

10 MATERIALS

10.1 Introduction

This chapter provides an assessment of the potential effects from the use of materials and generation of waste associated with the Scheme. It follows guidance in Interim Advice Note (IAN) 153/11: Guidance in the Environmental Impact Assessment of Materials, which has been interpreted into the Welsh context, and Technical Advice Note (TAN) 21 Waste (Welsh Government, 2014).

The assessment of the potential impacts on materials and waste from the Scheme has focused on the construction phase. It is anticipated that most of the impacts are likely to arise during construction. Operational activities such as repairing potholes, clearing out drains and general road surface maintenance are relatively minor scale and not likely to cause significant effects.

The construction of the Scheme has the potential to use large amounts of raw materials and generate quantities of waste. The consumption of material resources and the management of waste give rise to environmental impacts that need to be managed and mitigated. This chapter does not cover indirect materials and waste impacts which occur off-site and may possibly occur outside the UK, including the depletion of non-renewable resources and the production of waste at the point of extraction and during manufacturing. These impacts are outside the scope of this assessment.

The impacts of primary raw materials, secondary or reused/recycled materials and manufactured construction products during construction of the Scheme are considered. Mitigation measures for any detrimental impact are described. The assessment considered the following factors:

Earthworks movements (including extent, method and programme of the proposed earthworks and construction activities);

- Quantities of materials to be imported;
- Quantities of materials to be exported or disposed of;
- Required lorry movements;
- Required treatment; and
- Storage on site.

It is assumed that the construction of the Scheme would be carried out in accordance with normal good working practice implemented on such projects.

The assessment of impacts of the Scheme on the Geology and Soils, together with contamination is presented in Volume 1, Chapter 9 of this ES.

10.2 Methodology

10.2.1 Study Area

The study area for the assessment comprises the Scheme and local road networks. Many material resources would originate off-site but others would arise on site during construction, such as excavated soil and rock or recycled elements of existing features. The latter are included within the Scheme boundary.

10.2.2 Scope and Guidance

A detailed assessment has been undertaken in accordance with IAN 153/11. The assessment is a quantitative exercise which aims to identify and quantify the effects associated with material use and waste during the construction of the Scheme. The guidance in IAN 153/11 is not prescriptive or exhaustive in order to provide a flexible approach enabling those undertaking the assessment to tailor their approach to the specific characteristics of each Scheme.

The assessment of the effects of constructing the Scheme on materials considers the extent, method and programme of the proposed earthworks and construction activities required to complete the Scheme. The impacts have been assessed before and after mitigation measures are applied.

For the purpose of assessing the effects associated with material use and waste, the assessment has identified and quantified the following where possible:

- The types and quantities of materials required for the project;
- Details of the source of materials;
- The cut and fill balance;
- The types and quantities of forecast waste arising from the project, including the identification of any forecast hazardous waste;
- Waste that requires storage on site prior to re-use, recycling or disposal;
- Waste to be pre-treated on site for re-use within the project;
- Waste requiring treatment and/or disposal off site; and
- The impacts that would arise from the issues identified in relation to materials and waste.

10.2.3 Significance Criteria

For the assessment of materials, no specific methodology has been developed to assign significance to both the environmental impact value of a material resource and the magnitude of an impact. As suggested in Interim Advice Note 125/09(W) 10.2, professional judgement and the procedures for assessing impacts given in DMRB Volume 11 Section 1 and 2 have been used.

Consistent with the standard DMRB assessment methodologies, Tables 10.2.1 and 10.2.2 have been used to assess the sensitivity and magnitude respectively of the identified impacts. The matrix presented in Table 10.2.3 has been used to assess the significance of the effect based on the sensitivity and magnitude.

Table 10.2.1: Environmental Value (or Sensitivity) of Feature (Table 2.1 of DMRB Volume 11, Section 2, Part 5, HA 205/08)

Value (Sensitivity)	Typical Descriptors
Very high	Very high importance and rarity, international scale and very limited potential for substitution (including internationally designated sites).
High	High importance and rarity, national scale, and limited potential for substitution (including nationally designated sites).
Medium	High or medium importance and rarity, regional scale, limited potential for substitution (including regionally important sites).
Low (or Lower)	Low or medium importance and rarity, local scale (including sites which are not designated, but which have a local interest).
Negligible	Very low importance and rarity, local scale (including sites with little or no interest).

Table 10.2.2: Magnitude of Impact (Table 2.2 of DMRB Volume 11, Section 2, Part 5, HA 205/08)

Magnitude of Impact	Typical Criteria Descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of an attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition to one or more characteristics, features or elements (Beneficial).
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 10.2.3: Arriving at the Significance of Effect Categories (Table 2.4 of DMRB Volume 11, Section 2, Part 5, HA 205/08)

		Magnitude of Impact (Degree of Change)				
		No Change	Negligible	Minor	Moderate	Major
Environmental Value (Sensitivity)	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

10.2.4 Legislative & Policy Context

European Legislation & Policy

EU Waste Framework Directive 2008/98/EC

The EU Waste Framework Directive 2008/98/EC provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. It lays down measures to protect the environment and human health by preventing or reducing the adverse effects of the generation and management of waste and by improving the efficiency and reducing the overall impacts of resource use. The Waste Framework Directive requires all Member States (including Wales) to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health or causing harm to the environment.

