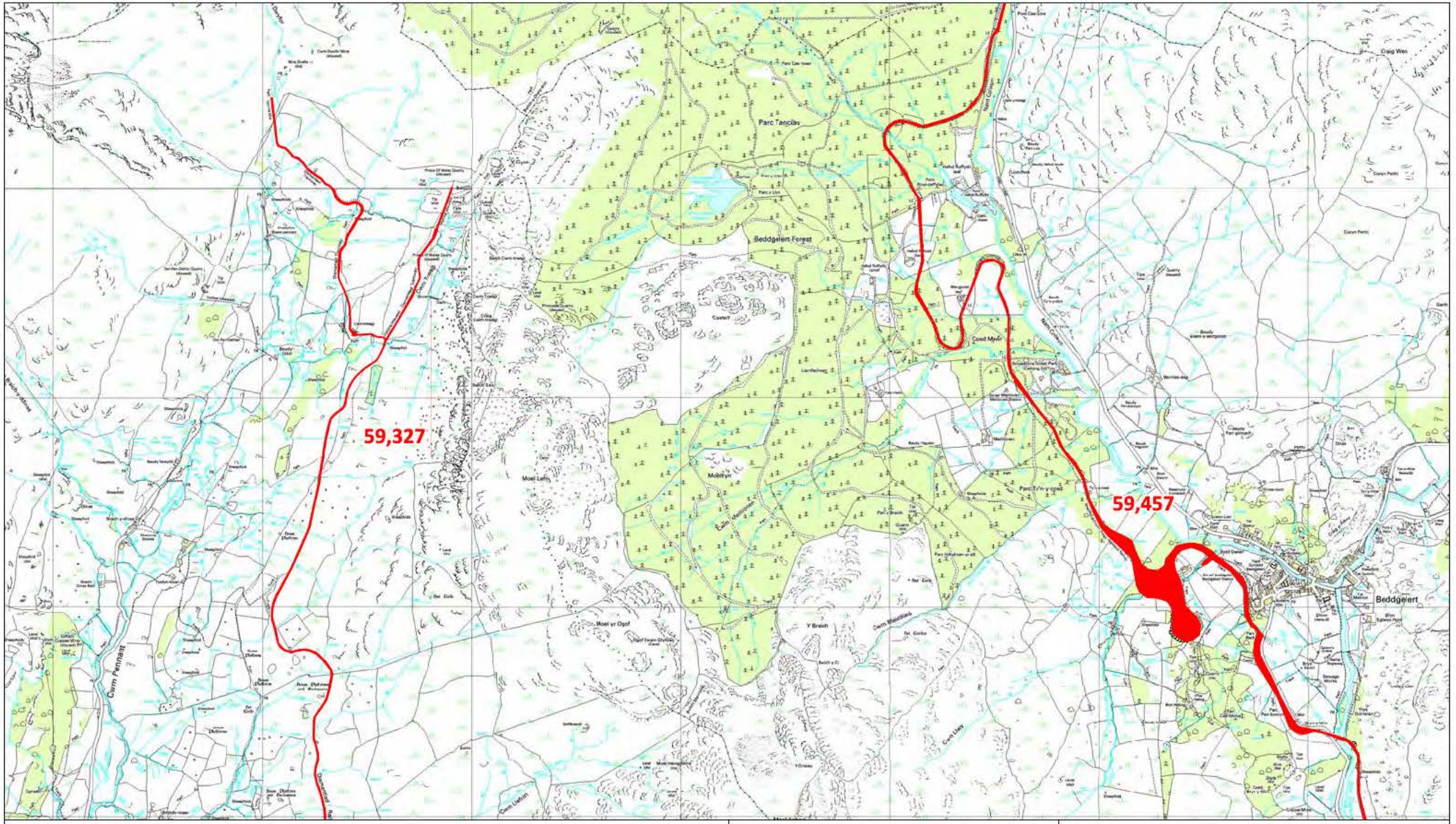

Figure 16 Beddgelert West

KEY

Railway

Road

Canal

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Scale 1:25000

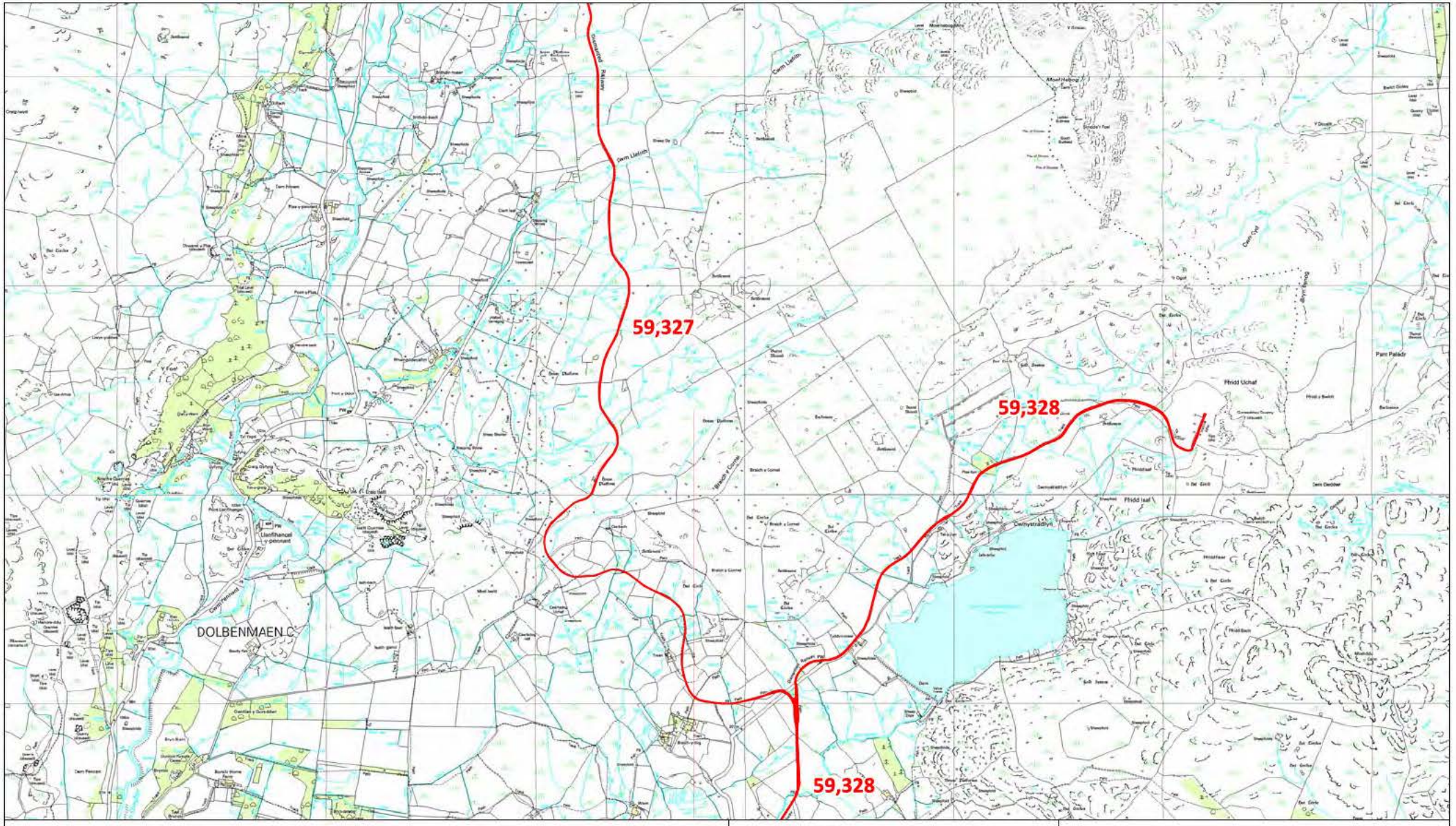