The Directive also mandates the waste hierarchy, which requires that where waste is unavoidable, products and materials should, subject to regulatory controls, be used again, for the same or a different purpose (re-use). Otherwise resources should be recovered from waste through recycling. Value can also be recovered by generating energy from waste and only if none of the above offer an appropriate solution should waste be disposed of.

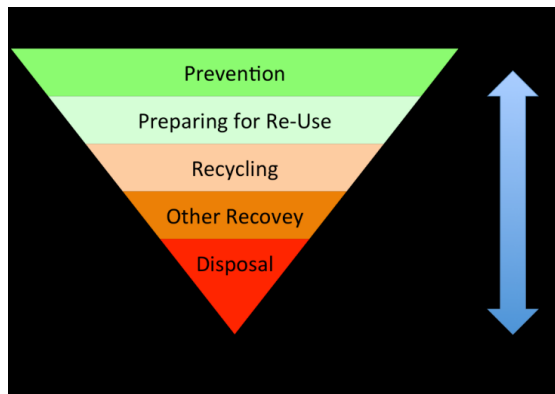


Diagram 10.1: The European Waste Hierarchy (source: Waste Framework Directive, Defra)

EU Landfill Directive 1999/31/EC

Where the reuse, recycling or recovery of waste was not possible or would cause greater harm to human health and the environment, disposal of such waste would remain the appropriate management option. The EU Landfill Directive sets stringent requirements for the landfilling of wastes in Wales. The key requirements of the Directive are:

- The separation of wastes through a classification approach to landfills: landfill for hazardous waste; landfill for non-hazardous waste and landfill for inert waste
- The treatment of wastes prior to landfilling;
- Banning of certain wastes from being landfilled for example, liquid wastes, explosive and flammable wastes; clinical and veterinary wastes and whole or shredded waste tyres;
- Reduction in the amount of biodegradable municipal waste going to landfill; and
- Landfill location requirements.

National legislation & policy

There are a number of primary legislative instruments in the UK on waste listed below which enact a wide range of secondary legislation that governs the storage, collection, treatment and disposal of waste:

- The Control of Pollution Act 1974;
- The Control of Pollution (Amendment) Act 1989;
- Environmental Protection Act 1990 (EPA);
- The Environment Act 1995;
- The Finance Act 1996;
- Waste Minimisation Act 1998;
- The Waste and Emissions Trading Act 2003; and
- The Clean Neighbourhoods and Environment Act 2005.

This chapter has been compiled with consideration of the above legislation and the regulations and strategies below.

The Waste (England and Wales) Regulations 2011

These Regulations transpose, for England and Wales, The EU Waste Framework Directive. These regulations require:

The establishment of waste prevention programmes;
Waste management plans for England and Wales;
The waste hierarchy in the Directive to be applied as a priority order; and
The separate collection of paper, metal, plastic and glass waste.
They impose duties in relation to the improved use of waste as a resource and duties on planning authorities when exercising certain functions under Welsh planning legislation. They also make provisions in relation to carrying and brokering in waste and enforcement.

The Waste (Miscellaneous Provisions) (Wales) Regulations 2011

These Regulations are supplementary to the Waste (England and Wales) Regulations 2011. They make amendments to several Welsh statutory instruments for the purposes of transposing, in relation to Wales, The EU Waste Framework Directive 2008/98/EC (summarised above).

The Landfill (England and Wales) Regulations 2002

These Regulations set out a pollution control regime for landfills for the purpose of implementing the EU Landfill Directive 1999/31/EC in England and Wales.

Towards Zero Waste – One Wales: One Planet 2010

Towards Zero Waste is the overarching waste strategy document for Wales (as required under the Waste (England and Wales) Regulations 2011). It sets out a long term framework for resource efficiency and waste management in Wales up until 2050, taking into account social, economic and environmental outcomes.

Local legislation & policy

The current adopted Development Plan for Gwynedd Local Planning Authority Area is the Gwynedd Unitary Development Plan.

Gwynedd Unitary Development Plan (UDP) (2009)

The main objective of the UDP is to ensure sustainable development and to create favourable circumstances to protect, support and develop the communities, culturally, environmentally and economically. At present mineral and waste planning policies are set out in the UDP and within the Municipal Waste Management Strategy.