Figure 17 Llyn Cwmystradllyn

KEY

- Railway
- Road
- Canal
- 59, 298 GAT PRN

Scale 1:25000

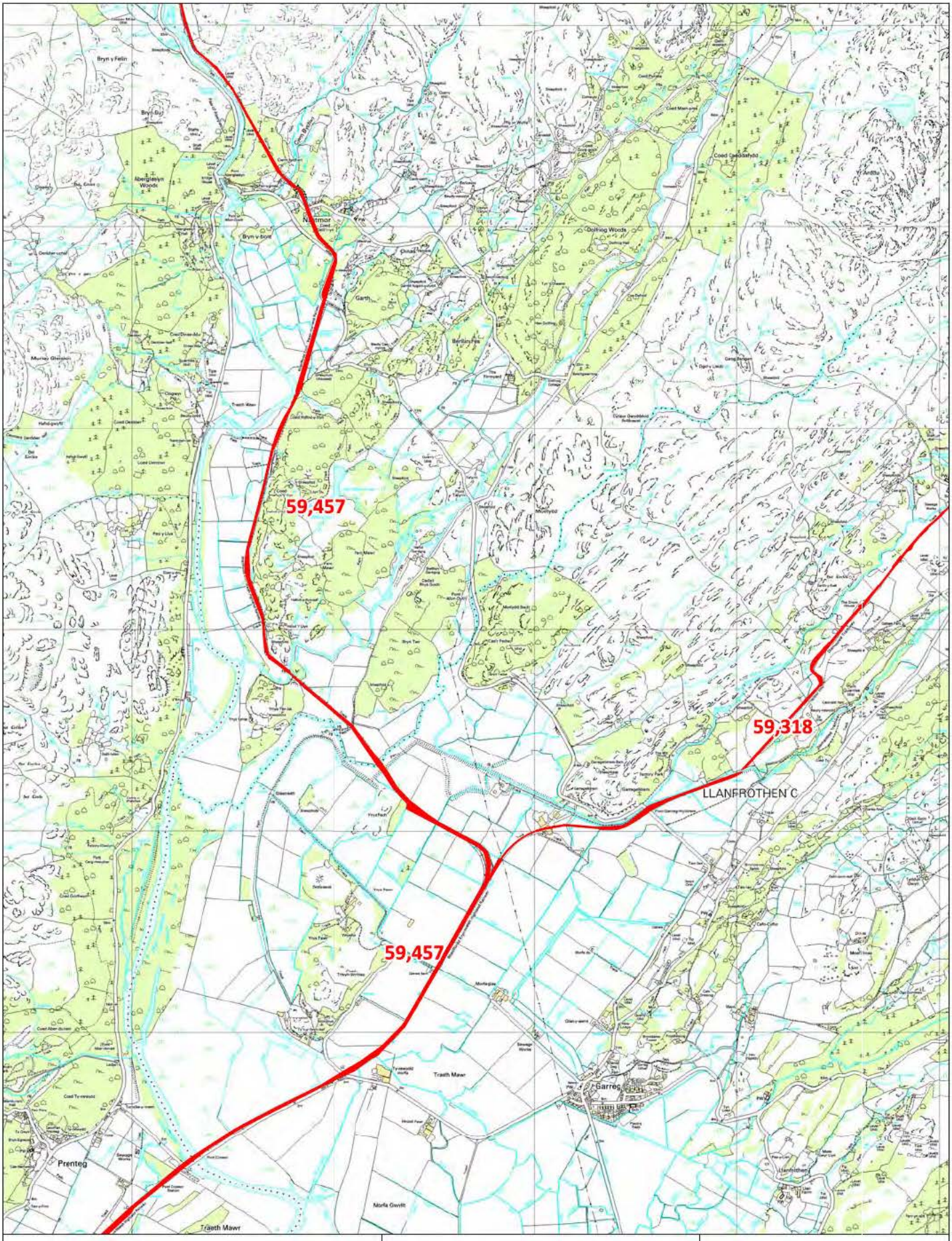

Figure 18 Garreg North

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

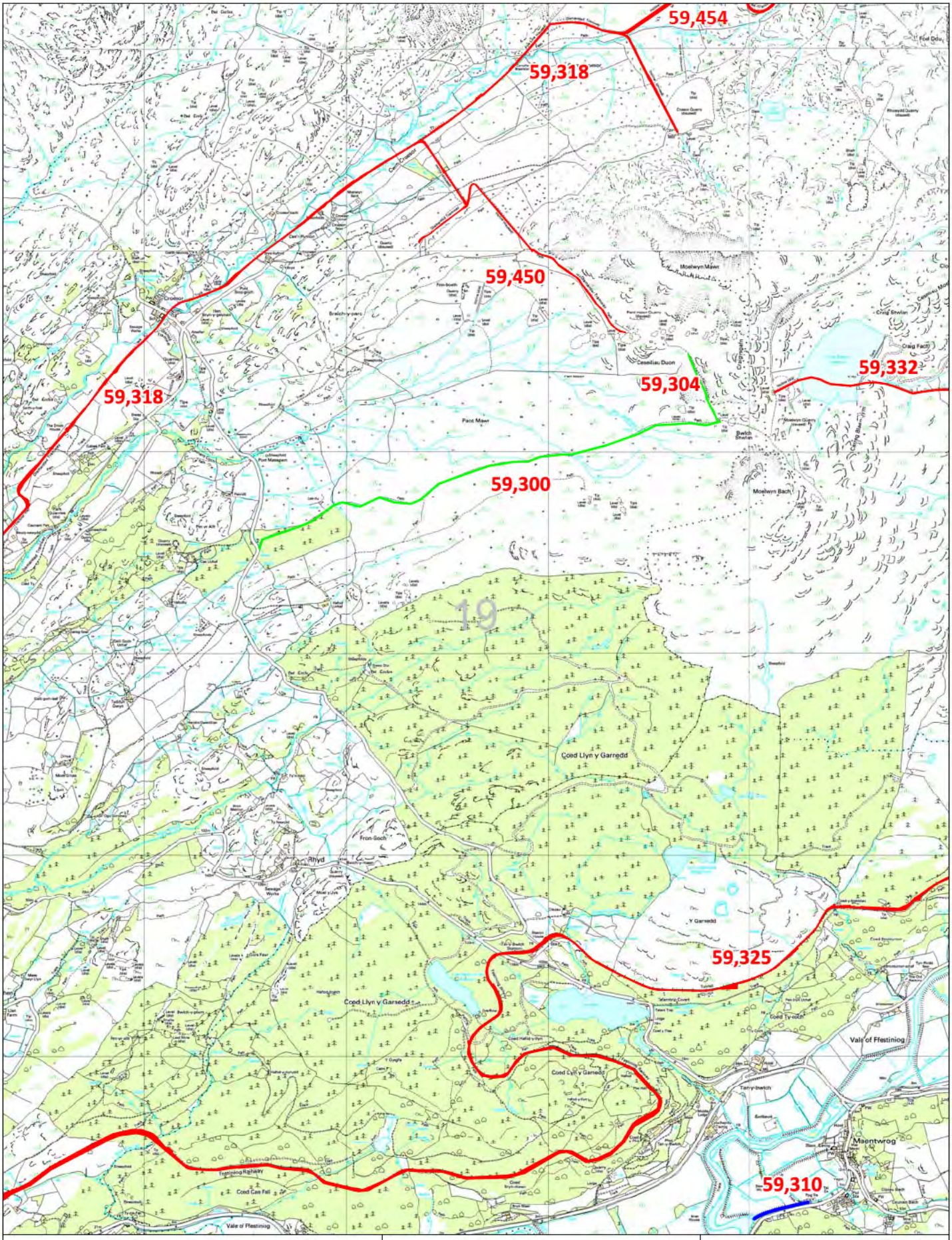

Figure 19 Maentwrog North West

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

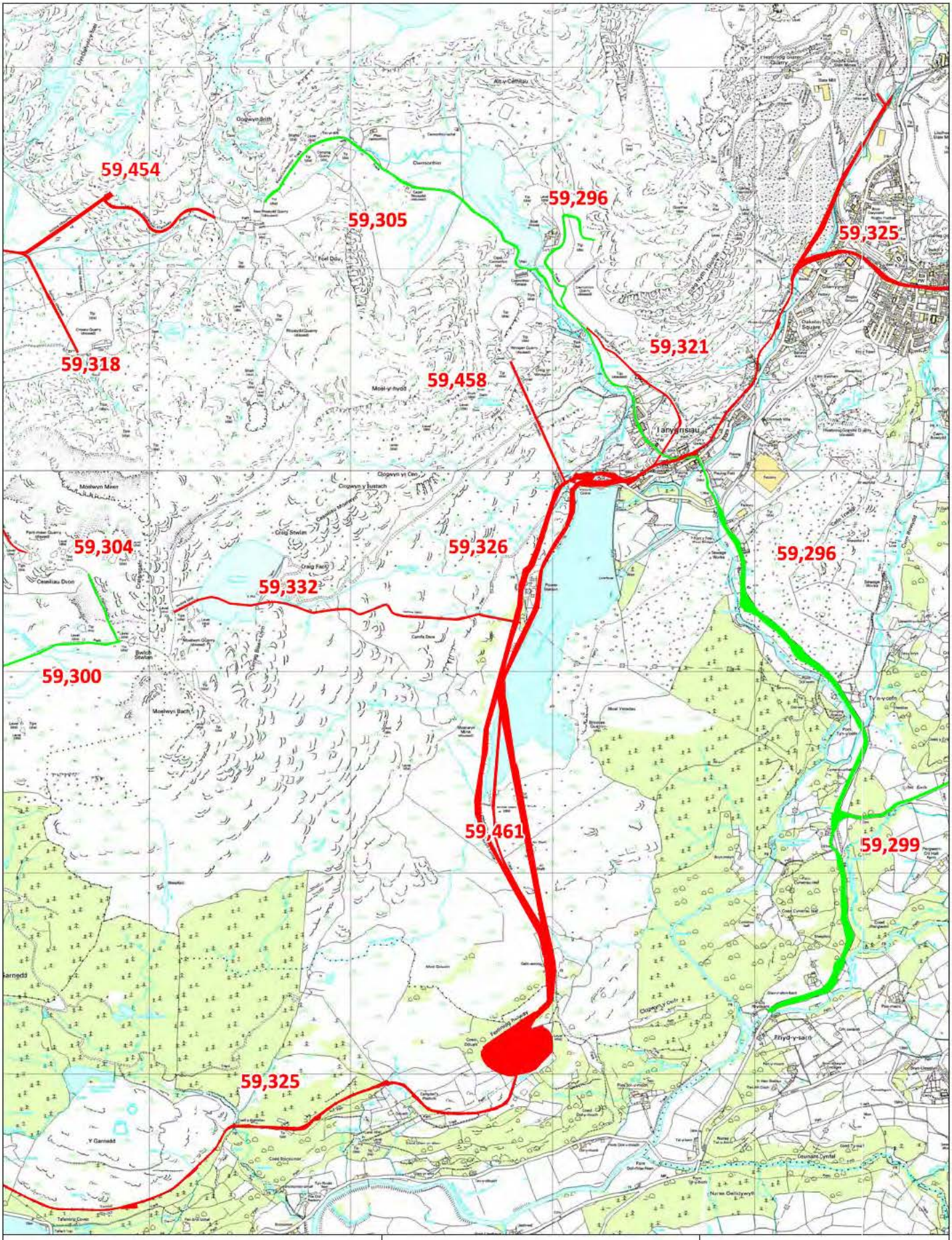

Figure 20 Blaenau West

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