Municipal Waste Management Strategy for Gwynedd (2004)

Gwynedd Council has produced a draft strategy for the management of municipal waste, which offers a way to improve on our arrangements for dealing with waste, and to meet future targets. The report includes issued guidance from the Assembly Government on what issues should be included within the Municipal Waste Management Strategy. These include:

- Identification of the Best Practicable Environmental Option for long-term management of municipal waste.
- A strategy for reducing the growth in municipal waste arisings (waste minimisation)
- Plans for dealing with certain wastes, including hazardous and difficult wastes
- Inclusion of statutory recycling plans
- Plans for partnership working with the community and voluntary sector and private
- Consultation with all stakeholders

At present mineral and waste planning policies are set out in the UDP and within the Municipal Waste Management Strategy.

10.2.5 Baseline Conditions

Geology and Contamination

A detailed description of the geological conditions and soils beneath the Scheme is provided in Chapter 9: Geology and Soils. A brief description of the type of materials that would be excavated during construction of the Scheme is provided below.

The majority of the Scheme (and surrounding area) is underlain by Glacial Till, a predominantly clayey stratum. Locally, where the Scheme passes over the channel for the Afon Seiont there is a Glaciofluvial Sheet, River Terrace and Alluvium deposits. The solid geology comprises geology from the Precambrian through to the Carboniferous periods. The sequence from south to north includes the Padarn Tuff Formation, the Fachwen Formation (inter-bedded siltstone and limestone), the Nant Ffrancon Sub-group (siltstone), the Allt Lwyd Formation (sandstone) and an unnamed igneous intrusion (granitic). These deposits make up the material that would be excavated during construction

Made Ground was encountered in localised areas throughout the site overlaying natural deposit. It should be noted that no Made Ground was encountered between Ch0000 and approximately Ch4200. However, small localised areas may be present between these points and thus encountered during the construction phase.

The soil quality was tested as part of the ground investigation completed in 2015 which confirmed that contaminant concentrations, elevated above the relevant soil assessment criteria applicable to the Scheme, do not exist within the scheme corridor, with the exception of one single marginally elevated concentration of benzo(a)pyrene. However, it is understood that the sample location of the exceedance is located within an area of proposed future cut and thus would be removed as part of the site preparation and clearance works. Based on the available information, the overall potential for soil contamination within the study area has been assessed as low.

10.2.6 Traffic and HGV Site Access

The Scheme consists of a new 9.7km highway commencing at the Goat roundabout (A499/A487 junction) and terminating at the Plas Menai Roundabout. It forms a western bypass to Llanwnda, Dinas and Bontnewydd before crossing the existing A487 to pass south of Caernarfon Quarry. It then crosses the River Seiont, passes south of the Cibyn Industrial Estate to a junction with the A4086. After crossing the B4366 the route drops steeply to the Plas Menai Roundabout on the A487. A description of the Scheme is provided in Volume 1, Section 2.1.

A plan showing the compound areas, access points and delivery routes is shown in Volume 2, Figure 2.7. It is anticipated that the main site office and compound would be located midway along the scheme and would have one main access from Seiont Mill Lane off the existing roundabout on the A487, with access directly on to the site from the east side of the compound at Ch4700, thus reducing unnecessary traffic movements on the existing roads.

Deliveries of materials to the scheme would be via one of the following five access points:

- Site Access No.1: Southern end of the Scheme at the A487 / A499 junction (Goat Roundabout)
- Site Access No.2: From A487 halfway between Bontnewydd and Caernarfon
- Site Access No.3: From A4085 (Waunfawr Road)
- Site Access No.4: From A4086 (Llanberis Road)
- Site Access No.5: Northern end of the scheme from the A487 at Plas Menai Roundabout

A number of satellite compounds would be located along the length of the scheme and these would predominately be located at major structures, with provisions for small offices, welfare, storage, preparation areas and access to the local road network. Haul roads would be formed around the structures to maintain a route along the scheme trace.

The Construction Strategy for the scheme is described in Volume 1, Section 2.2 and is summarised below.

Construction of the scheme would be carried out over a period of 23 months. The first two months would be predominately site clearance works and the last month would be predominately preparation of landscape plots, planting and finalising the site works. Therefore, the main construction vehicular movements and earth moving works would be undertaken over a period of 10 months with drainage and road construction taking a further 9 months.