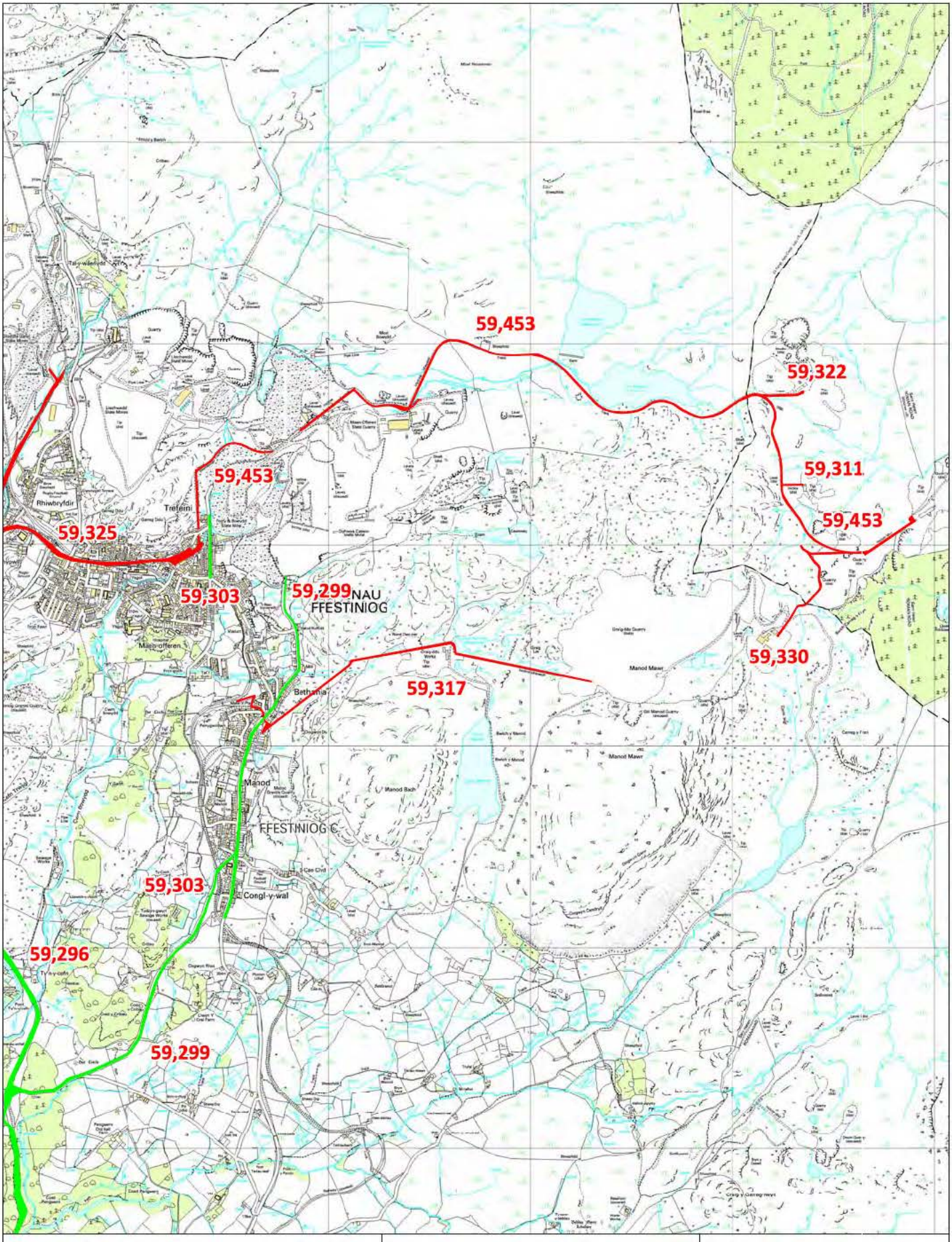

Figure 21 Blaenau East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

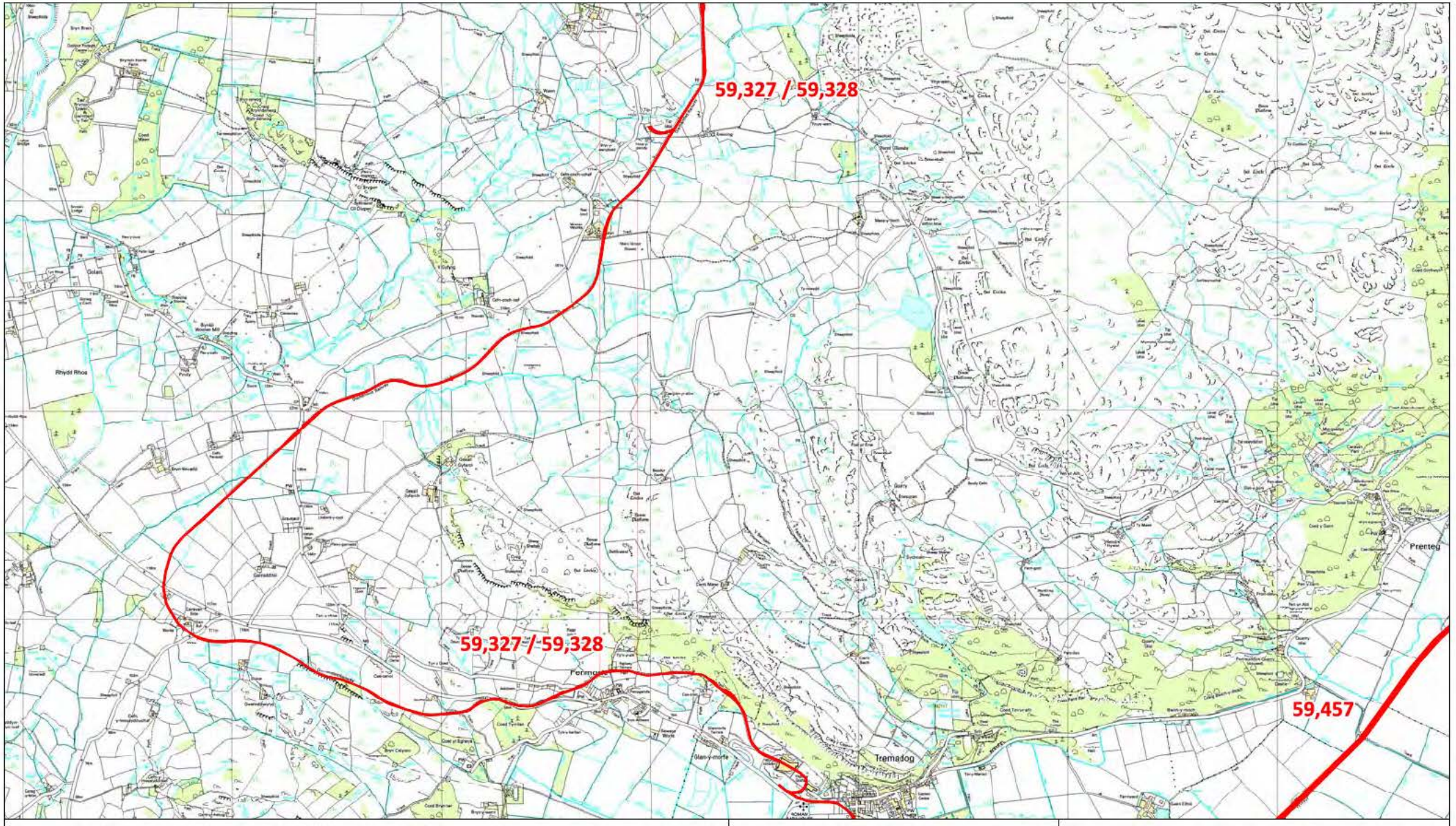

Figure 22 Tremadog North