10.2.7 Landfill

The Landfill (England and Wales) Regulations 2002 require that disposal sites are classified into one of three categories dependent on the chemical composition of the material they receive. These are:

- Hazardous waste - This is waste that may be harmful to human health or the environment e.g. asbestos, chemicals, healthcare waste, electrical equipment, lead-acid batteries, oily sludge and pesticides;
- Non-hazardous waste - This may include municipal waste, general office waste and catering waste; and
- Inert waste - This is waste that does not undergo any significant physical, chemical or biological transformation such as construction and demolition waste.
- Prior to disposal, if material is deemed hazardous it must be pre-treated to meet the Waste Acceptance Criteria. Further stipulations within the Landfill (England and Wales) Regulations 2002 are as follows:
- Higher engineering and operating standards to be followed;

- Hazardous liquids, flammable, corrosive, explosive, oxidising and infectious wastes have been banned from landfill since July 2002;
- Non-hazardous liquids have been banned since 2007;
- Co-disposal has been banned since 16 July 2004;
- Whole tyres were banned from 2003, and shredded tyres have been banned since 2006;
- Waste would be required to be pre-treated prior to landfilling; and
- Operators must demonstrate that they and their staff are technically competent to manage the site, and have made adequate financial provision to cover the maintenance and aftercare requirements.

Table 10.3.1 identifies landfill sites for construction waste within a reasonable proximity of the Scheme.

Table 10.3.1: Landfill Sites for Construction Waste within Close Proximity to the Site

Name of Landfill Site	Address
Gwynedd	
Nant y Garth	Nant y Garth, Bangor, Gwynedd, LL56 4QD
Llwyn Isaf	Clynnog Fawr, Caernarfon, LL54 5DF
Ffridd Rasmus	Morfa Road, Harlech, LL47 6TR
Powys	
Bryn Posteg Landfill Site	Potters Yard , Severn Road , Welshpool, Powys SY21 7YE
Cheshire	
Hooton Brickworks Landfill Site	Hooton Road, Hooton, Ellesmere Port, Cheshire, CH66 7NB
Gowy Landfill Site	Ince Lane, Wimbolds Trafford, Chester, Cheshire, CH2 4JP
Hapsford Landfill Site	Land / premises, Moor Lane, Hapsford, Frodsham, Cheshire WA6 0JU

10.3 Predicted Environmental Effects

10.3.1 Overview

Material resources encompass the materials and construction products required for the construction of the Scheme. The potential environmental effects are associated with the extraction and transport of primary raw materials, the manufacture of products, and their subsequent transport to, and use on construction sites. Many material resources would originate off site, purchased as construction products and some would arise onsite such as excavated soils or vegetation.

Waste would arise where there are surplus materials either from demolition of existing features, surplus excavated material from earthworks, or from materials brought on to site but not used for the original purpose (e.g. damages, off cuts, surplus). The

potential environmental effects are associated with the production, movement, transport, processing, and disposal of such waste streams from site.

The Scheme would inevitably result in some surplus material which would need to be disposed of as waste. This is most likely to arise from:

Existing site materials e.g. excavation of material from earthworks which cannot be reused within the site; or
Materials brought on to site but not used for its intended purpose (e.g. damaged goods or residual amounts not used).

Diagram 10.2 illustrates how materials and waste are used in the process.

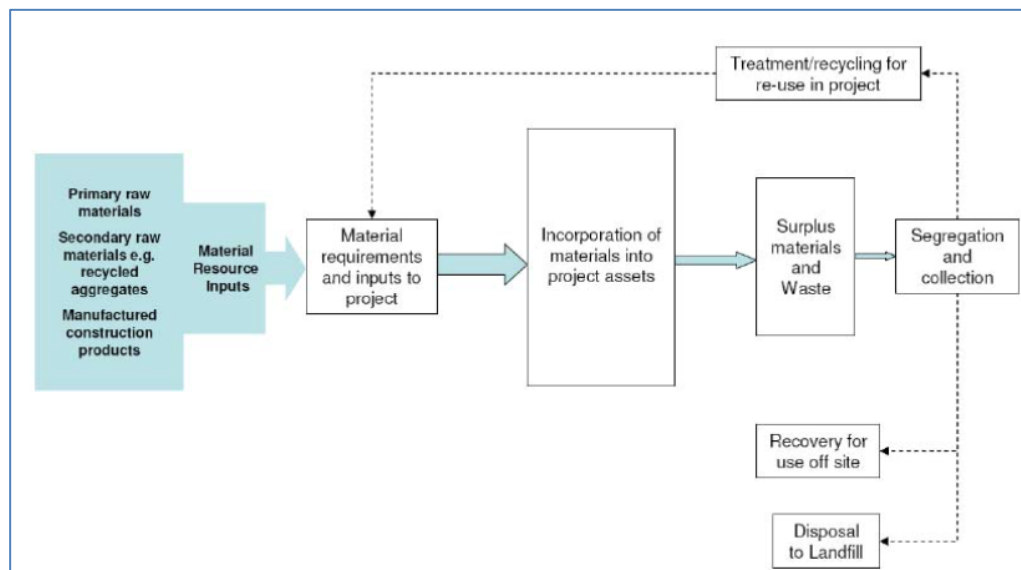


Diagram 10.2: Project Material Flow Diagram (source: IAN 153/11)

10.3.2 Materials

The Construction Strategy for the Scheme is set out in Section 2.2 in Volume 1 Chapter 2 of this ES.