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

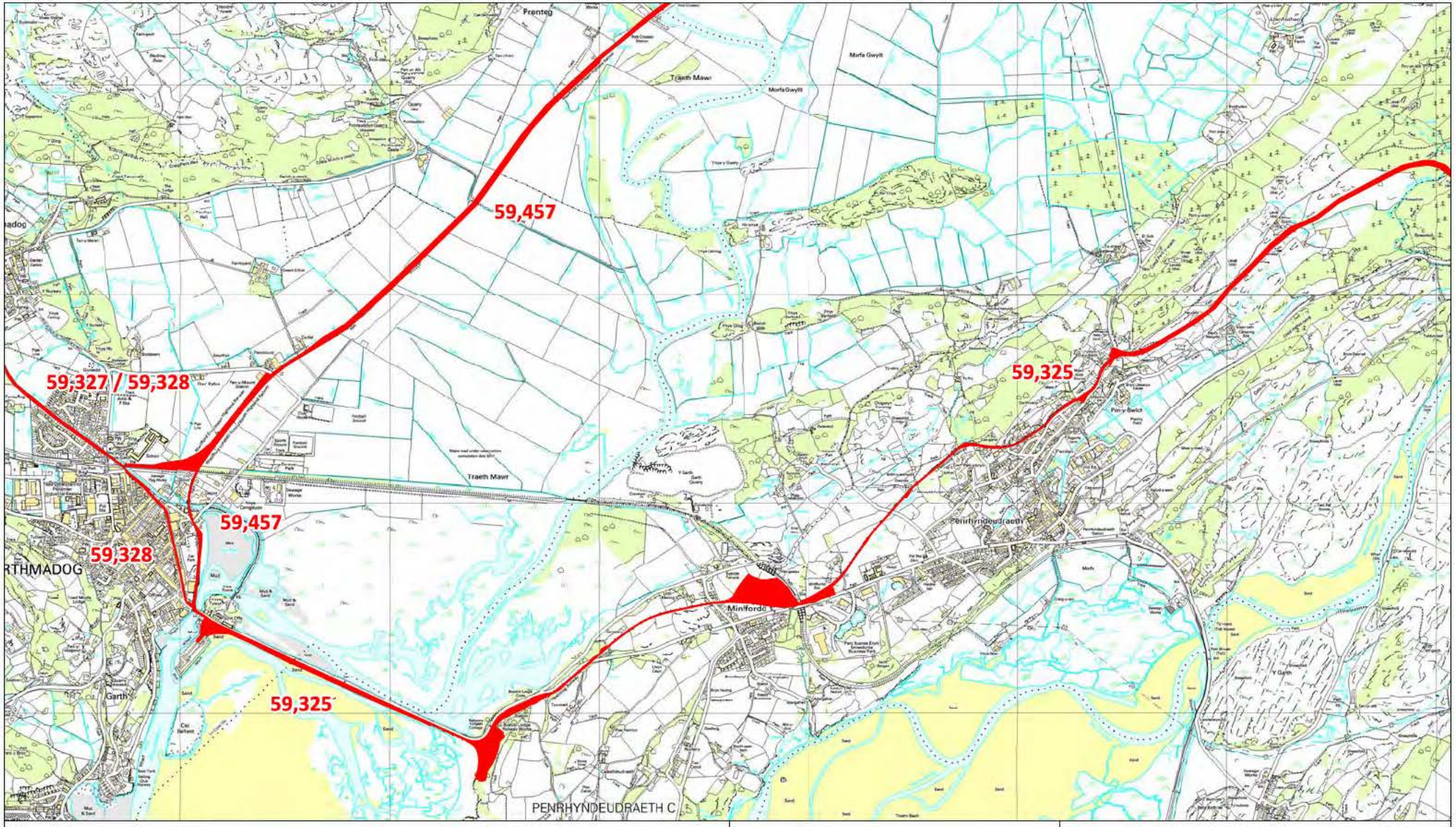

Figure 23 Porthmadog East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

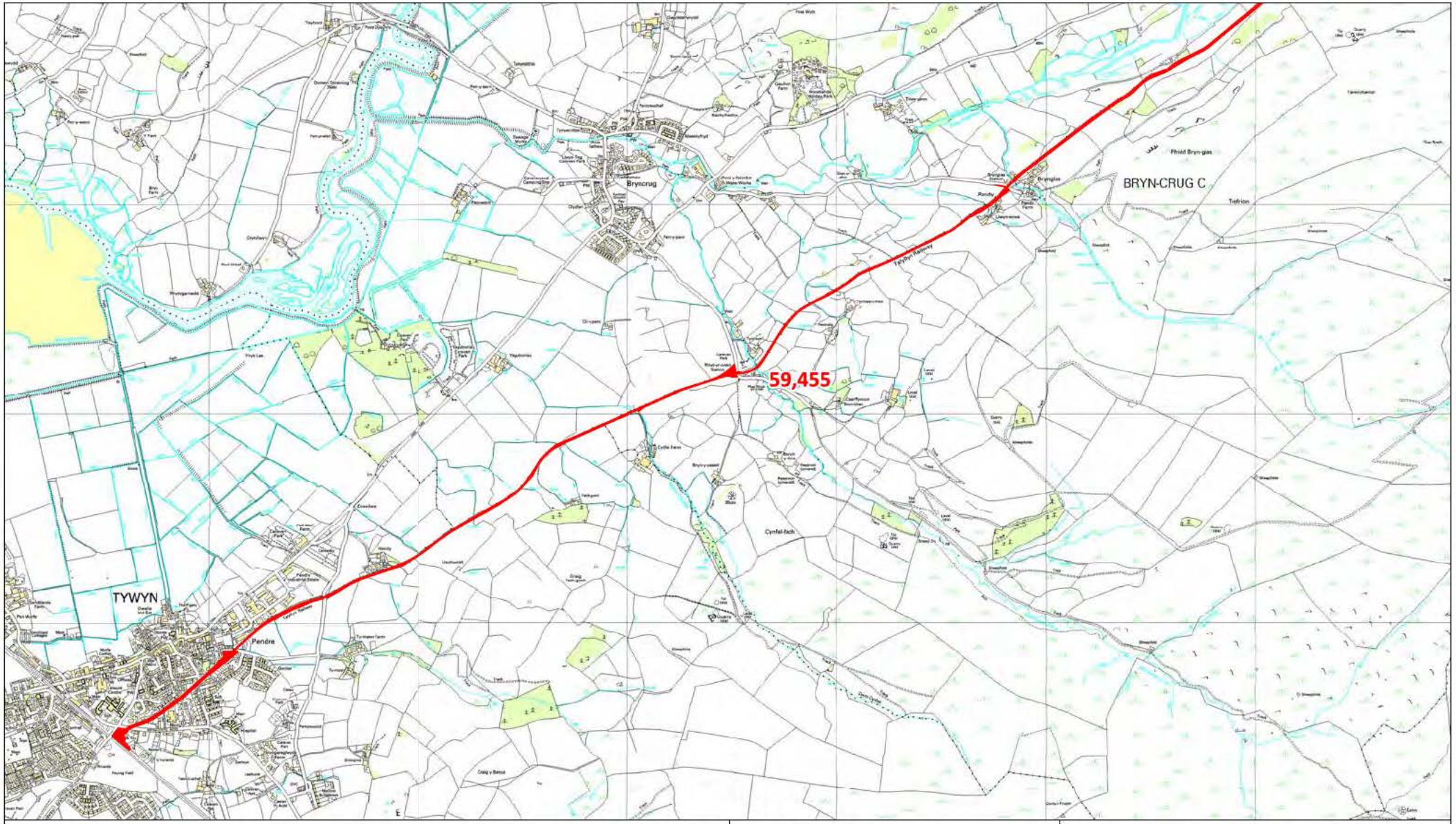

Figure 24 Tywyn North East