Importing materials for construction and the onsite excavation and stockpiling of materials has the potential to have an adverse effect in relation to landscape, traffic and dust. Effects on dust (air quality) and landscape are discussed in Volume 1 Chapters 5 and 7 respectively of this ES. The potential environmental effects of importing materials to site are associated with the extraction and transport of primary raw materials. This chapter does not cover indirect materials and waste impacts which occur off-site and may possibly occur outside the UK, including the depletion of non-renewable resources and the production of waste at the point of extraction and during manufacturing. These impacts are outside the scope of this assessment.

Types of materials required to construct the Scheme are listed below:

- Surfacing material i.e. Blacktop
- Fill material, including topsoil and rock fill;
- Aggregates

- Concrete;
- Structural steelwork
- Other materials including pipework, concrete manhole rings and geogrid and geotextiles

Table 10.4.1 summarises the approximate quantity of materials required to construct the Scheme, material won on site and material to be imported to the scheme.

Table 10.4.1 Quantity of material and likely HGV movements to import material onto the scheme

Type of Material	Approximate Quantity Required	Approximate Quantity Won*	Approximate Quantity Imported	Number of HGV movements required
Topsoil/subsoil (m ³)	242,191	242,191	0	0
Fill material (m ³)	667,191	642,730	24,461	2,201
Aggregates (m ³)**	266,545	266,545	0	0
Concrete (Imported) (m ³)	15,000	0	15,000	2,500
Surfacing Material (tonnes)	77,820	0	77,820	3,890
Drainage pipes and ducting (linear metres)	15,000	0	15,000	400
Concrete manhole rings and other products (units)	750	0	750	
Geogrid and geotextile rolls (m ²)	150,000	0	150,000	
Structural steelwork (Tonnes)	980	0	980	33

* Site won materials include materials excavated as part of constructing the scheme.

** Including aggregate for use in Cement Bound Material

The Scheme would be constructed via a combination of cut and fill earthworks using site won and imported material. Embankments would be formed using approximately 667,191m³ of general fill, of which approximately 642,730m³ would be site won in the cuttings. A total of 24,461m³ of fill material would be imported and sourced locally where practicable generating approximately 2,201 lorry movements over a period of 10 months when the main construction vehicular movements and earth moving works would be undertaken. This is the equivalent of approximately 11 lorry movements per day assuming 20 working days per month.

Total material excavated from the route of the Scheme would be approximately 1,311,476m³ including topsoil and rock fill. Most of this material (909,275m³) would be used by the scheme as fill and aggregates for roads and structures. The remaining 402,201m³ would include topsoil / subsoil and unsuitable material. The topsoil / subsoil (242,191m³) would be used for reinstating the side slopes and remaining 160,010m³ of unsuitable material would be taken off site and placed in a local tip requiring approximately 14,400 lorry movements over a period of 19 months. This includes the main construction vehicular movements and earth moving works (10 months) and drainage and road construction including landscaping and environmental mitigation (9 months). This is the equivalent of 38 lorry movements per day assuming 20 working days per month.

The unsuitable material volume at present is based on assumptions and results of findings of the latest ground investigation work and this therefore may change if on site excavation works reveal differing conditions. During the planning and construction phase it is envisaged that more work would be done to reduce the unsuitable volumes by using a combination of ground improvement techniques and provision of additional landscaping areas where materials can be placed. This should in turn reduce the amount of material taken off site.

The material sourced on site would be hauled in dump trucks to the appropriate area via the haul route which runs along the length of the scheme trace. A material processing area would be located at the northern end of the scheme (refer to Volume 2, Figure 2.7) which would process (where required) the site won material into the required specification. The movement of material and construction traffic are described in further detail in Volume 1, Sections 2.2.2 to 2.2.9 of the ES.

Materials would be stored in areas away from sensitive receptors including watercourses and visual receptors. The sensitivity of the receptors as a result of storage and treatment is considered to be low, and the potential magnitude of impacts associated with storage and treatment during the works would be minor. The overall significance of effect has been consequently assessed to be neutral.

Approximately 77,820 tonnes of surfacing material would be required for the scheme which would be delivered via 3,890 lorry movements over a period of 9 months when the road construction works would take place. This is the equivalent of 22 lorry movements per day assuming 20 working days per month. Surfacing material is likely to be sourced locally where practicable e.g. Penmaenmawr, Bangor or via quarries at Minffordd. Surfacing material from these sources would access the scheme from any of the 5 Site Access points.

There is a possibility that a concrete batching plant would be set up for the project at the Main Site Compound to make the 15,000m³ of concrete required for the scheme. This option is still being considered, and until the quality of the aggregate source can be confirmed on site by material testing, this possibility cannot be confirmed at this time. Approximately 18,000 tonnes of aggregate required for the concrete could be sourced from the works. As part of the site concrete batching option approximately 6,000 tonnes of cement (200 lorry movements) and approximately 9,000 tonnes of sand (300 lorry movements) would be required to be delivered to the concrete batching plant thus saving 2,000 lorry movements on the local highway network when compared with the option of importing concrete (total of 2,500 lorry movements over a period of 7 months which is the equivalent of 18 lorry movements per day assuming 20 working days per month).