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

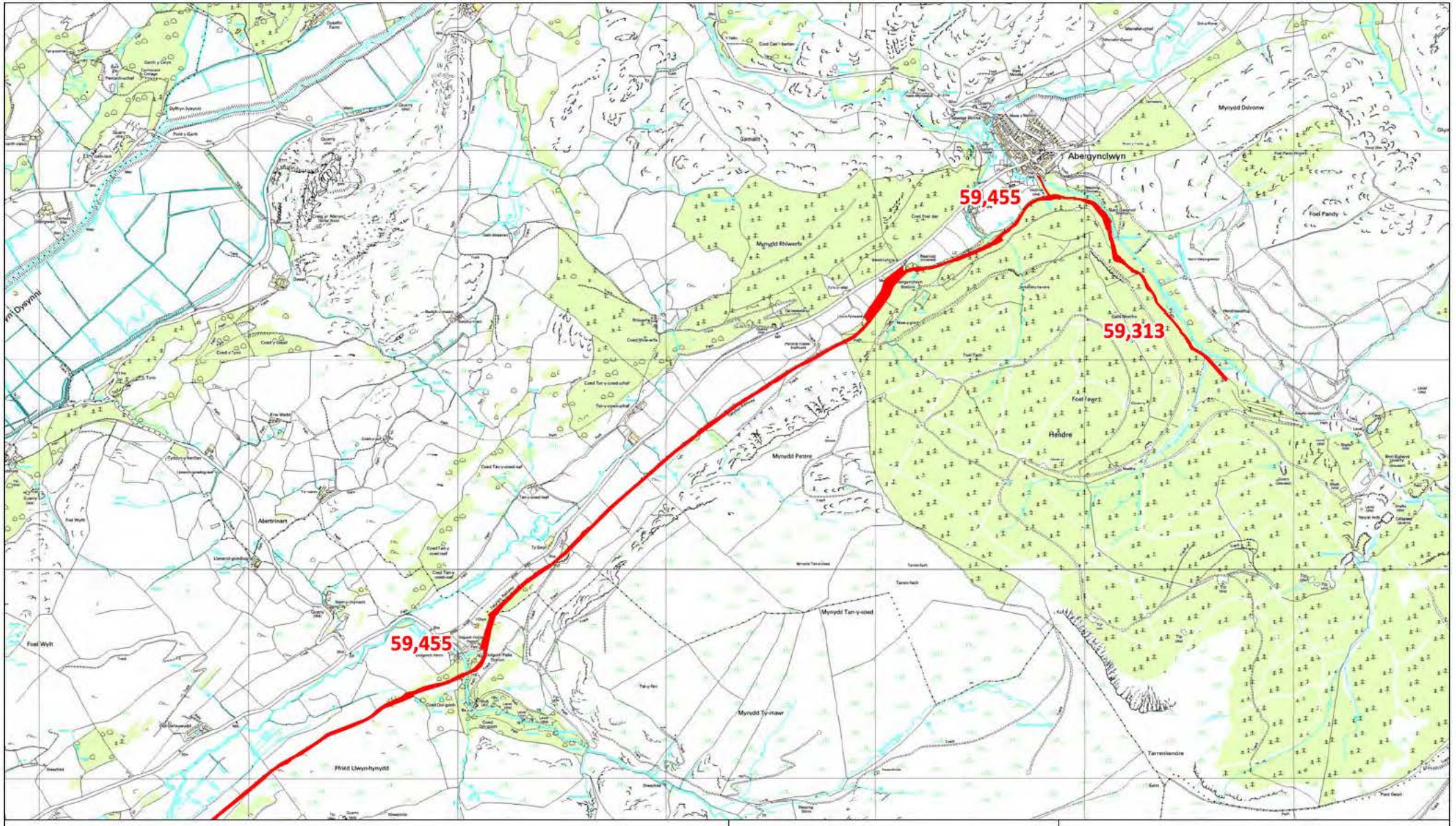

Figure 25 Abergynolwyn South West

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25000