Other materials items (drainage pipes and ducting, concrete manhole rings and geogrid and geotextile rolls) would likely be sourced through national builder merchants and would be delivered direct from suppliers due to the quantities needed. The deliveries would generate approximately 400 lorry movements and would access the scheme from any of the 5 Site Access points. Materials would be stored at various compound locations located throughout the Scheme (refer to Volume 2, Figure 2.7).

Cement Bound Material (CBM) would be used to construct the Scheme using approximately 27,000m³ of site won aggregate (included in the 266,545m³ volume quoted in Table 2.4.1) to form the bottom pavement layers. This would remove the importation of approximately 60,000m³ of fill material which would have been required in addition to the 24,461m³ of fill material being imported.

As described above construction materials is required to be imported for the Scheme in order to construct the carriageway and proposed structures. Materials would be imported from local suppliers. Given that the Scheme has been developed to achieve a balance of cut and fill and so minimise the export of site-won materials from the works areas, import of materials would be minimised. Furthermore, given that the sources of material would be existing suppliers of materials, the sensitivity of the source is considered to be low. The magnitude of impact on the material source is considered moderate. The significance of effect is assessed to be slight adverse.

10.3.3 Waste

The majority of the waste generated during construction of the Scheme is likely to be excess fill material from earthworks and construction site waste from the Contractor Compounds (for example packaging and residual materials). The waste streams anticipated during construction of the Scheme and their corresponding classifications are listed in Table 10.4.2.

Table 10.4.2: Anticipated Waste Streams during Construction

Waste Stream	Waste classification
Excess excavated material unsuitable for engineered fill	Inert waste
Structures waste – rubble and building materials	Inert waste / non-hazardous waste
General non-putrescible waste	Non-hazardous waste
General putrescible waste	Non-hazardous waste
Contaminated soil from spills of fuels, oils and lubricants	Hazardous waste
Waste oil and lubricants	Hazardous waste
Green waste from vegetation removal and construction timber	Non-hazardous waste
Solid and liquid waste from temporary ablution facilities	Non-hazardous waste

As stated in Section 10.4.2 the unsuitable fill material (160,008m³) generated by the scheme would be taken off site to a local tip. The other waste stream generated during construction of the Scheme is likely to be construction site waste from the Contractor Compounds (for example packaging and residual materials).

Any excess materials would be taken to the nearest or most economical disposal facility. The sensitivity of the receptor (disposal site) is considered to be low as they would already have planning permission and environmental controls in place for taking waste. Given the quantities of materials that are likely to require disposal offsite, the magnitude of the impact is considered moderate. The significance of the environmental impact on the disposal site is considered to be slight adverse.

10.3.4 Movement of materials during construction

The existing A487 trunk road is regularly used by HGVs to transport materials to and from the industrial and commercial developments in the Caernarfon and Bontnewydd area and other areas in North Wales. There is therefore no need for alternative HGV route options.

An estimate has been made of the number of HGV movements per day on public roads during construction in Section 10.4.2. For construction of the embankments

and landscaping, site-won materials would be transported via haul roads from areas of cutting to areas of fill, within the site boundary.

Based on these estimates of additional HGV flow figures, the magnitude of traffic flow impacts have been assessed, considering the current traffic flow based on the available traffic model (refer to Volume 3, Appendix B.2 for AADT flows on the local highway network). The sensitivity of the receptors (existing A487 and local public roads users) is considered medium.

The magnitude of the impact on the road network due to importing/exporting of construction materials to site is considered minor in all cases, and therefore the significance of such impact is considered to be slight adverse.

The movement of materials for off-site disposal could have potential impacts on the local road users on a local scale. The sensitivity of the receptor is considered to be medium. Given the very low number of additional HGV movements that are likely to be required to dispose of the unsuitable materials off site, these are not considered to have a significant impact on the local road network and thus the magnitude of impact is considered minor.

The significance of effect from disposal of unsuitable materials is therefore assessed to be slight adverse.

10.4 Proposed Mitigation

10.4.1 Mitigation through Design

To limit potential impacts upon resources, decisions made during design have demonstrated materials resource efficiency and consideration of waste management. The design of the Scheme aims to minimise the volume of imported material required whilst balancing the need for appropriate construction.

Specific design-related mitigation measures include:

- Gradient of embankments designed to minimise material requirements;
- Construction compounds and site accesses are provisionally located to allow for material from one section of the site to another during construction; and
- Structures designs using pre-cast concrete materials and steel materials where practicable.
- Possibilities to reduce the unsuitable volumes by investigating the design of ground improvement techniques
- Possibility of utilising additional identified landscaping areas in order place the unsuitable fills and create additional landscape character.
- Construction

A Draft Construction Environmental Management Plan (CEMP) has been prepared as part of this ES (Volume 3, Appendix L.1) containing methods and procedures to manage construction related environmental risks including procedures for managing earthworks during cut and fill activities such as stockpiling. Materials would be stored in areas away from sensitive receptors including watercourses and visual receptors. Through the implementation of the CEMP, construction waste would be recycled where feasible. Non-recyclable general waste from the site (from the contractor's facilities) would be disposed of at a licenced landfill site.

10.4.2 Materials

The reuse of excavated material from earthworks activities would be employed to minimise the volume of imported fill required and the volume of waste removed from site for disposal. Using site-won material within the Scheme would mitigate the potential impacts of using large quantities of raw materials and limiting HGV trips associated with construction. Any imported materials required would be from approved sources, the suitability of the material checked and sourced as near as reasonably practicable to the Scheme.

By utilising ground improvement techniques, it envisaged that the importation of bulk earthworks materials to the scheme can be reduced thus reducing the HGV trips during the construction stage. Also the volume of unsuitable material being taken off site may be further reduced through the use of ground improvement techniques and through utilising the unsuitable material in additional landscaped areas.

To mitigate the potential impacts of transporting materials to site, material would be sourced from the nearest practicably available source and suitable location to keep HGV journey distances to a minimum. Furthermore, HGV routes to and from the Scheme would be agreed in consultation with Gwynedd Council within the Construction Traffic Management Plan (CTMP) to provide routes which have the least air quality and noise and vibration impacts on sensitive receptors. This approach would be balanced with keeping journeys to the minimal distance where possible.

For any imported materials, appropriate chemical testing would be undertaken to confirm that no contamination is present within the imported materials.

10.4.3 Waste

Consideration of materials and waste at the design stage has allowed mitigation to be incorporated into the design and for such measures to become part of the Scheme. This approach helped to identify opportunities to 'design out' waste prior to construction.

These design-based waste mitigations would be incorporated into a Site Waste Management Plan (SWMP) that would be developed prior to construction. The purpose of the SWMP would be to facilitate the principles of the waste hierarchy and minimise the production of waste from the outset of the Scheme. Such measures are to be incorporated into the design of the Scheme and implemented during construction. This would be achieved by ensuring that, wherever possible, materials on site are reused. Where waste cannot be re-used or recycled, it would be disposed of in accordance with the Landfill Directive (1999/31/EC) and Landfill (England and Wales) Regulations 2002.

The SWMP would aim to ensure that:

Building materials are managed efficiently;
Waste is tested, classified and disposed of appropriately; and
Opportunities for materials recycling, reuse and recovery are maximised.
Reference would be made in the construction tender documentation to good practice guidance such as from Waste and Resources Action Programme (WRAP) which provides guidance on reducing waste and using resources efficiently. WRAP has specific, web-based tools to enable construction projects to minimise waste and uses five key principles, namely:

- Design for reuse and recovery;
- Design for off-site construction;
- Design for materials optimisation;
- Design for waste efficient procurement; and
- Design for deconstruction and flexibility.

It is essential that the construction work is carried out closely with waste management contractors, in order to determine the best techniques for managing waste and to ensure a high level of recovery of materials for recycling.

In accordance with good practice waste management, opportunities to minimise waste are outlined in Table 10.2. These opportunities form the basis of the mitigation of construction waste impacts and would be taken forward into the SWMP and CEMP prior to construction.

Waste production and management would be monitored during construction and records would be kept of any incidents of deviations from the arrangements set out in the SWMP. The majority of waste would include residual soil from earthwork that is not a suitable grade for re-use and contractor site waste. Waste would be re-used on site where practicable or sent off-site for recycling or disposal.

In accordance with legislation and good practice reasonable steps would be undertaken to ensure that all waste from construction of the Scheme is dealt with in accordance with the relevant legislative requirements (as described above in Section 10.2.1).

10.4.4 Operation

Material and waste effects occurring once the Scheme is operational would be mitigated primarily through an efficient maintenance programme. Materials required for maintenance would be sourced using good practice such that waste is kept to a minimum. Waste from on-going vegetation management would be disposed of at a suitable landfill facility.

10.5 Residual Environmental Effects (following mitigation)

10.5.1 Construction

As shown in Table 10.6.1 the main materials required to construct the Scheme are aggregates for use in earthworks, concrete and other materials.