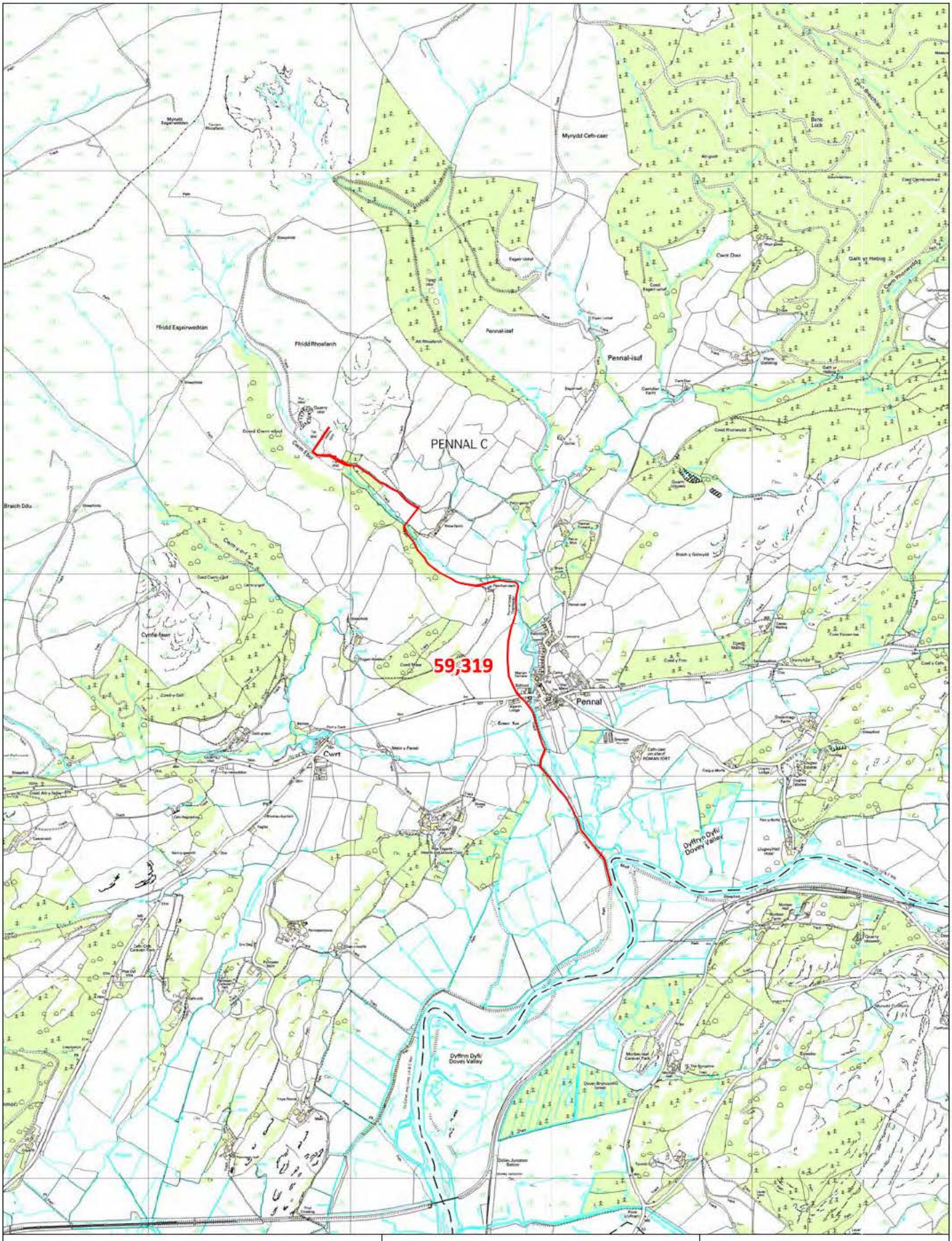

Figure 26 Pennal West

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

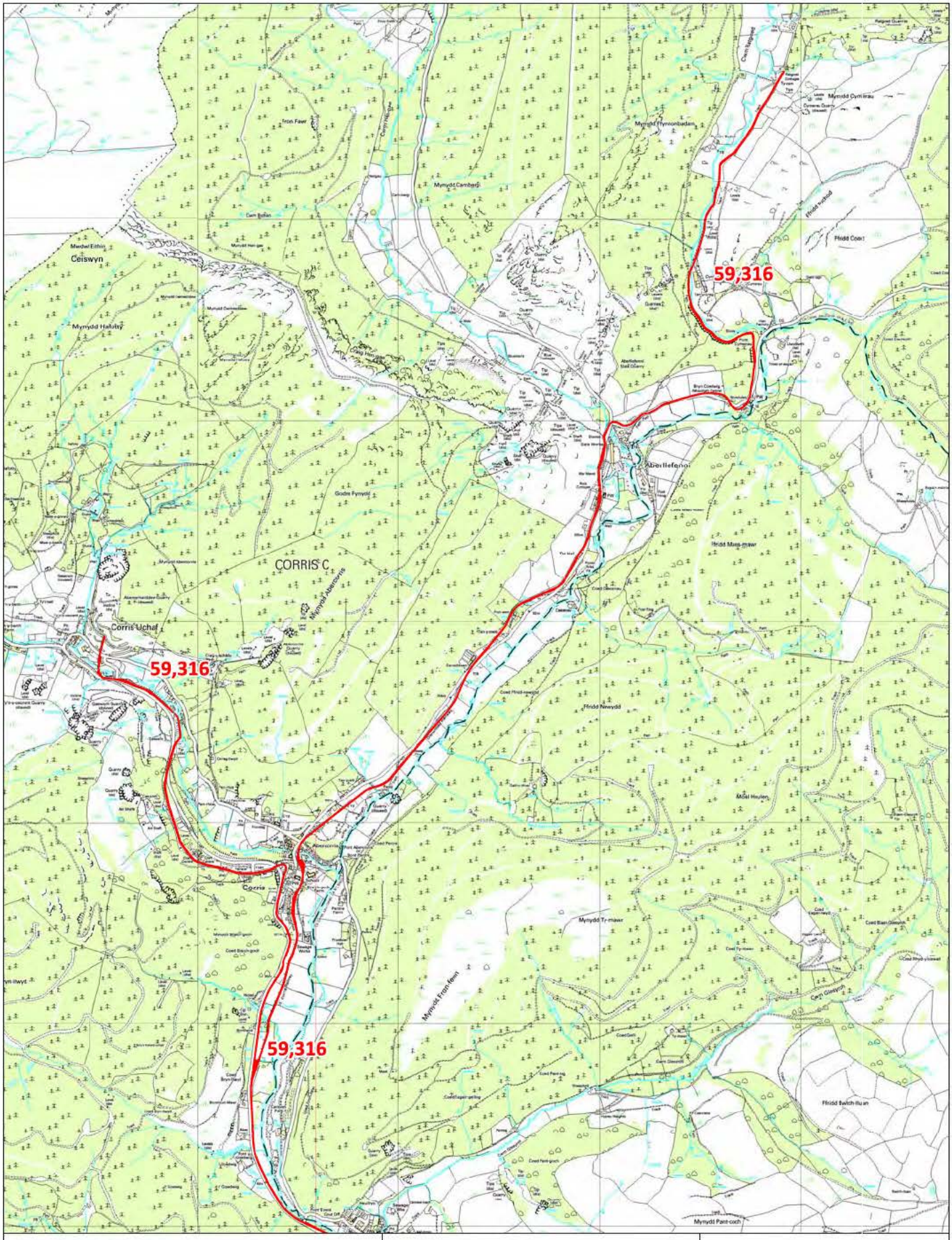

Figure 27 Corris North

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

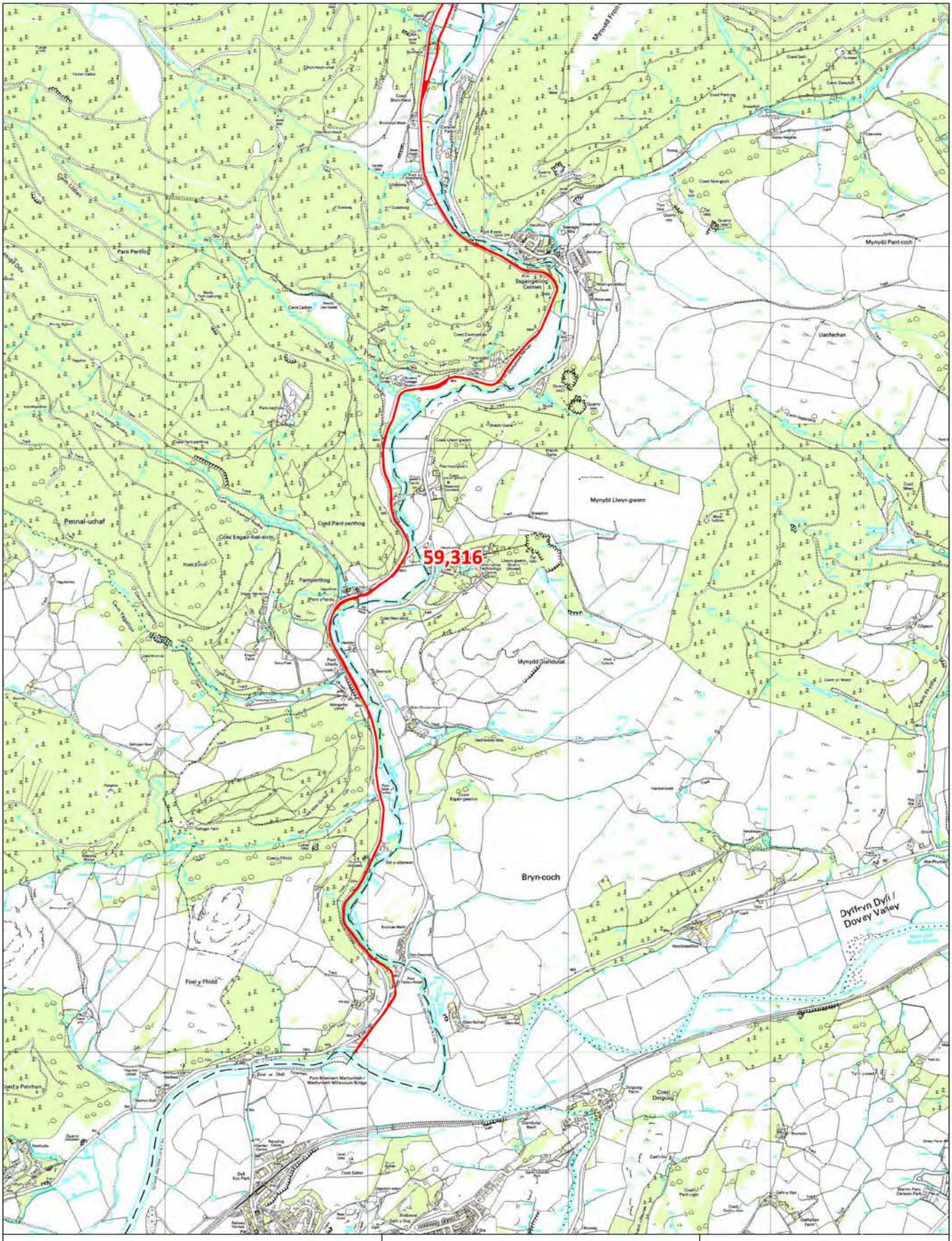

Figure 28 Corris South

KEY

Railway

Road

Canal

59, 298 GAT PRN

Scale 1:25,000

Gwynedd Archaeological Trust
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