Table 10.6.1: Opportunities to Minimise Construction Waste

Waste	Waste Management Strategy	Waste Hierarchy
Soil from earthworks	Re-use within scheme as fill for embankments	Re-use
	Residual amount sent for disposal to local tip	Disposal
Topsoil from earthworks	Re-use on verges, cuttings, embankments or elsewhere within scheme	Re-use

Waste	Waste Management Strategy	Waste Hierarchy
Stones from earthworks	Sieved out crushed and reused as sub base for the road or graded and used in the drainage system.	Re-use
Removed vegetation	Shredded stored / composted on site and reused as soil cover mulch in replanted areas.	Re-use
Structures waste – rubble & building materials	Sorted and rubble crushed/graded for reuse in the drainage system and remaining material sent to landfill	Re-use / Disposal
Drum storage and collection	Careful temporary storage and segregation of drums at the contractor's compound so that these can be recycled or returned to the supplier	Recycling / Re-use

Other waste that would go to landfill includes some municipal (putrescible and non-putrescible) waste from the construction compound, vegetation and damaged or residual products or components that cannot be recycled. It is not known at this stage which landfill sites wastes would be disposed at as this would be determined during the preparation of the SWMP prior to construction.

The construction works would be programmed to provide resource efficiency in the use of raw material and minimal waste generated, therefore the residual effect of the Scheme on materials and waste would be minor adverse. Residual effects would be mainly limited to minor, infrequent and temporary traffic, noise and vibration impacts from the transportation of materials to the site and the transportation of waste streams to waste facilities for recycling and disposal.

As summarised in Table 10.6.2 and the remaining residual effects during the construction and operational phases following mitigation are considered to be either neutral or slight adverse.

Table 10.6.2: Magitude and Significance of the Construction Impacts with mitigation

Impact	Description	Magnitude of impact with mitigation	Significance of impact with mitigation
Unsuitability for re-use of site won earthworks materials within the Scheme requiring additional import of suitable materials.	Ensure adequate separation, processing, and storage of site won materials to maximise potential for re-use.	Minor Adverse	Slight Adverse
Imported construction materials required to construct the Scheme.	Efficient detailed design to reduce requirements for imported materials.	Moderate to Minor Adverse	Slight Adverse

Contamination of imported materials – spreading of contamination to other areas.	Ensure that appropriate chemical testing of any imported materials is undertaken to confirm no contamination present.	Negligible	Neutral
Excess fill material from earthworks and construction site waste from the Contractor Compounds requiring off site disposal.	Processing of materials to be considered where possible for re-use within the Scheme within SWMP. Excess materials would be taken to the nearest or most economical disposal facility	Moderate Adverse	Slight Adverse
Traffic movements due to import of construction materials / export of material to be disposed.	HGV routes to and from the Scheme would be agreed in consultation with Gwynedd Council within the Construction Traffic Management Plan (CTMP). Stagger delivery times for materials. Restrict material deliveries during critical traffic periods.	Minor Adverse	Slight Adverse

10.5.2 Operation

Residual operational effects would be kept to a minimum through an appropriate road maintenance programme and by using good practice to obtain natural resources. Adverse impacts in relation to materials and wastes associated with operation of the Scheme are considered to be negligible.

10.6 Summary and Conclusions

The construction of the Scheme requires a large amount of materials and would generate some waste. The consumption of material resources and the generation of waste give rise to environmental impacts that would need to be managed and mitigated.

The bulk of the material requirements is for the earthworks with approximately 667,191m³ fill material required. Approximately 642,730m³ of this would be site won general fill and approximately 24,461m³ would be sourced locally.

Total material excavated from the route of the Scheme is approximately 1,311,476m³ including topsoil and rock fill. Most of this material (909,275m³) would be used by the scheme as fill and aggregates for roads and structures. The remaining 402,201m³ would include topsoil / subsoil and unsuitable material. The topsoil / subsoil (242,191m³) would be used for reinstating the side slopes and remaining 160,010m³ of unsuitable material would be taken off site and placing in a local tip.

The volume of unsuitable material being taken off site may be further reduced through the use of ground improvement techniques and through utilising the unsuitable material in additional landscaped areas.

The majority of the waste generated during construction of the Scheme is likely to be excess fill material from earthworks and construction site waste from the Contractor Compounds.

In addition to fill and aggregate being required, other materials would be used for new structures, signage, fences and barriers associated with the Scheme. The impact of the manufacture process of these products is not included in this assessment. The impacts of road construction products and their use are limited to the transportation of materials to and from site, and the associated effects of noise and air pollution on sensitive receptors from HGVs.

As the proposed Scheme project is in an early stage in terms of resource use and estimation of waste generated, there are opportunities to improve the results of this assessment, principally by reducing waste generated. This may be through efficient product sourcing in relation to the recycled content of materials used and the re-use or recycling of waste materials. The SWMP would be crucial in implementing the mitigation measures identified and would provide an opportunity to further improve the environmental performance of the project.

Overall, it is considered that the effects of the Scheme in relation to materials and waste would be neutral or slight adverse providing the CEMP and SWMP is implemented.